The Adoption and Diffusion of IT Management Innovations: Adaptation, Reinvention, Alternative Designs, and Rhetorical Persuasion

Quang N. Bui
Bentley University: PhD Final Defense Form

This is to certify that we have examined this copy of a doctoral dissertation by

Quang N. Bui

and have found that it is complete and satisfactory and that any and all revisions required by the final examining committee have been made

Committee Chair:

Signature

Mr. Lynne Markus

The John W. Poduska, Sr. Professor of Information and Process Management, Bentley University

Committee Member:

Signature

Sue Newell
Cammarata Professor of Management, Bentley University
Professor of Information Management, Warwick Business School

External Reviewer:

Signature

Kalle Lyytinen
Iris S. Wolstein Professor, Department of Information Systems, Case Western Reserve University

Date: 7/22/2014
The Adoption and Diffusion of IT Management Innovations: Adaptation, Reinvention, Alternative Designs, and Rhetorical Persuasion

Quang N. Bui

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business

2014

Program Authorized to Offer Degree:

Information and Process Management, Bentley University
In presenting this dissertation in partial fulfillment of the requirements for the doctoral degree at Bentley University, I agree that the Library shall make its copies freely available for inspection. I further agree that extensive copying of the dissertation is allowable only for scholarly purposes, consistent with “fair use” as prescribed in the U.S. Copyright Law. Requests for copying or reproduction of this dissertation may be referred to ProQuest Information and Learning Author Relations Team at (800) 521-0600 ext. 7020, to whom the author has granted “the right to reproduce and sell (a) copies of the manuscript in microform and/or (b) printed copies of the manuscript made from microform.”

Signature

Date June 24, 2014
DEDICATION

To my parents, whose dreams and ideas inspired my pursuit of a Ph.D.

To my brother, whose thoughts and actions encouraged me to strive harder.

To my wife, whose sacrifice and support made completing my Ph.D. even possible.
ACKNOWLEDGEMENTS

Foremost, I would like to express my special appreciation and thanks to my advisor, Professor M. Lynne Markus, for her incredible support and guidance. She has been exceptionally kind, patient, and supportive to me. Her actions and tireless efforts inspire me, intellectually and personally. Getting to know and work with Lynne is the highlight of developing my dissertation, something that I will cherish dearly. I would also like to thank my committee members, Professor Sue Newell and Professor Kalle Lyytinen for their brilliant comments and suggestions. Their support has helped to improve the quality of my work tremendously.

In addition, I would like to express my gratitude to the Bentley IPM department and the Ph.D. Office for their wonderful support. I also wish to thank my Ph.D. cohort and friends, especially Art Tomasino, Flavius Chircu, Mari-Klara Stein, Anna Karpovsky, and Luisa Melo for their amazing companionship. Lastly, I would like to thank Marilyn Matis from the ESOL Center for her great job of editing my dissertation over the years.

My research was supported in part by the National Science Foundation (NSF), (the Art of the States Study, Grant #SES-0964909). I gratefully acknowledge the NSF’s support to make my research possible. Also, special thanks go to the participants in my case studies.

Last but not least, I would like to express my deep appreciation to my family. Words cannot express how grateful I am to my parents, my brother, and my wife for all of the sacrifices that you’ve made on my behalf. At the end, I would like to specially thank my beloved wife, Phuong T. Nguyen, who has shown me unconditional love and support, even in the moments when I had lost hope myself.
Abstract

The Adoption and Diffusion of IT Management Innovations: Adaptation, Reinvention, Alternative Designs, and Rhetorical Persuasion

Quang N. Bui

Chair of the Supervisory Committee: M. Lynne Markus
The John W. Poduska, Sr. Professor of Information and Process Management

This research examines the adoption and diffusion process of Information Technology (IT) management innovations—ones that focus on the organizing logics and governance of IT activities. IT management innovations are inherently important to organizations as they can dramatically transform the way businesses are organized and operated. However, because those innovations are tacit and composed mostly of abstract ideas, their adoption and diffusion are often plagued by ambiguity and fads, at times best described as “a solution in search of a problem.” Against this backdrop, using theories from communication, sociology, Information Systems, and organizational studies, this research focuses on three underexplored aspects of IT management innovation adoption and diffusion: adaptation and reinvention processes, alternative designs, and rhetorical persuasion.

The research advances our understanding on the differences in adopting and diffusing IT management innovations as compared to product innovations and management innovations. Particularly, it contributes to prior theories on post-adoption behaviors, innovation diffusion, and communication and dissemination strategies. The findings suggest the possibility of limited diversity in innovation adoption and highlight the roles
of diverging mechanisms in the diffusion processes (e.g., alternative designs as opposed to a single dominant design). To practitioners, this research stresses the importance of mindfully adapting and modifying a particular innovation rather than blindly following management fads. Future research is encouraged to further investigate the issues and challenges of IT management innovations, especially mechanisms that lead to the limited diversity in adoption behaviors and diffusion patterns.
# Table of Contents

List of Figures ........................................................................................................... xiv
List of Tables ............................................................................................................... xv

**Chapter 1: Introduction** ......................................................................................... 1

Why IT Management Innovations? ......................................................................... 2
Substantial Background: Enterprise Architecture .................................................... 4
  The Current State-of-the-Art of Enterprise Architecture ...................................... 6
Theoretical Background: Adoption and Diffusion Mechanisms .............................. 7
  Classic Diffusion Studies ......................................................................................... 8
  Institutional Diffusion Studies .............................................................................. 10
  Cognitive-Institutional Diffusion Studies ............................................................... 12
  What We Know and What We Do Not Know ....................................................... 15
Research Motivation .................................................................................................. 17
Research Design ......................................................................................................... 18
Major Findings ............................................................................................................ 19
Implications and Contributions ............................................................................... 25
Limitations and Future Research ............................................................................. 26
General Summary ...................................................................................................... 27

**Chapter 2: Enterprise Architecture Typologies** ................................................. 29

Surviving the Jungle of EA Frameworks: A Typological Theory of Enterprise
Architecture Frameworks ......................................................................................... 30
Abstract ..................................................................................................................... 30
Introduction ................................................................................................................ 31
What is Enterprise Architecture? ............................................................................ 33
  Characteristics of Enterprise Architecture ........................................................ 34
  Summary .................................................................................................................. 37
A Brief History of EA Developments in the U.S. ..................................................... 37
  EA Developments in the Public Sector ................................................................ 38
  EA Developments in the Private Sector ................................................................. 39
  The Current State-of-the-Art of Enterprise Architecture .................................... 41
A Typological Theory of EA Frameworks ................................................................. 42
  Essential Elements of Enterprise Architecture Frameworks ............................. 44
  A Typology of Branded EA Frameworks ............................................................... 49
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA Types and Expected Organizational Benefits</td>
<td>54</td>
</tr>
<tr>
<td>Summary</td>
<td>58</td>
</tr>
<tr>
<td>Discussion and Conclusion</td>
<td>60</td>
</tr>
<tr>
<td><strong>Chapter 3: Enterprise Architecture Adaptation and Reinvention</strong></td>
<td>64</td>
</tr>
<tr>
<td>Magnitude of Innovation Changes: Adaptation and Reinvention in Enterprise Architecture Implementation Process</td>
<td>65</td>
</tr>
<tr>
<td>Abstract</td>
<td>65</td>
</tr>
<tr>
<td>Introduction</td>
<td>66</td>
</tr>
<tr>
<td>Innovation Changes During Implementation</td>
<td>69</td>
</tr>
<tr>
<td>From the Adaptation Literature: The Nature of Innovation Changes</td>
<td>70</td>
</tr>
<tr>
<td>From the Reinvention Literature: The Boundary of Innovation Changes</td>
<td>72</td>
</tr>
<tr>
<td>The Scope of Innovation Changes</td>
<td>75</td>
</tr>
<tr>
<td>Summary</td>
<td>78</td>
</tr>
<tr>
<td>Method</td>
<td>80</td>
</tr>
<tr>
<td>Enterprise Architecture—Concepts and Practices</td>
<td>80</td>
</tr>
<tr>
<td>Field Site</td>
<td>81</td>
</tr>
<tr>
<td>Data Collection</td>
<td>83</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>84</td>
</tr>
<tr>
<td>Findings</td>
<td>86</td>
</tr>
<tr>
<td>EA Adoption and Implementation at State Enterprise</td>
<td>87</td>
</tr>
<tr>
<td>Historical and Critical Events</td>
<td>87</td>
</tr>
<tr>
<td>Appropriated EA Concepts at State Enterprise</td>
<td>88</td>
</tr>
<tr>
<td>Appropriated EA Practices at State Enterprise</td>
<td>91</td>
</tr>
<tr>
<td>Summary</td>
<td>97</td>
</tr>
<tr>
<td>EA Adaptation and Reinvention at State Enterprise</td>
<td>98</td>
</tr>
<tr>
<td>Adaptation and Reinvention of EA Concepts</td>
<td>98</td>
</tr>
<tr>
<td>Adaptation and Reinvention of EA Practices</td>
<td>102</td>
</tr>
<tr>
<td>Summary</td>
<td>105</td>
</tr>
<tr>
<td>Magnitude of Innovation Changes at State Enterprise</td>
<td>106</td>
</tr>
<tr>
<td>SOA Approach and Open Standards</td>
<td>106</td>
</tr>
<tr>
<td>Legal Advice in EA Development</td>
<td>107</td>
</tr>
<tr>
<td>Summary</td>
<td>107</td>
</tr>
<tr>
<td>Discussion</td>
<td>108</td>
</tr>
<tr>
<td>Practical Implications</td>
<td>111</td>
</tr>
<tr>
<td>Limitations</td>
<td>112</td>
</tr>
</tbody>
</table>
Conclusion ................................................................................................................................. 112

Chapter 4: Enterprise Architecture Alternative Designs ......................................................... 114

Alternative Designs for Widespread Adoption: Empirical Evidence from Enterprise
Architecture Implementation in U.S. State Governments ................................................. 115

Abstract ..................................................................................................................................... 115

Introduction ................................................................................................................................. 116

Theoretical Background ............................................................................................................. 119

Widespread Adoption with Dominant Designs ................................................................. 119

Summary .................................................................................................................................. 123

Implications from IT Management Innovations ............................................................... 124

Summary .................................................................................................................................. 128

Method ..................................................................................................................................... 129

Data Collection .......................................................................................................................... 130

Popular Branded EA frameworks ......................................................................................... 130

State EA Adoptions .................................................................................................................. 132

Data Analysis ............................................................................................................................... 133

Findings ..................................................................................................................................... 135

Evidence of EA Widespread Adoption in the U.S. State Governments ......................... 136

Ideal EA Designs Promoted by EA Vendors .......................................................................... 137

EA Alternative Designs Implemented in the U.S. State Governments .............................. 141

Technical EA Design ............................................................................................................... 141

Operational EA Design ........................................................................................................... 143

Technical-Operational EA Design .......................................................................................... 145

Strategic EA Design................................................................................................................ 147

Summary .................................................................................................................................. 149

Discussion ................................................................................................................................. 150

Innovation Designs in Adoption Decisions ........................................................................... 152

Convergence and Divergence Mechanisms in the Diffusion Process ................................. 154

Conclusion ................................................................................................................................. 156

Chapter 5: Enterprise Architecture Rhetorical Persuasion .................................................. 158

Rhetorical Persuasion throughout the Diffusion Process: Creating a Compelling
Cognitive-Institutional Account for Widespread Adoption ................................................. 159

Abstract ................................................................................................................................. 159

Introduction ................................................................................................................................. 160

Toward Widespread Adoption: The Role of Cognitive-Institutional Accounts .................. 162
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be Effective: The Persuasion Problem</td>
<td>164</td>
</tr>
<tr>
<td>To be Effective: The Evolution Problem</td>
<td>166</td>
</tr>
<tr>
<td>Summary</td>
<td>167</td>
</tr>
<tr>
<td>Theories on Cognitive-Institutional Accounts</td>
<td>168</td>
</tr>
<tr>
<td>Organizing Vision Theory</td>
<td>168</td>
</tr>
<tr>
<td>Technological Action Frame Theory</td>
<td>171</td>
</tr>
<tr>
<td>Institutionalization Theory</td>
<td>173</td>
</tr>
<tr>
<td>Summary and Implications</td>
<td>176</td>
</tr>
<tr>
<td>Method</td>
<td>178</td>
</tr>
<tr>
<td>Coding for State CIOs’ Contingencies</td>
<td>179</td>
</tr>
<tr>
<td>Coding for Dynamics of Innovation Rhetoric</td>
<td>180</td>
</tr>
<tr>
<td>Findings</td>
<td>182</td>
</tr>
<tr>
<td>State CIO’s Contingencies Since 2000</td>
<td>182</td>
</tr>
<tr>
<td>Dynamics of NASCIO’s Rhetoric</td>
<td>184</td>
</tr>
<tr>
<td>NASCIO Initiated EA Efforts in State Governments: 2000-2004</td>
<td>184</td>
</tr>
<tr>
<td>NASCIO Adjusted EA Approach: 2004-2005</td>
<td>188</td>
</tr>
<tr>
<td>NASCIO addressed concerns of States: 2005-2011</td>
<td>193</td>
</tr>
<tr>
<td>Summary</td>
<td>197</td>
</tr>
<tr>
<td>Discussion</td>
<td>199</td>
</tr>
<tr>
<td>Limitations and Future Research</td>
<td>202</td>
</tr>
<tr>
<td>Conclusion</td>
<td>203</td>
</tr>
<tr>
<td><strong>Chapter 6: Discussion and Conclusion</strong></td>
<td>204</td>
</tr>
<tr>
<td>Overview</td>
<td>204</td>
</tr>
<tr>
<td>Study #1—EA Typologies Contributions</td>
<td>205</td>
</tr>
<tr>
<td>Study #2—EA Adaptation and Reinvention Contributions</td>
<td>206</td>
</tr>
<tr>
<td>Study #3—EA Alternative Designs Contributions</td>
<td>207</td>
</tr>
<tr>
<td>Study #4—EA Rhetorical Persuasion Contributions</td>
<td>209</td>
</tr>
<tr>
<td>Future Research</td>
<td>210</td>
</tr>
<tr>
<td>Limited Diversity in Innovation Adoption</td>
<td>210</td>
</tr>
<tr>
<td>Innovation Use Mechanisms and Organizational Outcomes</td>
<td>211</td>
</tr>
<tr>
<td>Concluding Thoughts</td>
<td>212</td>
</tr>
<tr>
<td><strong>Figures and Tables</strong></td>
<td>213</td>
</tr>
<tr>
<td>Chapter 1 : Introduction</td>
<td>213</td>
</tr>
<tr>
<td>Chapter 2 : Enterprise Architecture Typologies</td>
<td>218</td>
</tr>
<tr>
<td>Chapter</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>3</td>
<td>Enterprise Architecture Adaptation and Reinvention</td>
</tr>
<tr>
<td>4</td>
<td>Enterprise Architecture Alternative Designs</td>
</tr>
<tr>
<td>5</td>
<td>Enterprise Architecture Rhetorical Persuasion</td>
</tr>
<tr>
<td>6</td>
<td>Discussion and Conclusion</td>
</tr>
<tr>
<td>A</td>
<td>Data Sources</td>
</tr>
<tr>
<td>B</td>
<td>Interview Questions</td>
</tr>
<tr>
<td>C</td>
<td>Acronyms</td>
</tr>
<tr>
<td>D</td>
<td>Essential Elements of EA Frameworks</td>
</tr>
<tr>
<td>E</td>
<td>State CIOs’ Priorities over the Year</td>
</tr>
<tr>
<td>F</td>
<td>NASCIO Coding Examples</td>
</tr>
<tr>
<td></td>
<td>References</td>
</tr>
</tbody>
</table>
List of Figures

Figure 2.1: EA Developments in the Public and Private Sector ............................................ 218
Figure 2.2: Common EA Layers .................................................................................................. 219
Figure 2.3: TOGAF Methodology (left) and Enterprise Architecture Planning Methodology (right) ........................................................................................................................................ 219
Figure 3.1: IT organizational structure of State Enterprise (with EA organization) ..... 225
Figure 3.2: Adoption Events in the State Enterprise ................................................................. 226
Figure 3.3: EA Concepts and EA Practices Appropriated by the State Enterprise ........... 227
Figure 3.4: Temporal Patterns of Adaptation and Reinvention Events in State Enterprise ........................................................................................................................................... 228
Figure 4.1: Emergence of a Dominant Design Compared Against Adoption Curve ...... 235
Figure 4.2: Number of State Initiated and Adopted EA by Year (45/50 States) .......... 235
Figure 5.1: EA Adoptions and Considerations over the Year in the U.S. State Governments .................................................................................................................................. 240
Figure 5.2: A Framework to Evaluate Innovation Rhetoric Over Time ............................. 240
Figure D.2: TOGAF Methodology (left) and Enterprise Architecture Planning Methodology (right).................................................................................................................................................. 253
List of Tables

Table 1.1: Popular EA Frameworks in the U.S. Private and Public Sectors ............... 213
Table 1.2: Comparison of Three Streams of Diffusion Studies................................. 213
Table 1.3: Dissertation Studies Overview .............................................................. 215
Table 1.4: Summary of Findings ............................................................................ 216
Table 1.5: Summary of Contributions .................................................................. 217
Table 2.1: Definitions of Enterprise Architecture.................................................... 219
Table 2.2: Popular EA Frameworks in the U.S. Private and Public Sectors ............ 221
Table 2.3: Typical Roles and Governance Bodies in an EA Organization ............... 221
Table 2.4: Essential Elements of EA Frameworks .................................................... 222
Table 2.5: Comparison of Popular Branded EA Frameworks in the Public Sector .... 223
Table 2.6: Profile of Ideal EA Types Promoted by EA Vendors ................................ 223
Table 2.7: Proposed Ideal EA Types in Comparison to Other Types in Literature ...... 224
Table 2.8: Findings Summary ................................................................................. 225
Table 3.1: Different Literature on Innovation Changes During Implementation Process ...................................................................................................................... 228
Table 3.2: Adaptation versus Reinvention................................................................. 231
Table 3.3: Coding framework .................................................................................. 231
Table 3.4: State Enterprise EA Concepts Compared to Association and Federal EA Concepts .................................................................................................................. 232
Table 3.5: State Enterprise EA Practices Compared to Association and Federal EA Practices .................................................................................................................. 233
Table 3.6: Summary of Adaptation and Reinvention Events at State Enterprise ....... 234
Table 4.1: Comparing Product Innovations and IT Management Innovations ............ 236
Table 4.2: Commonly Found EA Frameworks ...................................................... 236
Table 4.3: Essential Elements of EA Frameworks .............................................. 237
Table 4.4: Comparison of Popular Branded EA Frameworks in the Public Sector ...... 238
Table 4.5: Profile of Ideal EA Alternative Designs Promoted by Vendors ............... 238
Table 4.6: EA Alternative Designs Implemented in the U.S. State Governments ....... 239
Table 4.7: Summary of Findings ........................................................................ 239
Table 5.1: Comparison of the three theories on cognitive-institutional account ....... 241
Table 5.2: Significant Events at the U.S. State and Federal Governments Level....... 242
Table 5.3: Coding and Analysis Framework .......................................................... 242
Table 5.4: State CIOs’ Contingencies .................................................................. 243
Table 5.5: NASCIO Rhetoric During the Initial Period: 2000-2004 ...................... 243
Table 5.6: NASCIO rhetoric during the Transition Period: 2004-2005 .................. 244
Table 5.7: NASCIO rhetoric during the Stabilization Period: 2005-2011 ............... 244
Table 5.8: Evolution of NASCIO’s Rhetoric (2000-2011) ...................................... 245
Table 6.1: Summary of Contribution ................................................................... 245
Chapter 1: Introduction

Management innovation is defined as “the generation and implementation of a management practice, process, structure, or technique that is new to the state of the art and is intended to further organizational goals” (Birkinshaw et al. 2008, p. 829).

Examples of management innovation include Toyota Motor Corporation’s lean production system or Procter & Gamble Company’s brand management model (Birkinshaw and Mol 2006). Various synonyms of management innovation are found in the literature, such as administrative innovation (Damanpour 1987; Ravichandran 2000) or organizational innovation (Damanpour 1991; Hage 1999). For the purpose of this dissertation, the term management innovation is adopted.

Management innovations are inherently important to organizations. They can dramatically transform the way businesses are organized and operated. For example, the multidivisional reform at General Motors and Du Pont in the 1920s brought both companies out of their performance crises and significantly changed how contemporary business is organized and structured (Chandler 1962). To some, management innovations are the solution for recession and poor performance. Nickell et al. (2001) found that when times were bad and business suffered, firms were more likely to introduce management innovations to improve productivity. Constantly refreshing managerial practices helped firms stay competitive and have a higher chance to survive.

Despite its importance, studies on management innovations have relatively been overwhelmed by studies of other types of innovation, especially product and process innovations (Birkinshaw et al. 2008; Birkinshaw and Mol 2006). Innovation studies are
typically concerned with factors and processes that influence technological innovations (Fichman 2000). Our current understanding of the dynamics of innovative management practices is limited, with only a few notable examples available (e.g., Chandler (1962); Damanpour (1991); Tolbert and Zucker (1983), and Fligstein (1985)). Recently, a call has been extended for more study on management innovations as a centerpiece of organizational design (Miller et al. 2009).

In this dissertation, I am particularly interested in Information Technology (IT) management innovations, or the adoption and implementation of innovative managerial practices, processes, and structures of IT activities. In other words, the organizing logics and governance of IT activities. Examples include the introduction of the CIO position in the early 1980s, the implementation of IT shared services models, the uses of IT outsourcing models, or the adoption of the Information Technology Infrastructure Library (ITIL). The question of interest is: how and why do IT management innovations diffuse? Particularly, the dissertation focuses on processes and mechanisms that hinder or promote the adoption and diffusion of IT management innovations across organizations.

**Why IT Management Innovations?**

IT management innovations, as a particular case of management innovations, have received only modest attention in the literature. The majority of IT innovation adoption studies is concerned with product and process innovations, focusing on factors that drive their adoption (Fichman 2000; Fichman 2004). In the Information Systems (IS) field, with the advent of the materiality debate in the early 2000’s (Orlikowski and Iacono
2001), attention to IT management innovations seems to be even scarcer\(^1\). The number of IT management innovations are only modest when compared to the number of studies on IT artifacts, product innovations, or system innovations.

This lack of attention raises theoretical and practical concerns. First, organizing IT functions is certainly a major task for IT managers, besides executing IT activities and setting IT policies (Agarwal and Sambamurthy 2002; Sambamurthy and Zmud 1999). As IT investments have been increasing at an exponential rate, designing an effective and efficient IT function has never been more urgent, especially when the magnitude of failed IT projects can be devastating. For example, in the U.S. federal agencies, the total IT spending trend has steadily increased, with the 2014 estimation of $10 billion dollars for the largest agencies, and around $100 million dollars for the smallest agencies\(^2\). The recent failure of the Healthcare.gov launch also owed no small part to the poor IT management of federal agencies. In the private sector, the need for better IT management is apparent, as globalization and expansion have significantly increased complexity of IT projects for global enterprises (Markus et al. 2012; Sia et al. 2011; Sia et al. 2010).

Second, IT management innovations have unique characteristics that imply distinct theoretical implications. IT management innovations are essentially innovative ideas and concepts about organizing IT activities, and thus they are conceptual innovations. IT management innovations consist of mostly abstract and conceptual components rather than physical and material components as technological innovations do. In other words,

\(^1\) In a recent discussion with a MISQ senior editor, the author was asked “if there is no IT artifact, how is your research [on IT management innovations] related to the IS field?”

these IT management innovations have more “administrative-ness” rather than “IT-ness” (Wang 2010). As a result, they embrace more ambiguity and uncertainty, and they afford more interpretive flexibility for adopters (Birkinshaw et al. 2008). Know-how becomes crucial; adaptation and modification become common practices; and external influences become stronger. These characteristics can lead to unique implications for the adoption and diffusion of IT management innovations, informing useful insights to practices.

Given the distinct theoretical characteristics and significant impacts in practice of IT management innovations, this dissertation focuses primarily on the issues and challenges of their adoption and diffusion. The overall question is: how and why do IT management innovations diffuse? To answer the question, the empirical domain for this dissertation is the adoption and diffusion of Enterprise Architecture in the U.S. State governments, the topic of the next section.

Substantial Background: Enterprise Architecture

The concept of Enterprise Architecture (EA) was conceived in 1987 as Zachman published an article in an IBM journal, laying down the ontological foundation for an Information Systems Architecture (Zachman 1987). The purpose was to describe IT architectural assets within an organization as a blueprint to reduce system complexity (Sessions 2007). Others built on Zachman’s concept, developing EA as a process to transform organizational IT architecture from an “as-is” to a “to-be” state (e.g., TOGAF framework, FEA framework). Today, many view EA as a management discipline or a strategic planning program that intends to align IT strategy and business strategy (Boh and Yellin 2007; Ross et al. 2006; Schmidt and Buxmann 2011).
Because of its association with both technical and managerial techniques, EA is a highly contested concept without an unambiguous definition. EA has been portrayed as a technical innovation as well as management innovation. For the purpose of this dissertation, I am particularly interested in the adoption and diffusion of EA as an IT management innovation, and frame EA as a term that has been applied to a range of best practices that include both technical and managerial practices. Technical practices include setting standards or defining software development procedures. Managerial practices consist of reducing IT investments or aligning IT strategy with business strategy.

Since EA is a relatively new and an emerging concept, it is experiencing various challenges that are associated with management innovations: highly contested definitions, skepticism about value propositions, and a slow adoption rate (Boh and Yellin 2007; Ericson 2011; Kappelman 2010b; Kluge et al. 2006). In fact, EA can be described as “a solution in search of a problem,” a dilemma that is found with many management innovations or complex innovations (Currie 2004; Wang 2009). Therefore, EA is an appropriate empirical phenomenon to examine the processes and mechanisms that can hinder or promote the adoption and diffusion of IT management innovations.

U.S. State governments are an “ideal” domain to study the diffusion of Enterprise Architecture. Today, the U.S. government has the largest and most intense EA program in the world since its inception in 1996 with numerous EA adoptions in federal and state government agencies (GAO 2006). With the fiscal crisis in state budgets in 2000, the need for cost-effective IT administration was clear, and EA has been promoted as an innovation that would help to streamline IT activities to help the agencies “do more with
less.” What’s more, even today, EA is not mandated at the U.S. State level, and there will be less political pressure to adopt EA. The findings, therefore, will be more likely applicable to the private sector too, where EA is often portrayed as a managerial practice that improves business performance (Ross et al. 2006).

Chapter 2 of the dissertation will discuss in details the history, definitions, characteristics, and popular branded frameworks in the EA field. For the purpose of brevity, I reproduce the summary of the current state-of-the-art of EA below as it will illustrate the current issues in the EA field.

The Current State-of-the-Art of Enterprise Architecture

Currently, EA has been widely considered a stable IT management practice rather than a fad (Kappelman 2010a). The field has been around for more than two decades with ongoing interests, good user base, and strong knowledge pool. Yet, skepticism still exists regarding EA benefits and practices (Boh and Yellin 2007; Ericson 2011; Kappelman 2010b; Kluge et al. 2006). Overall, a few observations can be made regarding the field.

First, there is little or no sign of convergence in the EA knowledge pool. There are many different EA definitions as well as EA frameworks, each focusing on different issues or having different assumptions and ideologies (Lapalme 2011; Schekkerman 2004; Sessions 2007). The number of available frameworks is surprisingly high, causing confusion to not only casual observers but also professionals. Table 1.1 provides an overview of the most commonly-found EA frameworks in the U.S. public and private sector.
Second, there is little or no sign of convergence in EA implementation practice either. Many organizations choose to modify and customize the popular EA frameworks, or develop their own versions. A recent study by Gartner found that, globally, a majority of private organizations chose to use a homemade or blended framework (37%), and no branded framework accounts for more than 8% of the adoptions (Gall 2012). A similar effect can also be found in the public sector with considerable variations found in public organizations: some accepted the common practices while others improved them (i.e., adaptation) or transformed them (i.e., reinvention) (Hjort-Madsen 2007).

Theoretical Background: Adoption and Diffusion

Mechanisms

Having identified EA as the area of interest, I next establish the theoretical framework for my dissertation. The dissertation is built on the literature of innovation adoption and diffusion, found in several streams of literature (e.g., social studies, organization studies, social movements, Information System (IS) studies). These literatures have been selected based on their relevance to the issues and challenges that I found with Enterprise Architecture. Without making a claim that the following review is complete or comprehensive, I next discuss three streams of research which provide the background for my subsequent studies. They are: 1) classic diffusion studies, 2) institutional diffusion studies, and 3) cognitive-institutional diffusion studies (Strang and Meyer 1993; Strang and Soule 1998).
Classic Diffusion Studies

Studies in the classic diffusion stream take a contact model of diffusion in which point-to-point interactions spread an innovation across a population (Strang and Meyer 1993; Strang and Soule 1998). The focus is usually on communication processes and channels, asking how and why an innovation is introduced and transferred between adopters. Classic diffusion studies are also an information-based model in which prior adopters or innovation promoters provide information to prospective adopters through word-of-mouth, person-to-person contact, or mass media (Rogers 2003; Ryan and Gross 1943). Therefore, the unit of analysis for classic diffusion studies is often individual adoption.

The underlying causal mechanism for classic diffusion studies is a contagion process in which an adopter with actual or latent needs comes in contact with an innovation or representation of an innovation (e.g., a description, an advertisement) that meets the needs. Upon contact, the innovation is recognized as a solution to particular needs, and is subsequently adopted. For example, Ryan and Gross (1943) analyzed the diffusion of hybrid corn among Iowa farmers in the 1930s. They found that the farmer-to-farmer exchanges of hybrid corn experience played a critical role in the diffusion process. Once farmers learned from their neighbors about the advantages of hybrid seeds over the traditional seeds, they were more likely to adopt the new practice.

Classic diffusion studies inspired innovation studies in various fields, setting up the research methodology and approach for studying the diffusion of innovation (Rogers 2003). One premise of classic diffusion theories is the focus on the direct benefits of innovations as the primary drivers for adoption. Upon learning of the advantages of the innovation or understanding how the innovation can be a solution to a particular issue,
prospective adopters are more likely to adopt. In other words, it is believed there is inherently something good about innovations that makes them appealing and beneficial to adopters. This is often known as the *pro-innovation bias* in classic diffusion studies (Rogers 2003). Additionally, classic diffusion studies also stress the reflective and internal calculations of adopters (Strang and Meyer 1993). Prospective adopters are assumed to be rational decision makers who can make adoption decisions based on the merits of the innovation alone. This assumption underpins many innovation studies, and is still considered one of the primary assumptions about adopters (Stoneman 1983; Tornatzky and Fleischer 1990; Wang 2009; Wang 2010).

On the other hand, classic diffusion studies are not without criticism. Opponents claim that institutional influences are largely ignored in the decision making process, making classic diffusion studies under-rationalized (Strang and Macy 2001). An adoption decision is often made based on internal calculations of bounded rational managers with little regard to context, environment, or network influences. While this view may be sufficient to explain adoption of simple innovations among individuals, it seems inadequate for complex innovations at the organizational level (Fichman 2000) or situations in which high uncertainty forces adopters to rely on others’ adoption decisions (Tingling and Parent 2002). While later studies built on the classic diffusion model do consider organizational adoptions, most classic diffusion studies are focused on individual adoptions (Rogers 2003). Thus, contemporary diffusion studies often turn attention to two macro views: institutional view in organizational studies and cognitive-institutional view in the social movements literature (Strang and Soule 1998).
Institutional Diffusion Studies

Diffusion research in organizational studies pays particular attention to the influences from context and environment on organizational adoptions, emphasizing a larger historical and spatial context than the classic diffusion studies. These studies are influenced by institutional theories, asking why and how institutional arrangements reproduce, diffuse, or decline in a population or organizational field (DiMaggio and Powell 1983; Scott 2008; Tolbert and Zucker 1983; Van De Ven and Hargrave 2004). Organizations, operating in institutional contexts, are often the unit of analysis in institutional diffusion studies. Some instances of institutional diffusion studies are Abrahamson and Fairchild’s (1999) analysis of management fashion in innovation adoption and Tingling and Parent’s (2002) emphasis on the diminishing role of mimetic isomorphism.

The underlying causal mechanism for institutional diffusion studies is a conformity mechanism in which organizations comply with external influences or pressures. Those influences can come in the forms of emulating peers or competitors (i.e., imitation), following directions from regulators or powerful organizations (i.e., coercion), or satisfying a standard or obligation (i.e., norm) (DiMaggio and Powell 1983; Scott 2008). Unlike classic diffusion studies, the triggers for adoption in institutional diffusion studies are concerns for the losses from non-adoption. Organizations are more motivated to avoid losses in business opportunities due to non-adoption than they are to maximize benefits from adoption (Kennedy and Fiss 2009; Lyytinen and Damsgaard 2001). For example, Damsgaard and Lyytinen (1997) found that many organizations joined a strategic EDI
network in Hong Kong because of the fear of losing important business opportunities once their partners joined.

Subsequently, institutional diffusion studies are often recognized for stressing the indirect benefits of innovation adoption: the *symbolic* benefits (DiMaggio and Powell 1983). These symbolic benefits are defined as “the extent to which they generate positive social evaluation” (Heugens and Lander 2009)(p. 63). Organizations enjoy not just the outcomes of adopting an innovation, but also the perceptions of external observers toward their adoptions. Therefore, organizations will be willing to adopt an innovation despite the uncertainty of outcomes if there is evidence of those symbolic perceptions (e.g., reputational advantages, status of organization, or legitimacy). As a result, institutional diffusion studies emphasize institutional influences in adoption decisions (DiMaggio and Powell 1983; Scott 2008; Van De Ven and Hargrave 2004). These influences create similarities in organizational structures and behaviors, or *isomorphism* (DiMaggio and Powell 1983).

However, while it is important to highlight the impact of institutional influences on decision making, institutional diffusion studies are criticized for overemphasizing the effects of institutional contexts (Heugens and Lander 2009; Tolbert and Zucker 1996). Modest efforts have been made to show how and why early adoptions occur or how innovative practices get institutionalized. While recent institutional work has provided insights into these micro processes (Barley and Tolbert 1997; Lawrence and Suddaby 2006), much remains to be learned.

Furthermore, another theoretical problem of institutional diffusion studies is the stress on social and environmental determinism at the expense of human agency (Child 1997).
Thus, institutional diffusion studies are criticized as being *under-rationalized* because adopters rely heavily on others’ decisions to make their own (Strang and Macy 2001). This view also assumes two conditions: 1) the presence of powerful regulators or organizations to exert their influences and 2) the high uncertainty of the innovation which makes others’ adoption a useful reference (Bui 2011; Tingling and Parent 2002). In situations in which there is no clear authority among organizations, or uncertainty is not high, organizations may rely more on their calculations to make autonomous decisions. Diffusion studies in social movements, presented next, focus on those situations, stressing the importance of collective actions and cognitive evaluations in adoption decisions.

**Cognitive-Institutional Diffusion Studies**

Another macro view on diffusion research is found in the social movements literature, focusing on collective actions that facilitate or constrain innovation adoptions or social movements, and how those collective actions emerge and change (Strang and Soule 1998; Van De Ven and Hargrave 2004). Cognitive-institutional diffusion studies share with institutional diffusion studies interest in the effects of context and environment, but stress the emergence and changes of collective actions at the population and community level (Van De Ven and Hargrave 2004). Therefore, cognitive-institutional studies are a subtype of institutional diffusion because they provide insights on areas that institutional diffusion studies lack: the micro processes of institutional work. And like classic diffusion studies, cognitive-institutional diffusion studies emphasize the importance of information that facilitates and enables sense-making of the innovation. In other words, information at the collective level allows cognitive learning about the innovation at the
organizational level (Wang 2009; Wang and Ramiller 2009). Hence the term “cognitive-institutional.” Some examples of cognitive-institutional diffusion studies are institutional work at the macro level (Greenwood et al. 2002; Hinings et al. 2004; Tolbert and Zucker 1996), the adaptive emulation model (Strang and Macy 2001), organizing vision theory (Swanson and Ramiller 1997), and technological action frames (Elliott and Kraemer 2008; Iacono and Kling 2001; Markus et al. 2008).

Because of the focus on collective actions to guide organizational adoptions within a population or community, the underlying causal mechanism for cognitive-institutional diffusion studies is a social learning mechanism. It is the process in which prospective adopters obtain necessary adoption knowledge and information from collective adoption rationales that reside within the organizational population. The trigger for diffusion is the information threshold that prospective adopters have to overcome in order to bypass certain levels of skepticism or concerns toward the innovation. These information or knowledge gaps trigger actions at the collective level to generate and accumulate the necessary information for the audiences. This explains why a number of cognitive-institutional diffusion studies emphasize the creation of collective frames and interpretive schemes which provide an interpretive lens for prospective adopters (Elliott and Kraemer 2008; Markus et al. 2008).

A merit of the cognitive-institutional diffusion studies is the view that the adoption rationale is created in part at the community or population level (Wang 2009; Wang and Ramiller 2009). Know-how, know-why, and know-what are generated by thought-leaders, associations, practitioners, or academics. This presents several theoretical advantages. First, scholars can examine the effects of institutional forces in
organizational communities or populations that have no clear authority or powerful organizations. The emergence of social movements or institutional forces is socially constructed through the actions of various actors within the community. Second, adoption decision-making can focus on both institutional influences and cognitive processes. Prospective adopters have the agency to determine which information is useful to their decisions, while institutional influences can exert power over adopters through the information they provide (e.g., collective frames), and/or the way the information is presented to adopters (e.g., framing, rhetoric).

This does not mean the cognitive-institutional diffusion studies are the only way to study the diffusion of innovation. Cognitive-institutional diffusion studies suffer from a few criticisms. First, there is a lack of attention to adoption needs and how those needs impact adoption decisions. For example, the organizing vision theory (Swanson and Ramiller 1997) asserts that the vision draws its meaning and language from the IS practitioner subculture in response to a business problematic. The IS practitioner subculture helps test the plausibility of the vision, while the business problematic determines the vision’s perceived practical importance. However, how the business problems and the plausibility of the vision (i.e., needs for adoption) emerged and were presented in the practitioner discourse was not addressed.

Second, cognitive-institutional diffusion studies largely ignore the characteristics of the innovation to the diffusion process in terms of features and affordances enabled by those features. Because one of the goals for collective action is to provide the necessary knowledge to prospective adopters, it becomes extremely important to include the innovation characteristics within the process: what kind of features the innovation
provides, what kind of affordances are made possible by those features, what kind of innovation configurations are available, and how those features and affordances fit adopters’ needs. Some scholars have offered the concept of technology ensemble interactions as a way to account for the missing role of innovation characteristics (Markus et al. 2008). Nevertheless, cognitive-institutional diffusion studies still need a way to include more consideration for innovation characteristics in the diffusion process.

What We Know and What We Do Not Know

In this section, I examined three streams of diffusion studies: classic diffusion studies, institutional diffusion studies, and cognitive-institutional diffusion studies. Each stream is characterized by different focuses, causal mechanisms, strengths, and limitations. Overall, the three streams of diffusion studies provide a compelling picture of innovation adoption and diffusion (see Table 1.2 for an overview). A few studies have shown the interplays of different causal mechanisms throughout the diffusion process: early adopters are motivated by rational and economic reasons, middle adopters are attracted by the fads and fashions, while late adopters are inspired by the normative behaviors and the legitimacy of the innovation (Tolbert and Zucker 1983; Wang 2010). On the other hand, there are a few notable areas that still need more attention.

First, the notion of innovation changes during implementation is under-theorized in innovation studies, and often is considered as “noise” of the diffusion process (Rice and Rogers 1980). The concept has been examined in classic diffusion studies under the term reinvention (c.f., (Rogers 2003)), but further attempts have been scattered in various fields and under different names (e.g., user customization, innovation modification, innovation adaptation, appropriation). In the case of IT management innovations, the
concept of innovation changes is extremely important as IT management innovations are mostly tacit and provide greater flexibility to adopters (Birkinshaw et al. 2008). As a result, adopters may tend to adapt and/or reinvent the innovation. For example, organizations tend to adapt or create their own EA versions from canonical EA frameworks (Gall 2012). While some attempts have been made to examine the notion of adaptation and reinvention in the diffusion process (Leonard-Barton 1988; Lytyinen and Newman 2008; Majchrzak et al. 2000; Tyre and Orlikowski 1994), this theoretical gap demands more attention from researchers.

Second, diffusion theories often focus on how different converging mechanisms lead to widespread adoption. Early studies focus on direct benefits and economical needs for innovations, later studies emphasize institutional influences and indirect benefits, while recent studies are more concerned with collective actions to provide necessary information to prospective adopters. However, in the cases of IT management innovations (e.g., EA) in which adaptation and reinvention is more common in implementation practice (Gall 2012; Hjort-Madsen 2007), and diversity and ambiguity characterizes the collective knowledge pool (Schekkerman 2004; Sessions 2007), how would the diffusion process be for IT management innovations? As flexibility is high and adaptation and reinvention is inevitable, what is the process by which IT management innovations come to achieve widespread adoption? Answering these questions is important for understanding the innovation journey, one that is characterized by not only converging mechanisms but also diverging mechanisms (Van de Ven et al. 2008).

Lastly, there is an increasing interest in macro-level studies. Diffusion studies over time have been concerned more with the influences of forces at the macro level (e.g.,
normative or coercive forces, collective actions) (Strang and Soule 1998). What we need is more insights on the underlying micro processes that lead up to the collective actions and beliefs at the macro level (Lawrence and Suddaby 2006) and more explanation on how to make the those collective beliefs become compelling to attract followers, since mere existence of discursive structures does not guarantee wide adoption (Strang and Meyer 1993). This is an important issue for the diffusion of IT management innovations as they are more susceptible to external influences (Birkinshaw et al. 2008). Yet the issue has not been properly examined, and additional studies are needed to understand the evolution of adoption rationales at the collective-level.

Research Motivation

So far, I have provided the substantive and theoretical background for the dissertation. In sum, the field of Enterprise Architecture has experienced little to no sign of convergence regarding EA knowledge (i.e., EA frameworks) or EA implementation practices. On the other hand, common adoption and diffusion studies pay modest attention to management innovation adaptation and reinvention; the dynamics of widespread adoption when divergence exists; and the evolution of collective adoption rationales. Those theoretical issues, in turn, are important to understand the diversity in EA knowledge and practices. Thus, in answering the research question on how and why IT management innovation diffuses, I focus on those particular theoretical gaps, and investigate four questions. Each is asked below in the context of Enterprise Architecture:

1. What (if any) are the different types of EA frameworks, and how do organizations distinguish the different types of EA frameworks?
2. How do organizations adapt and/or reinvent canonical EA frameworks?
3. How does EA come to achieve widespread adoption?
4. How do EA promoters encourage EA adoption in a community?

**Research Design**

To address these questions, four studies are conducted and reported in this dissertation. In this section, I provide a high-level overview of the four studies (see Table 1.3).

To understand how organizations can distinguish the different types of EA frameworks, the first study reviews EA literature and identifies seven essential elements of EA frameworks. Those seven elements encapsulate the general ideologies and mechanisms of an EA framework, allowing organizations to make sense and easily compare existing EA frameworks in the field. Based on the analysis of eight popular branded EA frameworks, this study proposes a typological theory of EA frameworks that connect the different types of frameworks to expected organizational benefits.

The second study takes an in-depth case study approach to explain a dynamic in EA adoption: although many branded EA frameworks exist, organizations tend to use a homegrown or hybrid EA framework (Gall 2012). The questions of interest in the second study are: *how and why do organizations adapt and/or reinvent canonical EA frameworks?* By examining the EA implementation in a public organization, this study reveals the many details underpinning EA adaptation and reinvention processes.

Given the existence of several types of branded EA frameworks, and the high tendency of organizations to adapt and/or reinvent their EA practices, the third study examines EA adoptions across organizations, asking *how EA comes to achieve widespread adoption.*
This study is particularly interested in comparing EA widespread adoption process to the product innovations where dominant designs are often the key driver to widespread adoption. Through a multiple-embedded case study of 50 U.S. State governments, the study illustrates how the different innovation designs in the EA field can also lead to widespread adoption.

To answer the fourth question on how EA promoters encourage EA adoption in a community, the final study investigates the role or rhetorical persuasion in the construction and evolution of collective adoption rationales at the community level, in this case, the 50 U.S. State governments community. Through a rhetorical analysis of discourse published by the National Association of State Chief Information Officers (NASCIO), a collective organization that actively promotes EA adoption among the U.S. State governments, the study investigates the use of different rhetorical strategies over time in order to increase the persuasiveness of EA adoption rationales.

**Major Findings**

The studies conducted here offer valuable insights into EA adoption and diffusion in particular, and IT management innovation adoption and diffusion in general. Here I summarize several major findings from the four conducted studies (see Table 1.4).

**Study #1 – EA Typologies:** In answering how organizations can distinguish different types of EA frameworks, I was able to identify and recommend seven essential elements to make sense of and distinguish EA frameworks. They are:

1. Defining EA technical layers: specifying technical layers such as Technical Architecture, Information Architecture, and Application Architecture.

3. Creating EA methodology: specifying the guided or general approach to implement EA.

4. Organizing EA structure: specifying the governance and decision-rights of an EA program.

5. Operating and monitoring EA: creating processes that operate and monitor EA development.

6. Enforcing EA values: creating processes that enforce EA values into organizational practices.

7. Integrating EA values: creating processes that integrate EA values into strategic planning processes.

Together, those essential elements capture the ideologies and the mechanisms through which an EA program can deliver organizational benefits. They are useful to compare and make sense of the different EA frameworks promoted by EA vendors. Specifically, eight branded EA frameworks have been analyzed based on the seven essential elements. The result is three ideal types of EA framework:

1. Technical EA frameworks: focusing mostly on defining technical EA layers and a methodology to implement EA.

2. Operational EA frameworks: emphasizing the establishment of both technical and business EA layers to create a holistic EA program. Operational EA frameworks also focus on specifying EA structure, operating and monitoring processes, and enforcement mechanisms.
3. Strategic EA frameworks: do not focus on defining different EA layers but rather on how to realize EA values. Strategic EA frameworks emphasize the enforcing mechanisms and integrating EA into strategic plans in order to drive organizational transformation.

Furthermore, each type of EA framework has a different emphasis, and therefore would impact certain organizational benefits. Particularly, technical EA frameworks would be more likely to increase information availability while operational and strategic EA frameworks would increase organizational alignment, resource portfolio optimization, and resource complementarity. Each essential element would play a different role to realize those benefits, and future research is welcomed to test the established propositions.

**Study #2 – EA adaptation and reinvention**: The second study investigates how organizations adapt and/or reinvent canonical EA frameworks. The findings suggest that innovation changes during implementation involves two possible processes: adaptation and reinvention. Adaptation is operationalized as changes made to the innovation and organizational structure to overcome misfits, thus their effects are often organizational-level effects. On the other hand, reinvention involves changes that are made to the innovation that can lead to significant departure from the normative practices: that is, the way the innovation is often understood and implemented in the community. Therefore, reinvention involves the large-scale adaptation events that have the potential to transform the innovation.

Furthermore, both adaptation and reinvention can happen to all three elements of an innovation: innovation concepts that specify the causal mechanisms of the innovation
(e.g., fully integrated functions and a centralized database in enterprise systems),
innovation objects that consist of physical and material components of the innovation
(e.g., Oracle databases, Cisco data centers), and innovation practices that enact the
innovation in organizational practices (e.g., generating customer reports using SAP).
While all three elements are equal in potential to transform the innovation, changes made
to the innovation concepts have a higher chance to alter the nature of the innovation and
push the boundary of changes to give rise to a new type of innovation.

In this study, the importance of legal and ethical misfits are highlighted. Especially in the
context of public organizations, it is crucial that the adopted EA features should not
hinder the fair and just status of the public organization. Because EA establishes state-
wide IT standards and procedures, public organizations would need to consider inputs
from multiple stakeholders to make sure no particular groups receive better options than
others. This legal and ethical fit have not been considered seriously by branded
frameworks in the public sector. As a result, managers in the public sector are encouraged
to be mindful about those legal and ethical issues in their EA development.

Lastly, the findings suggest that the temporal patterns of change occur differently for
innovation concepts and practices. For innovation practices, changes happen in an
ongoing and continuous manner, while innovation concepts are modified episodically,
each time accompanied by organizational jolts and learning. Further studies are needed in
order to closely examine these different patterns.

Study #3 – EA Alternative Designs: Continuing to investigate the diversity in EA
adoptions, the third study focuses on the question of how EA comes to achieve
widespread adoption. Today, EA is widely known and adopted in the U.S. State
governments (23 States have adopted and 22 States have initiated EA). Based on the prior literature, one should expect to see a shakeout in the vendor community, followed by an emergence of a dominant design and a convergence process in the actual EA implementations.

Yet, the EA vendor/promoter community still supports three different ideal EA designs (i.e., technical EA, operational EA, and strategic EA). These different EA designs have different assumptions and can promise different organizational benefits (as established in study #1). What’s more, new EA frameworks with different designs are still being introduced into the community in recent years (e.g., Gartner revamped its EA frameworks in 2005, and MIT’s CISR group introduced their approach in 2006), and current EA frameworks are continuously refreshed. A shakeout is far from reality in the EA promoter community.

In addition, the U.S. States adopt and adapt those ideal designs into four different designs, each with its own assumptions: technical EA design focusing on technical EA layers, operational EA design emphasizing a holistic EA program using both technical and business EA layers, technical-operational EA combining the holistic approach with a technical focus, and strategic EA design aiming the integration of EA values into strategic planning processes. These designs are both the variations and the exact ideal EA designs as promoted by the EA vendors. The adoption of Enterprise Architecture illustrates that alternative designs may be more possible and even more desirable for IT management innovations. In fact, the different designs, while not providing stability like a dominant design does, can provide adopters a bigger pool of collective knowledge that allows them to overcome the knowledge barriers and adapt, modify, and reinvent a
version that best fit their needs. That is, those different designs provide interpretive viability for adopters, leaving room for ambiguity to allow potential adopters to recognize their own version of the innovation, and thus increasing the attractiveness of the innovation as well as increasing the size of potential markets (Benders and van Veen 2001). Ambiguity, in the right conditions, is actually a good thing for innovation diffusion.

Study #4 – EA rhetorical persuasion: The last study focuses on the dynamics at the community level, asking how EA promoters encourage EA adoption in a community. The findings suggest that EA promoters rely on rhetoric to frame and encourage EA adoption in State governments. In particular, an effective collective adoption rationale needs to be developed and evolved to guide EA adoptions in a community. To make a compelling adoption rationale, the discourse provided by EA promoters needs to specify three elements of innovation rhetoric:

1) Problem specification: a rhetoric that specifies a business problem that is important and relevant to the audiences. The rhetoric explains what the problem is and why it is important to the audiences; thus, it represents a why-rhetoric of innovation adoption.

2) Innovation specification: a rhetoric that explains what an innovation is in terms of its distinct characteristics, its practical value (e.g., success stories), and its comprehensive how-to guidance. As such, the rhetoric is a what-rhetoric of innovation adoption.

3) Innovation justification: a rhetoric that explains how the innovation is the solution to the specified problem. The rhetoric establishes the cause-effect link between
the problem and the innovation by elaborating the mechanisms through which the innovation can solve the problem. Therefore, the rhetoric is a *how-rhetoric of innovation adoption*.

In addition, the innovation rhetoric needs to evolve and adapt over time to the contingencies of the audience. Each of the elements needs to fit with the audience’s contingencies in order to create *rhetorical congruence*, thus increasing effectiveness of the collective-institutional accounts.

**Implications and Contributions**

This dissertation offers several contributions to both theory and practice. First, the dissertation contributes to the under-theorized field of IT management innovation as well as diffusion studies (Birkinshaw et al. 2008; Miller et al. 2009). As business challenges increase and IT investments reach record-high levels, it is even more important to examine the concept of IT management innovations in order to advance our understandings in one of the most important activities of operational managers: organizing and governing IT functions and activities.

Furthermore, this dissertation addresses several theoretical gaps in diffusion studies: the conceptualization of adaptation and reinvention in innovation changes, the role of alternative designs to widespread adoption, and the evolution of collective adoption rationales. Each topic is either under-theorized or relatively new in innovation studies. The dissertation also utilizes a longitudinal approach on innovation adoption at different levels: a single case study, a medium-size N comparison study, and a study at the community level. As a result, the dissertation examines the four processes of innovation...
diffusion (Swanson and Ramiller 2004): a comprehension process in which firms engage with the collective organizing vision (i.e., study #4), an adoption and implementation process in which firms develop adoption rationale and implementation strategy (i.e., study #3), and an assimilation process in which the innovation becomes infused and routinized into organizational structures (i.e., study #2). Therefore, the dissertation potentially provides a more “complete” view of innovation diffusion.

In addition, this dissertation contributes to practice in several ways. First, the dissertation examines the diffusion of Enterprise Architecture, an emerging field that is still suffering from various ambiguities (Kappelman 2010b; Salmans and Kappelman 2010). The dissertation provides clarifications on key terms, topics, and concepts that will advance the field in general (i.e., study #1). Furthermore, we also identify various factors and issues that support or hinder the adoption, implementation, and use of EA within the U.S. State governments (e.g., legal and ethical issues in study #2). These findings would be useful for institutional entrepreneurs (e.g., regulators, consultants, managers) who are seeking ways to encourage EA adoption in the U.S. State governments.

Details of the contributions for each study are discussed in Chapter 6: Discussion and Conclusion. Table 1.5 produces a summary of contributions for each study.

**Limitations and Future Research**

As with any study, this dissertation also has its share of limitations. Because the empirical setting focuses exclusively on the U.S. State governments, the generalization of the studies is limited. Elsewhere, scholars have made the argument that public and private organizations have distinct differences that need to be accounted for (Caudle et al. 1991).
However, EA adoptions in the U.S. State governments are exempt from the typical coercion usually found in the public sector, and since the late 1990s, the States have experienced similar difficulties as the private organizations did, and have adopted similar IT management techniques to address those challenges (e.g., IT outsourcing, IT shared services) (Markus et al. 2013a; Markus et al. 2013b). Therefore, the findings here can be applicable to the private sector. Future research can also replicate the studies in other settings such as the E.U. market, for-profit, and non-profit organizations.

In addition, the studies also have limitations in the methodology choices. All studies rely on case qualitative methodologies (e.g., case study, rhetorical analysis) and therefore will have limited generalization. However, the studies focus on different levels of analysis (e.g., single case study, population-size comparison, and longitudinal analysis) as well as utilize data triangulation from multiple sources (e.g., interviews, archival data, office visit, informal conversation). Rigorous procedures have been followed and carefully documented. Thus, while the findings may not have statistical generalization, they can offer analytic generalization (i.e., generalization to theories) (Yin 2009). Future studies are certainly helpful to validate the findings here (e.g., survey format).

**General Summary**

This dissertation is one of the very first investigating Enterprise Architecture adoption and diffusion in the context of the U.S. State governments. Furthermore, it focuses on issues that are important to both EA professionals and students of innovation adoption: how to make sense of the different existing EA frameworks, how to understand the adaptation and reinvention processes, how the widespread adoption unfolds for non-
product innovations, and how collective adoption rationales evolve to remain compelling to the audiences. In sum, the findings show a different way diffusion processes unfold when ambiguity is high, and adopters have greater possibility to adapt. The studies contribute to the past and current conversation on innovation adoption: dominant design perspective (Anderson and Tushman 1990; Tushman and Murmann 1998), innovation changes (Lyytinen and Newman 2008; Rice and Rogers 1980), and rhetorical strategies (Green 2004).

The next chapters reproduce the four papers that make up this dissertation.
In this chapter, I investigate the current diversity in the EA collective knowledge pool. The history, definitions, and characteristics of EA are discussed. This chapter provides a substantial overview on EA in general, providing a background on which subsequent chapters will build. Furthermore, I suggest a framework by which organizations can make sense of and navigate through the “jungle” of existing EA frameworks.
Surviving the Jungle of EA Frameworks: A Typological Theory of Enterprise Architecture Frameworks

Abstract

To both casual observers and IT professionals, the number of Enterprise Architecture (EA) frameworks that exist in the industry is surprisingly high. Yet, studies to make sense of and navigate these frameworks are far from satisfactory, with the focus mostly on the informative and descriptive level. This paper proposes a typological theory of EA frameworks to draw a connection between the types of EA frameworks an organization can adopt and the organizational benefits it can expect. Seven essential elements are identified to distinguish EA frameworks and programs, and based on an analysis of the eight most commonly-found EA frameworks, I identified three different types of EA frameworks: technical, operational, and strategic EA frameworks. Each type has different implications in respect to the expected organizational benefits, and future research is needed to empirically test these links.

Keywords: Enterprise Architecture frameworks, typology, essential elements, organizational benefits
Introduction

“More than double.”

If there were a quick quiz on Enterprise Architecture (EA), “more than double” would be the answer to the question “how many EA frameworks have been introduced in the last ten years?” In 2004, when Schekkerman (2004) published his book on surviving the “jungle” of EA frameworks, he described in detail 14 popular EA frameworks found in practice. In 2012, when Gartner surveyed more than 200 organizations about their EA practices, the number of EA frameworks was reported at 33 (Gall 2012). In another interesting statistic, Simon et al. (2013) estimated that the number of EA publications per year has tripled from about 40 in 2004 to more than 140 in 2009. The message is clear: the interest in EA has increased significantly, and so has the number of EA frameworks.

Against that backdrop, it is important for organizations to find a way to make sense of and navigate through the “jungle” of EA frameworks. To date, there are only a handful of studies comparing the different EA frameworks (Alwadain et al. 2011; Leist and Zellner 2006; Schekkerman 2004; Sessions 2007; Simon et al. 2013). While all studies have pointed out the differences between the frameworks, none was able to clearly articulate whether the differences represent variations in types, or only in degree. What’s more, little has been done to connect those differences to the potential organizational benefits from EA implementation. Could a certain type of EA lend itself to certain benefits?

Answering this question is important as organizations have been having a difficult time to articulate the benefits of EA (Bradley et al. 2011; Tamm et al. 2011). Furthermore, such clarification can assist managers in deciding how to implement an EA framework that fits
their organizational needs or structure to avoid the trap of blindly following a management fad.

In this paper, I investigate the following research questions:

1. How can organizations distinguish the different types of EA frameworks?
2. What are the main types of EA frameworks commonly found in the field?
3. What are the expected organizational benefits for different types of EA frameworks?

To answer these questions, this paper proposes a typological theory of EA frameworks. A typological theory specifies and categorizes independent variables (e.g., EA frameworks) into configurations or types. A typological theory is used to specify the pathway through which particular types connect to specific benefits (George and Bennett 2005). Therefore, the contribution of the proposed typological theory is that it proposes a link between types of EA frameworks and expected organizational benefits. I argue that by understanding how organizations implement EA (i.e., what EA elements they use), we will have a better understanding of the benefits they get than if we look solely at how well they implement EA (i.e., the typical EA maturity model).

The rest of the paper is structured as follows. A quick overview of EA definitions and history is presented. Then, the paper reflects on the existing EA literature and practitioners’ writings to propose seven essential elements of an EA framework. Together, these essential elements encapsulate the ideologies as well as the mechanisms of a given framework, allowing organizations to understand and distinguish EA frameworks. Eight popular branded EA frameworks are analyzed using the elements,
suggesting three different types of EA frameworks. Each type of EA comes from
different assumptions and historical development, and each is argued to connect to
different type of organizational benefits. For example, a technical EA type would expect
to yield technical information availability, but an operational EA type would more likely
result in organizational alignment. Future research is needed to verify these patterns.

What is Enterprise Architecture?

It is not difficult to find various EA definitions; some are quite contradictory to each
other (see Table 2.1). The reason is that enterprise architecture means several things,
depending on whom you ask. On one hand, enterprise architecture can refer to the actual
architectural foundation of a real-world enterprise, consisting of all systems, their
components, their relationships, and the principles that govern them (IEEE 2000). On the
other hand, enterprise architecture can refer to the models and documentations that
describe a high-level view of an enterprise’s processes and IT systems, their
interrelationships, and the extent to which these processes and systems are shared (Tamm
et al. 2011; Zachman 1987). The former is an actual architecture of an enterprise, while
the latter is an enterprise-perspective model of an enterprise and its systems, components,
and relationships (Ahlemann et al. 2012).

The EA literature, in general, is more concerned with the latter concepts, focusing on the
planning processes and models of an enterprise. Within this view, several approaches
exist:
• Enterprise architecture as a plan, a blueprint, that provides tangible documentation of an enterprise (e.g., architecture diagrams, system specifications, artifact descriptions) (GAO 2006).

• Enterprise architecture as a planning process that translates business visions into changes by documenting and creating models that describe an enterprise future state and its evolution (Lapkin 2006).

• Enterprise architecture as a management philosophy that provides the organizing logic for business processes and IT infrastructure (Ross et al. 2006).

• Enterprise architecture as a management program, one of organizational functions that supports strategy planning and strategy implementation (Bernard 2004).

What’s more, because of its association with both technical and managerial techniques, EA has been portrayed and perceived as a technical solution as well as management solution. In this paper, for the purpose of brevity, I view Enterprise Architecture as a management term that has been applied to a range of “best practices” that include both technical and managerial practices. Technical practices include setting standards or defining software development procedures. Managerial practices consist of reducing IT investments or aligning IT strategy with business strategy. This definition allows me to treat EA as a conceptual innovation, one that focuses on innovative ideas and concepts of managing IT activities in an enterprise.

Characteristics of Enterprise Architecture

As an innovative concept toward IT management, Enterprise Architecture has several distinct characteristics; each has important implications for its adopters.
First, EA has more *conceptual components* than technical and material components. This sets it apart from technological innovations, which are made up mostly of technical and material components (e.g., data warehouses, Enterprise Systems). Most of EA developments involve activities at an abstract level, such as modeling activities, standardizing procedures, or coordinating decisions. There are limited activities that involve technical and physical IT artifacts, like setting up databases, purchasing software packages, or installing enterprise systems.

**Implication:** EA therefore does not require intensive capital investment, but it requires intensive collaboration across business functions (i.e., effort intensive). Because the goal is to achieve alignment between IT and business strategy at an *enterprise perspective*, the challenge is to find support not only from top managers, but also from department-level managers who contribute to EA developments, and later use it in their decision making process. With low capital requirement, but high effort-intensity, many overlook the necessity of EA, and find it difficult to commit their time and energy (GAO 2006).

Second, EA has high *interpretive flexibility* (Orlikowski 1992), or the involvement of adopters to constitute the realizations of the innovation. Because EA contains more conceptual components, it allows more subjective interpretations from prospective adopters (Birkinshaw et al. 2008), giving them the flexibility to interpret and comprehend EA in ways that most fit their needs.

**Implication:** Many find it easier to reinvent or customize existing EA models to fit their needs. Although adjustments and customizations are often needed at some levels to implement an innovation, in the case of EA, its adopters experience a
higher flexibility to adjust EA models into their organizations. A recent survey from Gartner found that up to 37% of EA adoption used a homemade or hybrid framework (Gall 2012). Among the rest, no branded framework accounts for more than 8% of organizations. Similarly, Hjort-Madsen (2007) found that out of 12 U.S. federal agencies, seven of them tried to adapt branded frameworks while two others tried to reinvent them, that is, significantly transform the branded frameworks.

Finally, EA adoption is knowledge intensive, thus being more susceptible to knowledge barriers (Attewell 1992). Having less technical and material components, EA proponents are often left with abstract and theoretical principles to induce their own actionable items. Consequently, this leaves a huge knowledge burden on the adopters to figure out and accumulate the necessary know-how to carry out the adoption, something Attewell (1992) terms knowledge barriers. As a result, the adoption process can unfold over years, and involve a lot of interpretations and discussions.

**Implication:** In many cases, prospective adopters seek necessary knowledge from external sources, such as consulting firms, conferences, associations, or academic research. Many organizations actively contribute or participate in different EA channels, while learning and adopting best practices in their organizations. For example, the U.S. States of Kansas and Virginia actively participate in the EA developments at the National Association of Chief Information Officers (NASCIO) while adopting best practices from others. The State of California conducted an intensive research project to combine all the EA best-practices in order to morph their own version. Subsequently, this partly explains the
exponential growth in EA models by consulting firms, associations, or practitioner groups in responding to the demand for know-how from adopters.

Summary

The flexibility and highly conceptual nature of Enterprise Architecture make it easier to modify, adapt, and reinvent. Furthermore, many organizations rely on external consulting firms for know-how to make sense and implement EA. Combined together, the EA field has witnessed a proliferation of EA frameworks promoted by different EA vendors and associations, as well as a diversity of recommendations in relation to how they should be implemented. In the next section, I provide a brief history of EA developments in the U.S. to summarize the current state-of-the-art of EA.

A Brief History of EA Developments in the U.S.

The concept of Enterprise Architecture (EA) was conceived in 1987 when Zachman published an article in an IBM journal, laying down the ontological foundation for an Information Systems Architecture (Zachman 1987). The purpose was to describe IT architectural assets within an organization as well as the related relationships (Sessions 2007). Others built on Zachman’s concept, developing EA as a process to transform organizational IT architecture from an “as-is” to a “to-be” state (e.g., TOGAF framework, FEA framework). Today, many view EA as a management discipline or a strategic planning program that intends to align IT strategy and business strategy (Boh and Yellin 2007; Ross et al. 2006; Schmidt and Buxmann 2011).

Since EA is a relatively new and emerging concept, it is experiencing various challenges: highly contested definitions, skepticism about value propositions, and a slow adoption
rate (Boh and Yellin 2007; Ericson 2011; Kappelman 2010b; Kluge et al. 2006). In fact, EA can be described as “a solution in search of a problem,” a dilemma that is found with many management innovations or complex innovations (Currie 2004; Wang 2009). Against that backdrop, the U.S. government is a flagship that has pushed forward the EA agenda in the U.S. Today, the U.S. government has the largest and most intense EA program in the world since its inception in 1996, with numerous EA adoptions in federal and state government agencies (GAO 2006). With the fiscal crisis in State budgets in 2000, the need for cost-effective IT administration was clear, and EA was promoted as an innovation that would help to streamline IT activities to help the State agencies “do more with less.” In the following sections, I review the EA developments in the public sector and private sector. Figure 2.1 provides an overview.

EA Developments in the Public Sector

Although the concept of Enterprise Architecture started in the private sector, it was the U.S. public sector that gave EA a big push. In the early 1990s, facing the increasing needs for system interoperability and communication, the U.S. Department of Defense (DoD) started to develop a Technical Architecture Framework for Information Management (TAFIM). The first draft was introduced in 1991 and published as the first version in 1994 (Ahlemann et al. 2012). Intrigued by the promised benefits of the TAFIM, the U.S. Congress passed the Clinger-Cohen Act in 1996 mandating all federal agencies to develop, maintain, and facilitate integrated system architectures. The DoD continued to evolve their framework into the Command, Control, Communication, Computer, Intelligence, Surveillance and Reconnaissance (C4ISR) framework in 1995, and later on a new version—the DoD Architecture Framework—was introduced in 2003.
Meanwhile, the 1996 Clinger-Cohen Act created a wave of interest about EA in public agencies. An immediate result was the introduction of the Federal Enterprise Architecture Framework (FEAF) v1.1 in 1999 by the U.S. CIO Council. Based on FEAF development, in 2002, the Office of Management and Budget (OMB) commenced the development of a Federal Enterprise Architecture, consisting of practical guides and detailed explanations for federal agencies on how to develop Enterprise Architecture. Since then, the OMB has published dozens of publications, guidelines, and reports on the topic of EA.

U.S. State governments, although not mandated by the Clinger-Cohen Act, were also attracted by the hype. Some States adopted IT Architecture as early as 1996-1997, right at the time of the Clinger-Cohen Act (e.g., Arizona, Kentucky, and North Carolina). In 2000, commissioned by funds from the Department of Justice, the National Association of State Chief Information Officers (NASCIO) formed an EA Working Group to promote and develop frameworks and guidelines for EA development in State government contexts. The result was an Enterprise Architecture Development Tool-Kit version 2.0 in 2002, and a later version 3.0 in 2004. Many States responded positively and embraced NASCIO’s frameworks (NASCIO 2005b), and NASCIO has been a strong advocate of EA in U.S. State governments.

EA Developments in the Private Sector

When Zachman first published his famous article on IT architecture in 1987, private enterprises were experiencing a difficult time managing and gaining benefits from IT investments. At that time, many organizations had a decentralized computing environment with a weak central IT unit and strong autonomous business units, resulting in issues such as proliferation of hardware and software, increased computing and
maintenance costs, and increased complexity enterprise-wide (King 1983). The concept of IT architecture, thus, was perceived as a possible solution to combat system complexity and align IT-business strategy (Sessions 2007). While Zachman’s framework is more accurately described as a taxonomy for identifying common IT terms and organizing architectural artifacts rather than a framework with detailed guidelines on EA development, it is still widely considered as a framework that lays down the ontological concepts for subsequent Enterprise Architecture frameworks.

The year was 1993 when Zachman for the first time called his framework “Enterprise Architecture” (Zachman 2011) and Spewak introduced his famous book on Enterprise Architecture Planning, clearly establishing a methodology for EA development (Spewak and Hill 1993). Thus, 1993 marked an important milestone when both EA’s ontology and methodology were officially introduced. The subsequent years witnessed an increasing interest in EA. Circa 1997, The META Group was another consulting company offering EA services in the private sector, introducing concepts like Enterprise Architecture Strategies, Enterprise-wide Technical Architecture, and adaptive architecture. Their influences were even found in the public sector with a number of States citing their frameworks and methodologies (e.g., North Carolina). In the meantime, in 1994 the Open Group took the TAFIM developed by the DoD and turned it into The Open Group Architecture Framework (TOGAF™) (Perks and Beveridge 2003). Their first version was introduced in 1995, with continuous upgrades since. Currently, the TOGAF is at version 9.0 and is arguably one of the most influential frameworks in the private sector, taking over the Zachman framework’s dominant position since 2004 (Simon et al. 2013).
In 2005, the META Group was absorbed by the Gartner Consulting group. Both companies combined their EA practices to introduce the revised Gartner Enterprise Architecture Framework (GEAF) (Bittler and Kreizman 2005; James et al. 2005). However, Gartner’s approach has mostly focused on establishing proper EA governance and practices rather than focusing on documenting EA standards as other frameworks did. Their goal was to gain benefits from EA developments rather than treating it as an ivory tower. Sharing the same sentiments with Gartner was the framework introduced by MIT’s Center for Information Systems Research (CISR). Based on case studies of IT management practices at dozens of firms, the framework proposed an approach that emphasizes good governance and linking mechanisms to harvest the promised benefits of EA (Ross et al. 2006). Today, the CISR framework is widely cited in academic circles, and used even by some U.S. State governments in their EA development (e.g., the states of California and Colorado).

The Current State-of-the-Art of Enterprise Architecture

Currently, EA is widely considered a stable IT management practice rather than a fad (Kappelman 2010a). The field has been around for more than two decades with ongoing interests, good user base, and strong knowledge pool. Yet, skepticism still exists regarding EA benefits and practices (Boh and Yellin 2007; Ericson 2011; Kappelman 2010b; Kluge et al. 2006). Overall, a few observations can be made regarding the field.

First, there is little or no sign of convergence in the EA knowledge pool. There are many different EA definitions as well as EA frameworks, each focusing on different issues or having different assumptions and ideologies (Lapalme 2011; Schekkerman 2004; Sessions 2007). The number of frameworks is surprisingly high, causing confusion to not
only casual observers but also EA professionals. Table 2.2 provides an overview of the most commonly-found EA frameworks (Ahlemann et al. 2012; Schekkerman 2004; Sessions 2007).

Second, there is little or no sign of convergence in EA implementation practice either. Many organizations choose to modify and customize the popular EA frameworks, or develop their own versions. Gartner’s study found a majority of private organizations used a homemade or blended framework (Gall 2012), and Hjort-Madsen (2007) reported a similar effect in the public sector with considerable variations in EA implementation.

This raises the question of how could one make sense of and navigate through the “jungle” of existing frameworks (Schekkerman 2004), and ensure an EA implementation is “effective”? In the next section, I present a typological theory of EA frameworks to help organizations make sense of and evaluate the existing EA frameworks.

A Typological Theory of EA Frameworks

Research has established that how well EA is implemented will affect the achieved outcomes (Ross 2003; Ross et al. 2006; Salmans 2010). As a result, several EA maturity models—stages of EA evolution cycles—have been proposed as a means to guide EA development (NASCIO 2003; Ross 2003; Salmans 2010). However, the organizational benefits from implementing EA may depend not only on how well EA is implemented (i.e., a typical maturity model), but also on the type of EA that is implemented. In other words, the version and specific elements of EA that organizations choose to adopt may have a significant impact on the outcomes.
This suggests that it is important to consider how one can determine what specific version(s) of EA to adopt, given the sheer number of existing EA frameworks. To date, a handful of studies have tried to compare different EA frameworks (Alwadain et al. 2011; Leist and Zellner 2006; Schekkerman 2004; Sessions 2007; Simon et al. 2013). Most of them were able to identify the differences, but have not done so in a systematic way in order to identify different types of EA frameworks. The identified differences remain mostly informative and descriptive, and they could not tell a potential adopter whether particular EA frameworks were different enough to represent another type of EA, and how that would impact the expected organizational benefits. As a result, to casual observers, the EA field is filled with various trends and fads, with no clear sign of convergence and stability (Hjort-Madsen and Pries-Heje 2009; Kappelman 2010a).

Because EA can be considered a management program, a lesson can be learned from policy research literature. In order to evaluate and compare different policies, Bardach (2009) suggests that a policy can be characterized by its essential and supportive elements. Essential elements provide the causal mechanisms for the intended values, while supportive elements are optional to the intended benefits of a policy. For example, a milestone payment program would include several essential elements: defining milestones, describing milestones, measuring and assessing the effectiveness of the milestones. On the other hand, having a one-to-one discussion while defining milestones would be an optional and supportive element. By identifying essential elements for a policy, one would be able to compare across the implemented policies for discrepancies.

Therefore, I theorize that by analyzing the essential elements of EA frameworks, we can better distinguish them and further link the specific elements to specific outcomes. To do
so, I propose a typological theory of EA frameworks (George and Bennett 2005). A typological theory is a theory that specifies independent variables (e.g., EA essential elements) into categories from which researchers could draw hypotheses on how these variables operate independently and in specified conjunctions or configurations (i.e., types of EA framework) to produce particular effects (e.g., expected organizational benefits).

In the following sections, I first propose seven essential elements that could be used to make sense of and distinguish EA frameworks. Based on the seven essential elements, the most popular EA frameworks are analyzed and grouped into a small number of types. These different EA types suggest different outcomes and approaches for potential adopters.

**Essential Elements of Enterprise Architecture Frameworks**

Numerous EA frameworks are found in both the public and private sectors (Schekkerman 2004; Sessions 2007; Simon et al. 2013). Do they represent different types of EA, or are they only variations of the same type? To compare the different EA frameworks, it is necessary to identify their essential elements. Based on EA literature as discussed by the academics and practitioners, seven EA essential elements can be found. They are described in detail below.

**1) Defining EA layers:** One of the tasks of an EA framework is to establish the different EA layers to guide IT standards and procedures (Simon et al. 2013). Four layers are commonly found: Business, Information, Application, and Technical or Technology (see figure 2.2). They can be presented in architecture forms—documentation about
processes, strategies, models, and standards, or in reference forms—taxonomy of common terms and definitions. The reference models can also be used to categorize and group similar processes, strategies, and models that are specified by the architectures.

The four layers are described below:

- **Business EA layers** commonly specify business organization, strategies, and models (Simon et al. 2013). They group business functions and related objects into clusters (or domains) that can provide commonalities and accountabilities over business processes (Versteeg and Bouwman 2006). For example, a business architecture for a global enterprise can divide their processes into geographical locations such as world level (e.g., global sales function, account management function), regional level (e.g., EU product processor), and country level (e.g., domestic payment, collections, claims) (Versteeg and Bouwman 2006).

- **Application EA layers** define the necessary applications to support the business processes, and specify the relationships between those applications and/or how to develop them. For example, the NASCIO EA framework suggests building the Application Architecture around the following constructs: an enterprise application portfolio that provides the inventory of current applications, design models that guide the development processes, and design patterns that specify pre-defined configurations for the development (NASCIO 2004b).

- **Information EA layers** provide an organization with the enterprise information assets (structured, unstructured, or semi-structured information) that are needed for the business processes and enterprise applications. They outline how the enterprise data and information are stored and accessed, as well as their
relationship to business processes, business management, and IT systems. For example, the Information Architecture can specify the physical repositories for operational and analytical data (e.g., customers, products, sales) in different formats (e.g., documents, images, web), as well as define the schema, data flows, and logical models to map the applications to those repositories (Leganza 2010).

- Technical EA layers describe the hardware and software infrastructure that support applications and their interactions. Different IT standards, structures, and relationship between technologies are included in technical EA layers. Thus, they provide a blueprint for IT at different levels. For example, NASCIO defines five levels in their Technical Architecture: domains, disciplines, technology areas, product components, and compliance components (NASCIO 2004b).

Furthermore, the EA literature has also distinguished between Business Architecture and other layers. Scholars have argued that Business Architecture is a distinct layer that can differentiate EA implementations (Bouwman et al. 2011; Ulrich and McWhorter 2010; Versteeg and Bouwman 2006). The Business Architecture enables a stronger connection between IT-business strategies and signals an enterprise approach rather than a silo technical approach. Thus, for the first essential element, I also distinguish between business EA layers (e.g., Business Architecture) and technical EA layers (e.g., Technical Architecture, Information Architecture, Application Architecture). The “defining EA layers” element is split into two:

(1) **Defining EA technical layers**: The EA framework only specifies technical layers such as Technical Architecture, Information Architecture, and Application Architecture.
(2) **Defining EA business layers**: The EA framework includes business layers such as Business Architecture or Business Reference Model.

(3) **Creating EA methodology**: Another essential task of an EA framework is to create a methodology that provides an outline or general approach toward developing EA, often represented in meta-models (Simon et al. 2013). The methodology presents a transitional plan to move from As-Is to To-Be architectures, or a migration plan to a step-by-step transformation of the architecture (see figure 2.3). For example, TOGAF includes an Architecture Development Method for EA developments which starts with creating an architecture vision, establishing different EA layers, setting migration plans, creating implementation governance, and incorporating change management. The Enterprise Architecture Planning method proposed by Spewak and Hill (1993) follows a “layer cake” approach in which development activities are divided into layers of priorities: getting started (layer 1); modeling current business and technology systems (layer 2); defining future architecture for data, applications, and technology (layer 3); and outlining an implementation plan (layer 4).

(4) **Organizing EA structure**: An EA framework needs to define the governance and decision-rights in order to create accountabilities and establish authorities for the program. The EA organization includes several positions, each with specific responsibilities. Examples of this step include setting up a Chief Enterprise Architect, identifying sponsors, or assigning enterprise architects. Table 2.3 provides a list of typical roles and governance bodies in an EA organization (2001; Ahlemann et al. 2012; NASCIO 2004b).
(5) **Operating and monitoring EA**: The next essential element of an EA framework is the processes to operate and monitor EA development. These processes often include suggesting new standards, evaluating the proposed standards, exempting agencies from certain standards, and continuously assessing the standard development processes. For this purpose, Ahlemann et al. (2012) suggest incorporating EA values into change management processes, using four steps: collecting change requests, assessing changes, implementing changes, and monitoring EA. Several maturity models have also been proposed to assess the development of an EA program (e.g., FEA maturity model, Gartner maturity model).

(6) **Enforcing EA values**: In order to have an effective EA program, additional steps need to be taken to enforce EA values. Most EA frameworks suggest an integration of EA milestones into project lifecycles or investment lifecycles (1999; Ahlemann et al. 2012). Overall, there are three modes of EA integration in the project lifecycle (Ahlemann et al. 2012):

- **Advising**: the enterprise architects assist with and advise on project execution. Depending on projects, the architects can provide needed information, give advice, and help monitor the project execution.
- **Participating**: when management support is sufficient, the enterprise architects can exercise certain control over project execution such as voting on project decisions or issuing rules for project execution.
- **Managing**: in cases where an EA team has strong influence, they can actively engage in the management of project execution and even drive the
implementation process (e.g., defining EA-related project goals, creating EA reporting processes).

(7) Integrating EA values into strategic planning: Many scholars have recommended another essential element to realize the benefits of an EA program is to integrate EA values into strategic planning processes (Ahlemann et al. 2012; Weiss et al. 2005). This allows organizations to make IT strategic directions that are coherent to the enterprise directions and exploit the capabilities created by Enterprise Architecture. For example, EA practices can be part of complement other management practices (e.g., strategy planning, strategy formulation); the EA documentation would involve a collaboration between managers, architects, and employees; top management is involved throughout the architectural development process; and strategic initiatives is guided by EA inputs. Similarly, the Gartner Consulting team suggested that architecting IT models was only a small part of an enterprise architect’s job, and that much of his/her time should be spent on strategizing, communicating, leading and governing (James et al. 2005; Lapkin 2005).

All together, the seven essential elements of an EA framework are summarized in Table 2.4.

A Typology of Branded EA Frameworks

In this section, using the seven essential EA elements, I compare popular branded frameworks often found in the U.S. to see how different they are from each other. Eight different branded EA frameworks are commonly found not only in the public but also the private sector (Schekkerman 2004; Sessions 2007). They are:
1. The Zachman framework (Zachman): developed by John A. Zachman since 1987, it is often considered the EA ontology for the field.

2. The Department of Defense (DoD) framework: developed by the U.S. Department of Defense in 1996, it was one of the very first EA frameworks in the public sector.

3. The Open Group framework (Open Group): their framework inherits the work done by the U.S. Department of Defense to become one of the very first EA frameworks in the private sector.

4. The Spewak and Hill framework (Spewak): the Enterprise Architecture Planning (EAP) framework developed by Spewak and Hill (1993) was one of the very first EA frameworks developed in the academic sphere.

5. The Federal EA framework (Federal EA): the first and official framework developed by the U.S. CIO Council to encourage EA development in the federal agencies.

6. The NASCIO EA framework (Association EA): the set of frameworks and guidelines developed by the National Association of State CIOs (NASCIO) for the U.S. State governments.

7. The MIT framework: developed by MIT’s Center for Information Systems Research. The framework and approach have been widely used by both academics and practitioners.

8. The Gartner framework: developed by the consulting firm Gartner and has been quite popular after Gartner’s buyout of its competitor—the META Group.
Publications for each framework were collected from their websites, their archived websites from the Internet archival database\(^3\), and from the literature. Overall, more than 100 documents were collected totaling over 7,000 pages. These documents provide a good understanding of the evolution of these frameworks. Table 2.5 provides the detailed comparison of the eight frameworks. (Note that the Open group framework is presented twice because they adjusted their framework in 2003.)

Overall, the eight frameworks are different enough from each other to be classified into three ideal types. The profile for the three ideal types can be found in Table 2.6.

1. **Technical EA**: frameworks of this type include the Zachman framework, DoD, Open Group prior to 2003, and the Spewak framework. For technical EA frameworks, the focus is establishing the technical layers of the enterprise, specifically the Technology or Technical Architecture. These Technical Architectures lay out the detail of the IT foundation, often in the form of an IT taxonomy or a standard reference model. Enterprise Architecture is seen as a job of the IS/IT organization, to identify the necessary IT components of the enterprise in order to reduce complexities and increase standardization. For example, the Zachman framework includes a matrix that suggests the specification documents for IT artifacts in an organization from multiple perspectives (e.g., business, engineer, technical).

---

\(^3\) The Wayback Machine—an Internet archival database [http://archive.org](http://archive.org)
The technical EA type started in the early phase of the EA field and became dominant mostly during the 1990s. Many frameworks of this type emphasize the establishment of a methodology and structure to allow organizations to transform from an As-Is to a To-Be stage. For example, the early Open Group framework consists of an Architecture Development Method that includes several transformative steps: creating a baseline, constructing gap analysis, finding opportunities and solutions, planning the migration, implementing, and maintaining the architecture.

2. **Operational EA**: frameworks in this type include the current Open Group framework, the Federal EA, and the Association EA framework. These frameworks focus on an enterprise-wide and holistic approach toward EA development, stressing the development of not only technical but also business EA layers. Typically, these frameworks would start by defining the Business Architecture—the documentation of key business processes—which in turn determines the details of subsequent EA layers such as Application, Information, and Technical Architecture. In this type, the focus has been shifted from technical issues (e.g., complexity, redundancies) into establishing an IT foundation for smooth and effective operations.

In addition, operational EA frameworks emphasize not only IT artifacts and models, but also IT planning, implementing, and controlling from an enterprise perspective. Those frameworks emerged during the 2000s when EA professionals
felt that the pure technical modeling approach of Technical EA frameworks was not enough to bring about EA’s expected outcomes (Ahlemann et al. 2012). As IT investment increases, and the impact of IT is felt throughout the enterprise, there is an increasing need to involve non-IT stakeholders in the IT decision making process. As a result, governance mechanisms, accountability, and enforcement processes become important to manage EA developments.

3. **Strategic EA**: frameworks that fit into this type include the MIT and Gartner framework. The rise of a strategic EA type commenced at the end of the 2000s until now. These frameworks view EA as one of the many management and strategic planning tools that allow organizations to take advantage of their IT investments. The focus has now shifted from establishing a good IT foundation to using and exploiting the IT capabilities of the built IT foundation. Thus, frameworks in this type are not particularly interested in establishing EA layers, documenting and specifying requirements—although they are still a part of EA professionals’ jobs—but more in the applications of EA values and principles to guide and drive organizational transformation. For example, the MIT framework does not mention what EA layers need to be developed, and Gartner stresses what framework an organization chooses is not as important as using and adapting it to their needs (Robertson and Blanton 2008). The recent Strategic Enterprise Architecture Management literature stresses only the integration of EA into change management, project lifecycle, and strategic planning. No EA layer was discussed at all (Ahlemann et al. 2012).
As summarized by table 2.6, despite the widespread adoption of EA in the public sector, there are still at least three ideal EA types promoted by EA vendors, each different from the other in terms of their essential elements. It is important to note here that these three EA types are related to each other and represent an evolution from technical to operational and lately strategic EA frameworks. Other studies have also simultaneously found distinct EA types from branded frameworks based on their ideologies (Lapalme 2011), their management objectives and styles (Ahlemann et al. 2012), or their citation connections (Simon et al. 2013). The proposed ideal EA types share a similar conceptualization with prior studies in recognizing three different EA types, but depart from the others in terms of what frameworks are included in each type. Table 2.7 summarizes the differences and similarities of the proposed ideal EA types with others found in the literature.

**EA Types and Expected Organizational Benefits**

An important goal of a typological theory is to link the different types (i.e., types of EA framework) with particular effects (e.g., expected organizational benefits). In this section, I reflect on the relationships between the identified EA types and expected organizational benefits.

Analyzing the organizational benefits from implementing EA, Tamm et al. (2011) suggests four direct benefits of EA implementation. They are organizational alignment, information availability, resource portfolio optimization, and resource complementarity.

**Organizational alignment**: IT strategy-business strategy alignment has been one of the primary goals of EA since its inception (Sessions 2007; Zachman 1987). Organizational
alignment refers to the extent to which organizational units share a common understanding of its goals and how to contribute to those goals (Tamm et al. 2011). While all EA activities have the potential to contribute to organizational alignment, Tamm et al. (2011) have suggested that the business analysis undertaken during the EA planning process can span different departments and has the most impact on organizational alignment. Through these activities, the different parts of the enterprise can engage in direct dialogue, allowing organizations to identify interdependencies and commonalities. As a result, relevant people can be involved in decision making processes, which encourage greater organizational alignment (Tamm et al. 2011).

Similarly, scholars have argued that the establishment of a Business Architecture can have a greater impact on aligning IT strategy-business strategy (Bouwman et al. 2011; Versteeg and Bouwman 2006). Through the planning and creating of the Business Architecture, key business processes are discussed for commonalities and interdependencies, allowing greater synergies among organizational units. Following this logic, it can be inferred that the establishment of business EA layers can lead to greater organizational alignment. Thus:

P1a: Defining business EA layers is expected to increase organizational alignment.

And because frameworks in a technical EA type do not focus on business EA layers, it can be expected that:

P1b: A technical EA framework can be expected to have less impact on organizational alignment than operational and strategic EA frameworks.
**Information availability**: Another goal of EA from its inception is to reduce organizational complexity (Sessions 2007; Zachman 1987). By establishing EA documents, organizations can increase information availability, defined as the extent of useful and high-quality information made available to decision makers (Tamm et al. 2011). As organizations document and plan EA models, they are able to capture the various essence of organizational processes and routines, making them available to decision makers. In many cases, the information is classified into useful subjects and categories, such as information for enterprise applications (e.g., Application Architecture) or information for data standards (e.g., Data Architecture). Especially the technical EA layers would reduce immensely the complexity and redundancies in an organizational IT environment as they capture the different layers of technical information in an organization. While all three EA types can arguably increase information availability, it can be argued that organizations adopted technical EA frameworks would primarily focus on making the technical information available to other parts of the organization (e.g., the Zachman framework provides a very comprehensive description of an organizational IT environment). In contrast, operational and strategic EA frameworks embrace other objectives such as organizational alignments or resource optimization (discussed next). These frameworks may increase not only technical information (e.g., standards for databases) but also strategic information (e.g., strategic directions, principles for IT investments). Thus, it can be expected that:

P2a: Defining technical EA layers increase technical information availability across organizational functions.
P2b: A technical EA framework have greater impact on technical information availability but less impact on strategic information availability than operational and strategic EA frameworks.

**Resource portfolio optimization and resource complementarity:** Many have also viewed EA as one of the strategic planning initiatives that allows organizations to use its IT resources more effectively (Lapkin 2005; Weiss et al. 2005). When implemented, EA can directly improve resource portfolio optimization and resource complementarity. Resource portfolio optimization refers to the extent to which an organization leverages its resources, reduces redundant investments, and invests widely in resources that further organizational goals. Relatedly, resource complementarity is defined as the extent to which the organization’s resources can support its strategic goals (Tamm et al. 2011). Both benefits are related to how organizations strategically make their IT investment decisions.

Defining the EA technical layers, and especially EA business layers, can help organizations to identify synergies, interdependencies, and therefore identify areas to invest and/or ignore. However, more importantly, these benefits are more likely to be realized through implementing EA values into actual organizational practices rather than through only planning and documenting activities (Tamm et al. 2011). In other words, an organization can have well-defined and documented EA models, but until those models and their principles are applied into actual practices, no benefits can be realized in terms of resource optimization and resource complementarity. This is different from organizational alignment and information availability because the planning and documenting activities alone can help organization units come closer and have a better
understanding of organizational goals as well as the available information. Nevertheless, it is not the same for the other two organizational benefits, which can only be realized through enforcing and using EA values. Therefore, it can be expected that:

P3a: Enforcing and integrating EA values increase resource portfolio optimization and resource complementarity.

P3b: Technical EA frameworks have less impact on resource portfolio optimization and resource complementarity compared to operational and strategic EA frameworks.

Summary

In this section, I review the existing EA literature and identify seven essential elements of an EA framework. They are:

- Defining EA technical layers: specifying technical layers such as Technical Architecture, Information Architecture, and Application Architecture.
- Defining EA business layers: specifying business layers that define business organization, strategies, and models.
- Creating EA methodology: specifying the guideline or general approach to implement EA.
- Organizing EA structure: specifying the governance and decision-rights of an EA program.
- Operating and monitoring EA: creating processes that operate and monitor EA development.
• Enforcing EA values: creating processes that enforce EA values into organizational practices.

• Integrating EA values: creating processes that integrate EA values into strategic planning processes.

Together, those essential elements capture the ideologies and the mechanisms through which an EA program can deliver organizational benefits. They are useful to compare and make sense of the different EA frameworks promoted by EA vendors. Specifically, eight branded EA frameworks have been analyzed based on the seven essential elements. The result is three ideal types of EA framework:

1. Technical EA frameworks: focusing mostly on defining technical EA layers and a methodology to implement EA. Examples include the Zachman framework, the DoD framework, Spewak framework, and the Open Group framework prior-2003.

2. Operational EA frameworks: emphasizing the establishment of both technical and business EA layers to create a holistic EA program. Operational EA frameworks also focus on specifying EA structure, operating and monitoring processes, and enforcement mechanisms. Examples include the Open Group framework after 2003, Federal EA and the Association EA framework.

3. Strategic EA frameworks: do not focus on defining different EA layers but rather on how to realize EA values. Strategic EA frameworks emphasize the enforcing mechanisms and integrating EA into strategic plans in order to drive organizational transformation. Examples include the MIT framework or Gartner framework.
Furthermore, each type of EA framework has a different emphasis, and therefore would impact certain organizational benefits. Particularly, technical EA frameworks would more likely increase information availability while operational and strategic EA frameworks would increase organizational alignment, resource portfolio optimization, and resource complementarity. Each essential element would play a different role to realize these benefits, and future research is welcomed to test the established propositions.

Discussion and Conclusion

It has been more than ten years since Schekkerman published his famous book on “How to survive in the jungle of Enterprise Architecture frameworks” and since then, the number of existing EA frameworks has more than doubled. Coupled with a conceptual nature and a high flexibility in implementation, the field has witnessed a proliferation in both the collective knowledge pool (i.e., an increase in number of EA frameworks) and the way EA is implemented in organizations (i.e., the EA implementation pattern). Yet, there has been only a limited number of studies to make sense of and help organizations to navigate through this “jungle” of EA frameworks (Alwadain et al. 2011; Leist and Zellner 2006; Schekkerman 2004; Sessions 2007; Simon et al. 2013). What’s more, existing studies lack a systematic way to compare and determine whether the existing frameworks represent different types or they are only slight variations of the same type. In addition, no study has linked the type of EA implemented in organizations to the organizational benefits that can be expected. It is likely that the type of EA implemented would influence the organizational benefits an organization would receive.
To fill the theoretical gap, this study reflects on the current proliferation of EA frameworks in the field and suggests seven essential elements that can be used to make sense of and distinguish the existing frameworks. These essential elements allow organizations to systematically compare the essence of each EA framework to the others in order determine whether they are significantly different. Based on the comparison of eight popular branded EA frameworks, three different types of EA frameworks are identifies, each with its own assumptions and mechanisms. As a result, each different type of EA framework has emphasized different goals and ultimately promised different benefits. By understanding the different types of framework and their expected benefits, organizations could make better decisions in adapting or creating their own framework. (See Table 2.8 for a summary of findings.)

The typological theory proposed here contributes to prior research on EA benefits and EA development (Bradley et al. 2011; Tamm et al. 2011). Specifically, it turns the attention from the maturity models often used in EA development to focus on the particular EA elements implemented by organizations. In reality, most organizations utilize a best-of-breed approach in which they combine several branded EA frameworks to create their own (Gall 2012). As a result, it is important to understand what exact EA elements can be combined, and how they contribute to organizational benefits. Future research is strongly encouraged to investigate the different elements, both essential and supportive elements, implemented by organizations and how the different configurations lead to organizational benefits. It is often recognized that there is no one-size-fits-all in EA implementation. Thus, the typological theory proposed here provides a first step
toward understanding what other “sizes” exist and how they are connected to different outcomes.

The different types of EA framework identified here also pose a question of how different types of IT organization would prefer a particular type of EA framework. For example, operational and strategic EA frameworks encourage interconnection between business processes and organizational units. While the benefits are potentially alluring, these types of frameworks require organizations to establish business EA layers and establishing enterprise-wide mechanisms to enforce and collaborate across business functions (Bouwman et al. 2011). In most cases, that means changes in organizational structure, increased centralization of IT activities, and increased standardization of IT standards. For organizations that have a more decentralized IT structure and culture, these changes may not be welcome, or worse, perceived as a threat to business units’ autonomy. This is part of the reason that Ross et al. (2006) suggested organizations to first identify their operating model, that is, establish their strategic vision before creating Enterprise Architecture. Companies that envision a low standardization and low integration business model may prefer a different type of EA like a technical EA framework. Furthermore, one can also imagine that operational and strategic EA frameworks, or essential elements of those frameworks, can only be applied in organizations in which the needs for change are urgent, or the central IT organization has enough power and control to drive the necessary change. To practitioners, the lessons here imply a need to choose and adapt essential elements that fit their organizational needs or structure to avoid the trap of blindly following a management fad.
The study is not without limitations. It only analyzes eight EA frameworks, and further studies are needed to test the generalization of the proposed theory with additional frameworks. Many selected frameworks also focus only on the U.S. market and therefore leave out important insights from the E.U. market. Currently, many European organizations are leading the charge in terms of adopting and implementing EA (Bidan et al. 2012; Schmidt and Buxmann 2011). Comparison studies between U.S. and E.U.-focused frameworks could add valuable insights to the findings here.

In conclusion, this research provides a survival guide for organizations to make sense of and navigate through the “jungle” of EA frameworks. Unlike previous studies, the findings here apply a typological theory to systematically distinguish the EA frameworks using a theoretically-derived framework on EA essential elements. At a minimum, the identified elements and the different types of EA frameworks here could aid managers who are looking for a way to adapt and invent their own EA foundation.
Chapter 3: Enterprise Architecture Adaptation and Reinvention

While the previous chapter investigates the diversity in the EA collective knowledge pool, this chapter takes a close look at the diversity in EA implementation at the organizational level. Particularly, this chapter examines the dynamics in EA implementation through the case of a U.S. public organization to understand how EA is modified, adapted, and reinvented. Understanding the organizational level dynamics can help to make sense of the diversity in EA implementation across organizations.
Magnitude of Innovation Changes: Adaptation and Reinvention in Enterprise Architecture Implementation

Abstract

This paper revisits the concept of innovation changes during the implementation process. Prior literature has mostly focused on innovation changes during the adaptation process and organizational-level effects of those changes. However, such a theoretical lens leaves out an important dimension in the magnitude of innovation changes: the potential community-level effects of changes. Large-scale, radical adaptation can be conceptualized as reinvention events that alter the nature of the innovation and create ripple-effects in the community. Thus, innovation changes include two possible processes: adaptation and reinvention. Through an in-depth case study of Enterprise Architecture implementation in a U.S. State government, this study illustrates how reinvention of innovation concepts can push the boundary of changes, creating a new way of implementation in a community. Legal and ethical issues are highlighted, especially for public organizations.

Keywords: innovations changes, adaptation, reinvention, magnitude, Enterprise Architecture, U.S. State government
Introduction

Innovations—whether they are new ideas, practices, or technologies—change as they are implemented into organizations. This is the only thing that we can be certain about in relation to the complex and uncertain process of innovation implementation. Innovations are rarely perfect when first introduced into organizations. Most of the time, an innovation undergoes changes during the adoption and implementation process in order to better reflect the needs and intents of the adopting organization. These innovation changes have been an important discussion in the literature, studied under various terms (e.g., adaptation, modification, reinvention, appropriation, and translation) and in multiple fields (e.g., policy research, organizational studies, management studies, and Information Systems) (Czarniawska and Sevón 1996; Fedorowicz and Gogan 2010; Lyytinen and Newman 2008; Majchrzak et al. 2000; Rice and Rogers 1980; Tyre and Orlikowski 1994).

Such a proliferation of terms, however, introduces theoretical confusion and ambiguity. One important area of uncertainty involves the magnitude of innovation changes. For example, adaptation studies are concerned with the organizational effects of innovation changes, scrutinizing the dynamics in the innovation and organizational structures/processes to overcome misfits (Leonard-Barton 1988; Majchrzak et al. 2000; Tyre and Orlikowski 1994). On the other hand, reinvention studies emphasize the additional effects of innovation changes on community and organizational populations (Bauman et al. 1991; Rice and Rogers 1980). Both the adaptation and reinvention literature talk about innovation changes, but of different magnitude. Yet, to date, the magnitude of innovation changes and their effects are only treated with scarce attention.
The issue is important because the magnitude of change can clarify the nature and boundary of innovation changes. Furthermore, if organizations frequently and continuously adapt the innovation, to what extent does the innovation change and at what point will it become a different practice that can no longer be thought of as the same practice (Ansari et al. 2010)? By distinguishing the magnitude, nature, and boundaries of innovation changes, one then can open the ‘black-box’ of innovation to understand the effects of changes, as well as the dynamics that contribute to different changes.

In this paper I argue that there are two possible processes in innovation changes: adaptation and reinvention. Adaptation is operationalized as changes that are made to the innovation and organizational structures/processes to overcome misfits, thus their effects are often organizational-level effects. On the other hand, reinvention involves changes that are made to the innovation that can lead to significant departure from the normative templates, that is, the way the innovation is often implemented and conceptualized in the community. Thus, reinventions are the large-scale adaptation events that have the potential to transform the innovation. Both adaptation and reinvention can happen to all three elements of an innovation: innovation concepts that specify the causal mechanisms of the innovation (e.g., fully integrated functions and data centralization in enterprise systems), innovation objects that consist of physical and material components of the innovation (e.g., Oracle databases, Cisco data centers), and innovation practices that enact the innovation in organizational practices (e.g., generating customer reports using SAP). While all three elements are equal in potential to transform the innovation, in this paper I argue that changes made to the innovation concepts have a higher chance to alter
the nature of the innovation and push the boundary of change to give rise to a new type of innovation.

To illustrate the process of adaptation and reinvention, I examine the implementation of Enterprise Architecture, an instance of IT management innovations. IT management innovations are innovative ideas about how to organize and manage IT activities. Examples include IT outsourcing models, IT shared services models, or the use of professionalization frameworks like ITIL and COBIT. The focus on IT management innovations is twofold: First, within the adaptation and reinvention literature, there is a limited number of studies on IT management innovations. The majority of studies to date have focused on the adaptation of technological innovations: expert systems, CASE tools, MRP, group support systems, office tools, and production equipment (Fedorowicz and Gogan 2010; Leonard-Barton 1988; Majchrzak et al. 2000; Tyre and Orlikowski 1994). This asymmetric attention creates a theoretical gap as IT management innovations have unique characteristics in their own rights. Second, IT management innovations do not consist of as many physical components or material artifacts as technological innovations do. Therefore, they are more flexible than technological innovations due to the lack of constraints from physical boundaries (e.g., system requirements, hardware specifications). Such increased flexibility makes them more susceptible to a higher degree of adaptation and reinvention. As a result, their implementation would offer a clearer illustration of what is being adapted and reinvented, and how the innovation is changed over time.

In sum, this paper is motivated to explore how organizations adapt and/or reinvent IT management innovations and what the effects are for those changes. Through a case
study of Enterprise Architecture implementation in a U.S. State government, I illustrate how reinvention processes involve the modification of innovation concepts, causing a fundamental shift in the way the innovation is later materialized into innovation practices (e.g., changing from silo functional systems to enterprise systems with centralized databases). It is during the reinvention process that the innovation is more likely transformed into a new type of innovation, pushing the boundary of change. The importance of legal and ethical misfits in this process of reinvention are highlighted, especially in the context of public organizations. Furthermore, the findings suggest temporal patterns of change occur differently for innovation concepts and practices. For innovation practices, changes happen in an ongoing and continuous manner, while innovation concepts are modified episodically, each time accompanied by organizational jolts and learning. Further studies are needed in order to closely examine these different patterns.

Innovation Changes During Implementation

During the innovation implementation process, an innovation will inevitably be modified and changed in order to get adopted into the local environment. The literature has treated the concept of innovation change uncritically or with inconsistent attention. Studies refer to the changes made to the innovation during the implementation process using various terms: modification, adaptation, appropriation, and reinvention (see Table 3.1). This theoretical proliferation, while useful to explore the concept, can be confusing and at times can cause inconsistencies and ambiguity. An important area of uncertainty involves the magnitude of innovation changes, as this will ultimately clarify the nature and boundary of innovation changes. In the following sections, I look at the two prominent
concepts in the innovation change literature—adaptation and reinvention—to articulate how the magnitude of changes could help us to understand the nature and boundary of innovation changes.

From the Adaptation Literature: The Nature of Innovation Changes

Adaptation refers to changes that are made to both the innovation (the ‘thing’ being adopted) and organizational structures/processes in order to overcome misfits and achieve better alignment (Majchrzak et al. 2000; Tyre and Orlikowski 1994). Those organizational misfits—technical, political, and cultural misfits—arise from the adoption and implementation of the innovation and they are the objectives of changes (Ansari et al. 2010). Organizations make change to the innovation as well as organizational structures/processes in responding to misfits. Thus the process of change can be viewed as a mutual adaptation process between the innovation and organizational structures/processes (Leonard-Barton 1988). Many studies have built on structuration theories as a way to understand the dynamics of system and structure change throughout the adaptation process (Lewis and Seibold 1993; Majchrzak et al. 2000), while others have utilized a socio-technical framework to understand the dynamics of socio-technical changes (Lyytinen and Newman 2008; Lyytinen et al. 2009).

In general, adaptation studies have suggested that innovation changes during the implementation process follow a punctuated and episodic pattern in which two types of changes are involved: continuous, incremental changes that involve small variations (e.g., adding new screens to online forms) and radical, revolutionary changes that introduce disruption and upheaval to the innovation (e.g., changing operating systems) (Leonard-Barton 1988; Lyytinen and Newman 2008; Tyre and Orlikowski 1994). This pattern,
often associated with the punctuated equilibrium model of change, asserts that continuous and incremental changes make up a period of stability with slow mutations, following by a short period of revolutionary change (Anderson and Tushman 1990; Gersick 1991). The difference between the two types of change is the magnitude of change: radical changes affect the system’s deep structure—the fundamental choices of the system that outline how the basic parts are organized or how different activity patterns and interactions are governed (Gersick 1991). Leonard-Barton (1988) distinguished between small and large adaptive cycles: small adaptive cycles contain minor adaptation while large adaptive cycles require the designers “return to the drawing board” (p. 260). Within those large cycles, a strategic shift occurs that alters how the innovation operates. For example, a new infrastructure with new performance criteria for a chemical reaction plant or a different technology to process order flow. It is those large adaptive cycles that cause radical changes to an innovation.

In studying adaptation dynamics, scholars have focused on how different changes bring about the different effects on organizational structures/processes and innovation uses. Adaptation can be operationalized as changes that are made by the users in their everyday technology uses to improve their experience. For example, defining a new screen layout, assigning hotkeys, customizing templates, adding navigation features, or restricting access to certain users (Majchrzak et al. 2000; Tyre and Orlikowski 1994). In this sense, adaptation is similar to concepts such as user customization (Hippel 2005) in which users modify and change the technology to better serve their needs and circumstances. Any workaround would be a meaningful change that can add positive or negative value to the user experience (Ferneley and Sobreperez 2006). Adaptation can also be done by
organizations to the innovation such as changing the system platform from Unix to Windows, adding new SAP modules, or changing performance criteria (Leonard-Barton 1988; Lyytinen et al. 2009).

Yet, such theoretical accounts may miss out another important aspect of the magnitude of changes: How is the changed and adapted innovation compared to other innovations implemented in a community? Do the changes represent a new type of technology or are they only variations in the degree of technology uses? These questions are important because if we accept the premise that organizations would almost always need to adapt the innovation during implementation, then throughout the diffusion process as the innovation transfers from one organization to others, it is possible that at one point the innovation is changed to the extent it can no longer be considered the same innovation, and instead represents a different type of innovation (Ansari et al. 2010). To date, the question of when and how the innovation is changed and becomes a different type of innovation has not received proper attention from scholars. To answer that question, one would need to look beyond the effects and magnitude of changes within the adopting organization, and look at the magnitude of changes across a community or organizational population that has adopted a particular innovation. For that purpose, the reinvention literature offers helpful lessons, articulated in the next section.

From the Reinvention Literature: The Boundary of Innovation Changes

Another kind of innovation change during implementation is often referred to as reinvention. Unlike adaptation which focuses on how the innovation and organizational structures/processes are changed to better align, reinvention studies are more concerned with how the innovation is changed in comparison to normative temples and original
designs (Rice and Rogers 1980), or to prior adoptions (Lewis and Seibold 1993). Thus reinvention studies emphasize modifications made to the innovation itself in comparison to other organizations’ adoption. One way to measure reinvention is to identify the number of elements in an implementation that are different from “core elements” of the innovation, features that are considered to be responsible for its effectiveness (Glick and Hays 1991; Rice and Rogers 1980; Rogers 2003). For example, policy reinvention can be measured by the liberalization of existing provisions or the addition of new provisions to existing laws (Glick and Hays 1991). Others have measured reinvention as how much the adopted innovation departs from the mainstream version of the innovation as promoted by a change agent (c.f., Rogers (2003)).

The difference in how adaptation and reinvention are conceptualized and operationalized imply a difference in the magnitude of changes. If adaptation refers to changes that affect the innovation performance within the adopting organization, reinvention refers to change that can potentially alter the nature of the innovation as well as the innovation performance in comparison to other innovation implemented in a community. For example, adding a computerized dispatching function to a transportation system (Rice and Rogers 1980), building a new infrastructure with different performance criteria for a chemical reaction process (Leonard-Barton 1988), or modifying data entry functionalities of a data processing system (Fedorowicz and Gogan 2010). Those changes are significant to the core cause-effect chains of the innovation and therefore can transform the innovation into a different type, one that has not been commonly seen in the community.

To be fair, the adaptation literature does consider changes that can transform the innovation (e.g., large adaptation cycles as suggested by Leonard-Barton (1988)).
However, such a conceptualization is easily overwhelmed by the vast number of studies that focus on organizational effects of user-level adaptations (Sun 2012; Tyre and Orlikowski 1994), group-level changes (Majchrzak et al. 2000), or system-level modifications (Lyytinen et al. 2009). At some point, the issue of community-level effects of organizational adaptation and reinvention is overshadowed. This treatment leaves out theoretical insights about changes in innovation identity during the diffusion process, as well as how micro-level changes are connected to macro-level changes (Ansari et al. 2010).

Therefore, I argue that innovation change should be conceptualized to include two possible processes: adaptation and reinvention (see Table 3.2 for comparison). The adaptation process is operationalized as changes made to the innovation and organizational changes to address misfits. That is, those changes that are triggered by certain needs and organizational and environmental events. On the other hand, the reinvention process is operationalized as changes made to the innovation that lead to significant departures from normative templates. Thus, reinvention equals large-scale adaptation events that are capable of transforming the innovation. What is different is the inclusion of normative templates in the analysis to investigate the effects of changes at the community level. Each time one observes a change that significantly transforms the innovation and separates it from normative templates, one should record it as a reinvention instead of an adaptation event.

What I am arguing here is that we not only need a change in methodological approach but also a change in theoretical lens. By including the normative templates in the analysis, researchers have an opportunity to observe whether changes happening at the adopting
organization level can have a ripple-effect in which the modified innovation represents a new type of innovation, potentially creating a technology discontinuity in the field (Anderson and Tushman 1990). Of course, not all changes have an equal chance to transform the innovation. For that, we need to understand the scope of innovation changes, the topic of the next section.

The Scope of Innovation Changes

Prior literature has been inconsistent about the scope of innovation changes. Adaptation studies, using a structuration lens, distinguish changes that can be made to the technology spirit and to technology features (Majchrzak et al. 2000). Technology spirit refers to the general intent of the technology with regard to values and goals while technology features refer to the capabilities of the technology (DeSanctis and Poole 1994). Throughout the implementation process, the technology can be appropriated faithfully to the original spirit and features, or appropriated unfaithfully, that is, being modified and adapted.

Similarly, the reinvention literature has classified three types of innovation change: managerial changes which affect the conceptual approaches of the innovation; technical changes which involve changes made to technical components like hardware and specific systems; and operational changes which concern changes to operational components such as innovation routines, procedures, and processes (Rice and Rogers 1980). Specifically, these refer to changes that can possibly be made to three innovation elements: innovation concepts, innovation objects, and innovation practices. Compared to the conceptualization based on the structuration lens, innovation concepts can be considered similar to the technology spirit, while changes that are made to technology functionalities
can be operationalized as changes made to the innovation objects and materialized in innovation practices.

What is involved in innovation change has been a topic for discussion. While DeSanctis and Poole (1994) did not imply unfaithful appropriation is bad, they do not consider technology spirit as the target for change. The technology spirit provides users a normative frame on how to act when using the technology or how to fill in procedures that are not previously specified. Thus, they represent the underlying philosophy of the technology, and if changed, would inherently change the nature of the technology as well as the intended outcomes (DeSanctis and Poole 1994). On the contrary, other scholars consider both technology spirit and features as vulnerable to adaptation and as sometimes necessary to overcome misalignments (Majchrzak et al. 2000; Tyre and Orlikowski 1994). Especially in situations in which change to technology features would not improve performance, organizations would be willing to alter the technology spirit to achieve a better fit (Majchrzak et al. 2000). The implication is that initially, the technology spirit is often left untouched, but can be modified during large adaptation cycles if necessary, especially when organizations encounter failed results and small adaptations are not sufficient (Leonard-Barton 1988).

In this paper I take as given that all innovation concepts, objects, and practices are potentially subject to change. However, not all innovation changes are equal in effect. While it is true that all changes made to innovation concepts, objects, and practices have equal potential to transform the innovation, some may have a greater chance to do so than others. Here, policy research studies can offer valuable lessons.
Bauman et al. (1991) theorized that during the diffusion of social programs, a successful adoption needs to include a program theory that articulates two things: the essential elements of the program that make it effective, and the causal model that explains how the program achieves its effect (i.e., innovation concepts). More importantly, they asserted that innovation change should only occur at the level of implementation, that is, in relation to innovation practices while the program theory should be preserved to maintain the program fidelity. This argument is similar to what DeSanctis and Poole (1994) have argued, that technology spirit (i.e., innovation concepts) should not be changed to retain the integrity of the innovation.

What can be inferred is that an innovation is more likely to be transformed into a new type of innovation when the innovation concepts are modified. Especially when compared to the normative templates or prior adoptions, if the modified innovation concepts significantly depart from these, it will more likely transform the innovation into a new type of innovation. In other words, changes that are made to innovation concepts have a higher chance to transform the innovation into a different type. For example, in the late 1910s, with the excessive resources after World War I, Du Pont used a diversification strategy to enter new markets. The inefficiencies of the old centralized, functionally departmentalized structure encouraged Du Pont to try other structures. When the concept of a multidivisional structure was introduced and implemented, it transformed how Du Pont operated and addressed the complexity of horizontal consolidation. Introduced in the early 1920s, the multidivisional structure later became a new type of strategy to cope with inefficiencies of the diversification strategy (Chandler 1962).
However, changes made to innovation concepts are not sufficient to transform the innovation into a new type as the new practices need to be stabilized and amass enough momentum and support in order to be considered a stable new type. Otherwise, it is at risk of being treated as an outlier or face pressure to reverse back to the normative form, or worse, drive organizations out of business. Unfortunately, failed adaptation and reinvention do not often grab scholars’ attention, with only a few examples in the literature (Wang and Swanson 2007; Wilmoth 1999). A good account of a failed attempt at reinvention is the case of Western Union (McDonald 2012). Once a proud and powerful American enterprise in the telegraphic business, today Western Union is merely known for its money transfer service. The firm tried to transform its business in the late 1960s using computer-based data transmission and information services, being one of the first in the telegraphic industry to do so on a large-scale. Yet, due to the lack of internal support and regulatory momentum, the reinvention failed, and left Western Union a shadow of its former glory. Similar accounts about an innovation change as a new type of innovation that fail to gain momentum is very scarce, and future studies are invited to investigate the phenomenon. For the purpose of this paper, I would only argue that changes made to innovation concepts occur at the boundary of innovation changes, and will have a high likelihood of transforming the innovation into a new type, given favorable conditions (e.g., momentum, support, followers).

Summary

Many terms are clustered under the concept of innovation changes during implementation: innovation modification, adaptation, reinvention, and appropriation. Such proliferation creates theoretical ambiguity, and one area of uncertainty involves the
magnitude of changes. Adaptation literature suggests there are two kinds of changes: small-scale, incremental changes and large-scale, radical changes. Yet, such changes are only concerned with the organizational level effects of changes, that is, how those changes address misfits and better align the innovation and organizational structures/processes. Looking at the same kinds of changes, the reinvention literature suggests that the impact of changes can be expanded beyond the organizational border to have impacts at the community-level. Specifically, large-scale, radical changes can potentially alter the nature of the innovation, and under favorable conditions it can become a new type of innovation. In other words, the adapted innovation can be reinvented and have a ripple-effect on other organizations in the community.

As a result, innovation change during implementation can be conceptualized as including two possible processes: adaptation and reinvention. Both can happen to three elements of an innovation: innovation concepts, innovation objects, and innovation practices. While all changes have equal potential to transform the innovation, they are different in their chance of doing so. I argue that reinvention of innovation concepts has the potential for the most profound effects on the innovation, and has a higher chance of transforming the innovation into a new type. Thus, it is during reinvention of innovation concepts that the boundaries of the innovation are pushed, but such boundaries can only be broken under favorable conditions such as where there is enough momentum or support.

To illustrate the processes of innovation changes involving both adaptation and reinvention, I investigate the changes made to Enterprise Architecture, an instance of an IT management innovation. Because of the lack of physical components, Enterprise Architecture implementation would be less impacted by constraints and influences of
physical boundaries and thus would demonstrate clearly how the innovation concepts and practices are modified and changed throughout the implementation process, as well as the magnitude of their changes. While the focus on innovation concepts and practices is useful to illustrate the theoretical arguments, it is a limitation itself to ignore the effects of change on innovation objects. Therefore, future studies are invited to duplicate the study for other types of innovation—ones that are consists of more innovation objects. In the next section, I present the method for the study.

Method

To answer the research questions of how organizations adapt and/or reinvent IT management innovations and what the effects are for those changes, I conduct an in-depth case study of an Enterprise Architecture implementation in a medium-sized U.S. State government. An in-depth case study approach is useful to reveal the implementation processes (Yin 2009) as well as the details at different implementation levels—an important issue given the need to distinguish adaptation and reinvention events. In this section, I first quickly review the concepts and practices of EA before presenting the case study procedure: field selection, data collection, and data analysis.

Enterprise Architecture—Concepts and Practices

The empirical setting for the study is the case of Enterprise Architecture (EA) implementation. EA is an instance of an IT management innovation, consisting mostly of concepts and ideas. Scholars have regarded EA as a management program and a documentation method (Bernard 2004), an organizing logic (Kettinger et al. 2010; Ross et al. 2006), a plan or set of plans (Bradley et al. 2012). EA invites a high level of
subjective interpretation and therefore offers a great degree of flexibility to adopters to modify, adapt, and reinvent during the implementation process (Bui 2012). Thus, it is an appropriate innovation for the study’s purposes. In fact, a Gartner study found that while many branded EA frameworks exist, most organizations adopted a homegrown or hybrid EA framework (Gall 2012).

The context of the study is EA adoption in U.S. State governments. The U.S. has been one of the pioneers in adopting and using EA. In 1996, the Clinger-Cohen Act mandated the use of EA in U.S. federal agencies. While State governments were not mandated, many have considered and adopted EA. Thus, it is a good site to investigate EA adoption, with the presence of various forces similarly presented to the private sector (e.g., economic-driven factors, social influence, and political forces) (Caudle et al. 1991). Next, I present the field site for my case study.

Field Site

I investigated EA adoption and reinvention at a medium-sized State government in the U.S.A., known by the pseudonym State Enterprise. State Enterprise has an annual budget of over $30 billion with more than 40,000 employees. The executive branch of State Enterprise consists of eight major agencies or departments; each autonomously offers unique services to constituents such as health services, public safety, or transportation. State Enterprise has a federated IT structure with a shared services model in which a central IT unit, hereafter referred to as IT Center, provides IT infrastructure, enterprise applications, and project management as services to the various agencies. The central IT unit has an annual budget exceeding $50 million.
State Enterprise was selected because of the potential adaptation and reinvention processes of EA and the maturity of its EA program. At State Enterprise, initial EA concepts were adopted as early as in 1998, and a formal EA organization was created in 2003. State Enterprise has a hybrid framework that is made up from two branded frameworks and it has been through several versions and has obtained a certain success with these initiatives. State Enterprise is one of the early State governments that adopted Service-Oriented Architecture, and it is using EA for new IT initiatives.

The structure of State Enterprise and its EA organization, a group or team of EA developers and architects within State Enterprise, are described below (see Figure 3.1):

- Like any State government, there are three branches within State Enterprise: legislative, executive, and judicial branches. Within the executive branch, there is an administration agency under the Governor which functions as the headquarters. Within the administration agency, there is a central IT organization (IT Center) which oversees the IT needs for the executive branch.

- A State CIO is the head of the IT Center, and there is a State CTO in charge of technological issues, reporting directly to the CIO. The EA organization reports to the CTO. Its structure includes an EA director and several EA team members. The EA organization is charged with the responsibility for developing a state-wide Enterprise Architecture framework. The EA team consists of about four to five members.

- Within the executive branch, there are other state agencies such as the Health and Human Services, Transportation, or Public Safety. Each agency can be considered as an autonomous business unit, offering distinct services to citizens and firms.
Each agency has an IT organization overseeing its IT needs. Much like the central IT organization, the agency IT organizations have different structures and duties, depending on the agency. The agency IT unit may have an EA team and develop its own EA framework. In those cases, the agency EA framework would follow the general directions set forth by the State EA framework, providing fine-grained and detailed information on the agency contexts. The agency EA team often has a working relationship with the central EA team.

Data Collection

Data was collected from multiple sources: semi-structured interviews, archival data, and informal conversations with key participants (see Appendix A). The data collection process took place between January 2011 and December 2013.

Seven interviews were undertaken with different stakeholders within the EA organization and the State government organization. Three initial interviews were conducted in 2011 while the rest of the interviews were conducted in 2013. The interviews were semi-structured, starting with a standard interview guide and evolving based on participants’ responses (Appendix B). These interviews were conducted with key stakeholders that were involved in the early EA development until the end of the research period, covering 13 positions at different levels of State Enterprise and its EA organization. These informants make up a reasonable portion of the EA organization and give a good representation of different stakeholders (the State EA team has only 4-5 members at any point in time). Each interview was digitally recorded and transcribed afterwards. The transcription is supplemented with interview notes; and follow-up emails as well as archival data were used to clarify any confusion.
A majority of the data comes from archival data collected from the current website as well as previous website versions as cached by the Internet archival database\(^4\). The website provided the current and past publications of the State Enterprise’s EA framework, IT policies, IT standards, and details of historical events. More than 80 different documents (2,000+ pages) have been collected throughout the process. Supplemental information also comes from observations made from two office visits and several informal conversations with key participants.

**Data Analysis**

The data analysis focused on two goals: 1) identify the adoption and implementation events that are associated with the EA development at State Enterprise, and 2) identify adaptation and reinvention events as well as the contextual factors that produce these events. I used a mixed approach with a theory-driven coding framework and data triangulation to build a descriptive and explanatory case of EA implementation at State Enterprise (Yin 2009).

First, based on the interviews and archival data, I constructed a historical account of EA implementation at State Enterprise. Next, the events were coded using an open coding method to identify how State Enterprise appropriated EA concepts and practices. The coding framework is presented in Table 3.3. This allowed me to construct a timeline of adoption and implementation events at State Enterprise.

In the second phase, I analyzed the appropriated EA concepts and practices at State Enterprise to identify adaptation and reinvention events.

- Adaptation events were coded as changes that satisfy two conditions: 1) changes made to EA concepts and/or EA practices as a response to an event in State’s IT environment; and 2) changes that only had a small-scale and incremental impact on State’s EA framework.

- Reinvention events were coded as changes that satisfy two conditions: 1) changes made to EA practices and/or concepts that have a significant impact on State’s EA framework (i.e., change the strategic direction of EA development); and 2) changes that set State Enterprise EA apart from the normative EA implementation (i.e., make State Enterprise EA different from other States’ EA implementation).

Because State Enterprise used two branded EA frameworks proposed by the National Association of State Chief Information Officers (NASCIO) and the Federal Enterprise Architecture Framework (FEAF), the concepts and practices suggested by the two frameworks were considered the normative EA implementation. The appropriated EA concepts and EA practices are compared to these two branded frameworks to identify the occurrence of reinvention events.

In order to understand the causal mechanisms of adaptation and reinvention, an explanatory pattern matching technique was used to identify and relate different historical and contextual events to the adaptation and reinvention events (Yin 2009). A causal network was constructed to understand the logic model of the events (Miles and Huberman 1994; Yin 2009). From there, a chronology of adaptation and reinvention events was created.
To also understand the magnitude of innovation changes, especially for reinvention
events, I first identified the appropriated EA concepts and EA practices that are not
mentioned in the normative EA implementation (i.e., NASCIO and NEAF frameworks).
Next, I searched for these reinvented EA concepts and practices in the community,
particularly the 50 U.S. State governments. The data of EA implementation in 50 U.S.
State governments was collected from another bigger research project. For each
reinvented EA concept and practice, I conducted a simple search to find States that have
similar EA concepts and practices. The date of their adoption was noted. Reinvented EA
concepts and practices that were found in other States’ implementation with later
adoption date are considered to have a community level effect.

In the next section, I present the findings of EA implementation over time at State
Enterprise.

Findings

In this section, I report the EA implementation process at State Enterprise. First,
historical and critical events are described, followed by two accounts of how EA concepts
and EA practices are currently appropriated at State Enterprise. In the second part, the
appropriated EA concepts and EA practices are matched to critical events and compared
to normative templates (e.g., Federal and Association EA frameworks upon which State
Enterprise built their own). This reveals the adaptation and reinvention events at State
Enterprise, as well as explains the cause-effects in the implementation process. Lastly, I
discuss the magnitude of reinvention events at the community level.
EA Adoption and Implementation at State Enterprise

This section describes the adoption and implementation of EA at State Enterprise, with a focus on critical events that have significant impact on State’s EA development. Figure 3.2 presents the timeline of the events, and Figure 3 presents how different events impact the way EA concepts and practices are appropriated at State Enterprise.

Historical and Critical Events

In 1996, State Enterprise appointed its first CIO, charged with the task of establishing IT standards, reviewing agencies’ strategic plans, and reviewing and approving IT procurement. Soon after, in 1998, State Enterprise published its first IT architecture and enterprise standards document. The goal was to create a blueprint for enterprise computing to promote inter-agency connectivity and interoperability. However, most standards at that time were about network and infrastructure.

In 2002, a new Governor was elected with a platform focusing on technological innovation and economic development. An IT Commission was created to pursue an enterprise approach for State’s IT. With help from a consulting firm, the IT Commission published a report in which various issues of IT governance and management at State Enterprise were identified. The urgent problems included an IT budget deficit, poor management, and dis-integration due to years of decentralized IT computing. Enterprise Architecture was among the recommendations to change the way technologies were selected and deployed at State Enterprise. Soon after the report, the first CTO was appointed and State Enterprise published its State EA framework version 1.0 in 2004 (hereafter SEAF). The aim was to identify standards, specifications, and technologies toward enterprise computing.
Later in 2004, State Enterprise published its SEAF version 2.0, adopting the EA frameworks published by the Federal CIO Council for U.S. Federal agencies (hereafter Federal EA), as well as EA guidelines published by the National Association of State CIOs (NASCIO) for U.S. State governments (hereafter Association EA). Those two EA frameworks are the most popular frameworks used in the U.S. public sector, and State Enterprise cited reasons for its choice as minimizing development time as well as taking advantage of the high familiarity of its IT vendors to those two frameworks.

Since then, the State EA team continued to develop the SEAF over the years with gradual and small changes. Then in 2008-2009, the State EA efforts hit another major milestone. In 2008, more than fifty IT and business leaders across State Enterprise participated in a day-long workshop to discuss IT issues and potential solutions for State Enterprise. The final report recommended several key initiatives, among them, IT consolidation and a Service-Oriented Architecture (SOA)\(^5\) infrastructure were the first two priorities. Shortly after the report, in 2009 the governor signed an Executive Order to formally commence an IT consolidation initiative at State Enterprise. The IT consolidation initiative dramatically transformed the IT environment at State Enterprise, driving it toward more centralization and standardization. As a result, EA became an important initiative for State IT consolidation, to standardize their IT standards and processes.

** Appropriated EA Concepts at State Enterprise

This section presents how EA concepts were appropriated at State Enterprise (see Figure 3.3).

---

\(^5\) More details about SOA provided in the Appendix
When the State EA framework (SEAF) version 1.0 was published in 2003, it adopted a Service-Oriented Architecture (SOA) approach that uses open standards solutions. The SOA was an approach to develop IT solutions using reusable code or components. For example, State Enterprise uses XML standards by the W3C to describe information and data specifications, or relies on web service registries like UDDI to store and share programmatic resources in building web services. Thus, building EA with SOA allows organizations to reduce redundancies and improve productivity in their IT development (Ren and Lyytinen 2008).

The decision to adopt SOA and open standard solutions was a result of two events at the time: 1) the State’s adoption of open standards in 2003, and 2) the State Health and Human Services’ successful adoption of a SOA approach in 2003-2004. These are discussed next.

**Adoption of open standards:** The first event occurred in 2003 when State Enterprise decided to take a big step toward vendor independence by adopting open standards IT solutions as a way to combat disintegration and to improve data sharing. After years of decentralized IT management with no overarching plan, there was a proliferation of applications, databases, systems, and standards used at State Enterprise, making it difficult to share or access data from legacy systems. By adopting open standards, State Enterprise hoped to avoid vendor lock-in, allowing State to be independent from particular vendors and switch vendors when they needed. The newly created State EA was adapted to the new direction, embracing open standards solutions.
Whenever possible, IT systems should be based on open standards instead of proprietary technologies to maximize interoperability and vendor independence (State EA v1.0, 1/2004)

However, the move toward open standards initiated a big and long debate at State Enterprise, including involvement from citizens, IT vendors, and political figures. The issues soon attracted national attention, and in 2005-2006, after years of headache, State Enterprise decided to accept both open standards and vendor proprietary solutions. In the SEAF 2008 version, the State decided to accept both open standards solutions and industry interoperability best practices, a compromise to avoid criticism from multiple stakeholders.

*Implementation of the SEAF will result in a Service Oriented Architecture for [State Enterprise] that uses open standards solutions where appropriate and industry interoperability best practices to construct and deliver online government services (State EA v4.1, 2/2008).*

**HHS’ adoption of SOA:** The second significant event was the adoption of SOA at State’s Health and Human Services (HHS). During 2003 and 2004, HHS as the biggest agency at State Enterprise decided to develop an Identity Management solution to encourage data sharing across services. Identity Management is a cross-functional IT solution that allows citizens to enter their information once for all HHS services (e.g., food stamps, health services). In order to develop the solution, an IT Architecture was created using a SOA approach to take advantage of reusable modules during the IT development process. State Enterprise’s central IT unit was a part of the initiative, helping HHS to set up the necessary back-end infrastructure for the initiative. The project
was a success, saving the agency development time and reducing costs. As a result, HHS’s model influenced State’s decision to adopt a SOA approach into the State’s EA framework. The CIO at that time commented:

>This shared services model was the first of its kind, to be honest, anywhere in the country. And the concept of an Enterprise Service Bus (see Appendix C) which today seems natural, 10 years ago we were like ‘Enterprise Service Bus what the heck was that?’ So if the HHS was definitely leading the way in terms of establishing the architecture, the State IT was certainly a part of that progress, participated in the development of it. We eventually at the time worked sort of hand in hand with the Blanket Purchase Orders (see Appendix C) from the Health and Human Services to make sure that we understood exactly what was happening and then we could make sure how eventually to operate (State Enterprise interview #6, 9/2013).

**Summary** Today, SEAF concepts include the adoption of a SOA approach to take advantage of reusable components, and the use of open standards and industry interoperability best practices to ensure vendor independence in their services. Both concepts are influenced by State’s adoption of open standards in 2003 and the HHS’ adoption of SOA in 2003-2004.

**Appropriated EA Practices at State Enterprise**

This section presents how EA practices are appropriated at State Enterprise (see Figure 3.3).
Early IT Architecture standards and policies were introduced at State Enterprise in 2000. At that time, vendors were required to comply with those standards when responding to a Request for Proposal (RFP), and agencies were required to follow those standards in their investment proposals. However, compliance was weak, as the policy was not strictly enforced by State Enterprise. Moreover, the lack of a clear governance structure and a formal unit for IT policies and standards also created inconsistencies among agencies. The result was confusion and lack of results.

*Agencies acknowledged the existence of the [early] Enterprise Architecture, but indicated that circumventing any standard would be easy... In interviews with the IT Center and agency staff, there was universal acknowledgement regarding the lack of compliance and enforcement of agency conformance to the Enterprise’s standards... While State IT Center has staff who perform policy and planning functions, it lacks a single focal point for enterprise architecture standards, such as might be performed by a chief technology officer or an enterprise architect. Such a focal point must be capable of arbitrating disagreement among agencies concerning the adoption of technology standards, and must be accountable for establishing and communicating the “construction codes,” as well performing a leadership role in compliance. (State Enterprise IT Strategy, 2/2003)*

As a result, when State Enterprise revamped its IT architecture team in 2003 to create its formal Enterprise Architecture program, its two main focuses were the enforcement practices and a formal standard creation process.

**EA enforcement practices:** In their report, the IT Commission recommended the establishment of a formal EA program. Based on their recommendations, the first CTO
was appointed at State Enterprise in 2003, charged with the responsibility to oversee the EA program. A State EA organization, a focal point for state IT policies and standards, was established with several architects to develop and maintain enterprise-wide IT standards. Soon after, the first version of State’s EA was published in early 2004, and version 2.0 was introduced in late 2004. During that time, State’s investment proposal guidelines included State EA standards as one of the suggested standards for technology assessment, but there was not a strong enforcement practice put in place. Compliance continued to be an issue as a formal agency CIO put it:

I would say they were probably trying to propagate that policy and the practice at the agency but I wouldn’t say in those years 2004 to 2008, I wouldn’t say it was totally successful, you know what I mean? I guess it’s not a measure of success I think it’s a measure of adoption and compliance, okay? (State Enterprise interview #7, 9/2013)

Yet, compliance did get better over time as agencies learned about the benefits of State’s EA framework. Circa 2005-2006, the investment proposal guidelines suggested that agencies needed to show compliance to EA standards for their proposal’s technology assessment, a policy considered stronger than the previous guidelines. Furthermore, there were two practices implemented to check agencies’ compliance: 1) IT projects that exceeded $100,000 budget would need to comply with the State EA in order to get approval, and 2) agencies’ IT projects that received funding from State Enterprise would need to comply with the State EA. The State CIO commented about that time:

We would check to make sure that every RFP that went out the door satisfied SEAF compliance, in [their] RFP. And ultimately the CIO has the signature
authority over any procurement over a certain dollar amount, forget what it is, I think over $100,000 or something, for application, $50,000 to $100,000 or so. CIO for the State got involved with any large procurement, and we make sure that when that happened the agency complied with SEAF. And then the third way was ... State Enterprise has about 90 million dollars a year to work with agencies, transfer to agencies for IT projects. So agencies will apply, almost like a grant process. They would apply for money for their IT projects, and through that process of distributing money we have sort of management check points along the way for the project schedule as well as compliance (State Enterprise interview #6, 9/2013)

After the State-wide IT consolidation in 2008, SEAF then became an important approach to ensure an enterprise-wide perspective for all IT investments. Since 2010, the State EA became an explicit requirement for IT investment proposals, and IT vendors are strictly required to comply with SEAF in their proposals.

In addition, the EA team also learned to adapt other practices to increase agencies’ compliance. In about 2006, enterprise architects started to get assigned or lent to agencies that received State IT funding to ensure their compliance throughout the project lifecycle. The practice of lending out EA architects is an adaptation of a previous practice at State Enterprise. In the early years when State Enterprise started to allocate funding to agencies, analysts were assigned to review the projects throughout the lifecycle. The practice built momentum over the years, and a team was created to support agencies’ projects that were state-funded. In 2004, Strategic Planning Group liaisons were formally
assigned to agencies with State funding. The EA team recognized the benefits of those practices and adopted it into their EA practices. The director of the EA team summarized:

*We were able to see that it makes a lot of sense for us as the oversight agency to participate in the various efforts of our agencies as things go forward, so one other thing we do is we will set aside enterprise architects for major projects in State Enterprise to offer consulting services to agencies in those projects on how those agencies or those projects can meet their business requirements utilizing a SOA approach. And allow for a large collaboration among and between agencies* (State Enterprise interview #1, 1/2013)

Over time, agencies have become more comfortable with State EA and especially the help they receive from the EA team. In projects where the use of an enterprise architect is not mandatory, the agency actively considers requesting it. One architect commented:

*So I’ve actually been loaned to the Department of Revenue for two years, working with them. And right now they do consider it if I’ve been taken away, I think they [will] still request for an architect to be part of the project* (State Enterprise interview #3, 4/2011).

**EA standards creation practices:** The creation of the State EA program in 2003 also helped to establish a formal process to create and set up EA standards. As State Enterprise evolved, they also adapted their processes of setting up EA standards. One adaptation is the use of legal advisors in EA development. Due to a long and daunting debate that State Enterprise had with IT vendors regarding proprietary formats versus open formats, State Enterprise became very sensitive about their choices of standards.
Thus, any new standards would frequently receive advice from the legal teams. As the CTO summarized:

*Being the government there’s always the legal component to anything, so we have a strong legal team here, and we involve them and work with them throughout...So for example, suppose I have to say, ‘essentially, that everybody must use Excel for spreadsheet,’ just randomly. Whatever reason doesn’t matter what the reason is. That means, so I may have a technical reason for this, but legally, I’m the State, and I’m telling everybody to use Excel which benefits a particular vendor, I better have a very good reason because if I’m another vendor, you may just lock me out of that space, and you didn’t do it for a full procurement, you just sort of identify it through a committee what you’re going to base this one on, and so that would be, this example never happens, but that would be an example of a case where the legal team would step in...they evaluate my reasons and make a legal recommendation as to whether I should proceed with this statement or whether I should [not] (State Enterprise interview#4, 4/2013).*

And in recent years, when State Enterprise decided to start IT consolidation to further encourage collaboration and sharing among agencies in 2008-2009, the EA team also introduced an Enterprise Architecture Council as a new entity that recommends additional standards to the ‘watch list’. A Decision Process was introduced to invite more inputs from agencies in the setting up of new enterprise IT standards.

*The State EA is a living document, where open and/or de facto industry standards are continually evaluated for recommendation as Enterprise Standards.*
IT organization’s Policy and Architecture unit keeps a “watch list” of current Enterprise Standards as well as emerging standards. The Enterprise Architecture Council (EAC) may recommend additions to the watch list (State EA v4.1, 2/2008).

In general, based on the recommendation from the IT Commission report in 2003, State Enterprise focuses on setting up a formal process to create EA standards and creating enforcement practices to increase EA compliance. Taking the lessons from managing state-funded projects, State Enterprise requires all state-funded projects to comply with EA standards, enterprise architects are assigned to state-funded projects, legal advice is sought for new standards, and a formal Council was created to involve agencies in the standard development process.

Summary

In this section, I presented the EA implementation process at State Enterprise, and how it currently appropriates EA concepts and EA practices. Figure 3.3 provides an overview of the process. At State Enterprise, the initial IT architecture was developed in 1998, but the State did not have a formal authority nor a strong enforcement practice for IT standards and policies at that time. In 2003, based on recommendations from the IT Commission, State Enterprise formally initiated a State-wide Enterprise Architecture program. In terms of EA concepts, the State Enterprise EA framework is built on the Federal EA and Association EA frameworks, adopting a SOA approach, open standards, and industry interoperability best practices. Regarding EA practices, enforcement practices are modified to increase compliance, as well as to encourage EA usage in State agencies.
New practices are also put in place to develop EA such as the inclusion of legal advice or a decision process for agencies’ input.

EA Adaptation and Reinvention at State Enterprise

In this section, I first compare the appropriated EA concepts and then EA practices at State Enterprise to the normative concepts and practices promoted in the Association and Federal EA frameworks. This section reveals the adaptation and reinvention events that occurred during the EA implementation process at State Enterprise. Historical events and insights from interviews are used to provide an explanation of the adaptation and reinvention events that have taken place at State Enterprise.

Adaptation and Reinvention of EA Concepts

The appropriated EA concepts are compared to the Association and Federal EA frameworks in relation to three aspects: definition, motivation, and approach. Table 3.4 provides an overview.

**Definition and motivation:** The definition and motivation underpinning SEAF are very similar to the Association and Federal EA frameworks. All three EA frameworks focus on standardizing the technology environment to increase agency collaboration and information interoperability. However, the State EA is motivated toward vendor independence, being able to avoid vendor lock-in, an emphasis that is not found in the Association and Federal EA. This motivation is the result of State Enterprise adapting their EA to fit their needs. A long history of a decentralized IT environment increased the complexity and a proliferation of IT artifacts at State Enterprise, forcing them to move toward vendor independence. The adaptation can be observed also in 2008 when State
added industry best-practices in their EA standards. For example, State Enterprise uses the Web Services Interoperability Organization (WS-I) as a baseline for their application specifications. The WS-I is an industry consortium charted to promote interoperability among web services specifications.

Yet, the inclusion of SOA together with open standards and eventually industry interoperability best-practices in the State EA can also be considered a large-scale reinvention event. It changed the nature of the EA frameworks at State Enterprise toward vendor independence as well as reusable components, something that was not found in the Association and Federal EA, or any other EA frameworks in the public sector at that time. The Federal EA started to promote SOA in 2004, but no detailed guideline was provided until 2008, and the Association EA only started to promote SOA in 2006; while State EA already utilized SOA since the end of 2003 and early 2004 in their very first EA version. Today, there are also only three other States utilizing a SOA approach for their EA framework. Similarly, the use of open standards is an invention itself. Currently, there are only three other States that explicitly state the use of open standards in their frameworks. Today, Federal and Association EA still do not have much information or guidelines on incorporating open standards in EA frameworks. State Enterprise was one of the very first States pioneering the use of open standards in the public sector. Their adoption of open standards in 2004, and later the adjustment to include industry interoperability best practices can be considered a reinvention—the creation of a different way to implement EA in the State government community.

**Approach to EA:** In terms of approach, there is a contrast in how EA is developed in the three frameworks. Both the Association and Federal EA frameworks tend to favor a
holistic approach with a focus on cross-agency standards. The standards would be
developed and specified by the EA organization to be rolled out to other business units.
On the other hand, State Enterprise chose a hybrid approach that gives their business
units—State agencies—much more autonomy. The high-level guidelines and list of
acceptable standards are specified by the State EA organization, while the agencies can
select and use standards that are most appropriate for them.

The differences are clearer when looking at how different frameworks describe EA
layers. For the Association and Federal EA frameworks, EA development starts by
specifying the business layers (e.g., business requirements, objectives, processes) which
will determine the needed solutions and applications (i.e., the Solution layer). Once the
solutions are specified, the kind of information needed can be specified. Lastly, all the
inputs from the business, solution, and information requirements determine the
technology layer. Thus, in this holistic approach, the business objectives would drive the
technology standards and procedures—a somewhat top-down approach.

On the other hand, State Enterprise chose to focus only on the Technology layer in the
first instance. The different standards are specified for the purpose of clarifying the
computing environment and to standardize the different technologies. As a result, the
standards are not strongly driven by the enterprise business objectives, but rather by the
local business unit needs. State Enterprise chose to only determine the list of acceptable
standards and let the business units decide which standard they would use. Other
agencies, e.g., HHS, can develop their own EA frameworks to specify detailed standards
and guidelines, as long as they fall within the guidelines of the State EA framework.
The implementation of a hybrid approach with a focus on the Technology layer in State’s EA framework can be considered adaptive in nature. Because State Enterprise has a federated IT structure in which agencies retain strong autonomy (e.g., HHS developed the first IT Architecture even before State IT Center does), having a holistic and somewhat top-down approach is not appropriate for State Enterprise’s IT culture and structure. The lack of power in the central IT unit also makes it difficult to specify the business EA layers, thus leaving the technology EA layers as suitable, at least in the first instance. This is being changed since the State IT consolidation in 2009, since when the central IT unit is gaining more control over IT decisions and processes. In one of my office visits, the CTO who came in 2009 showed me his plan to develop other EA layers, although nothing has been formally accomplished yet.

**Summary** In sum, State Enterprise’s EA framework shares a similar definition and motivation with the Federal and Association EA frameworks, focusing on standardization, agency collaboration, and information interoperability. Unlike the Federal and Association EA frameworks, State Enterprise reinvents their EA framework to utilize a SOA approach as well as open standards and industry interoperability best practices to increase vendor independence. They were among the first States in the nation to do this, and have inspired three other States to adopt SOA and/or open standards. Thus, their EA concepts depart from the normative guidelines of the national frameworks and can be considered an innovative way to implement EA among the State governments. In terms of approach, State Enterprise adapted their EA framework to a technical EA type instead of a holistic approach as promoted by the Federal and Association EA frameworks. This is an adaptation by State Enterprise to better align with their federated
IT environment. Table 3.4 provides a comparison between the State Enterprise EA framework and the normative concepts promoted by the Federal and Association EA frameworks.

**Adaptation and Reinvention of EA Practices**

The EA practices appropriated at State Enterprise are compared to the Association and Federal EA frameworks on two aspects: set-up and enforcement. Table 3.5 provides an overview. In general, various EA practices at State Enterprise are similar to ones found in the Association and Federal EA frameworks: an EA organization with clear authorities, a process to include agency inputs and create enterprise-wide IT standards, and the integration of EA standards into project lifecycle for enforcement. On the other hand, some EA practices are distinctively adapted to the State Enterprise environment.

**Set-up practices:** Due to the negativity surrounding the open standards adoption in 2003, State actively seeks legal advice for their choices of IT standards. This is a unique adaptation due to State’s status of being a public organization. If it were a private organization who chose to adopt open standards, there would likely not be many, if any, criticisms raised against the decision as open standards help to reduce costs and increase interoperability. However, State Enterprise as a public organization has to maintain a *fairness* status and cannot choose open standards as it will makes the State to appear as unjust or prejudiced. For example, State Enterprise received strong opposition from the blind community who felt that open standards could not provide them the sufficient support that proprietary standards do. Other vendors who provide proprietary standards felt they would be in a disadvantage against vendors that use open standards. As a result, State Enterprise had to adjust their approach to include proprietary best practices that
have better accessibility support for the blind community and accepted proprietary
standards in their bidding procedures. Yet, this important legal and ethical aspect of
public organizations has not been considered seriously by any branded EA frameworks,
even those produced specifically for the public sector. As a result, it can also be
considered an invention event, one that illustrates how State Enterprise makes a better EA
framework for its context. However, the effects of this modification are only modest and
was retained within the organization. No similar practice is found in other State
governments. Put it differently, the practice does not have the community-level effect of
reinvention. However, while it cannot be considered a reinvention event, but at a
minimum, the legal and ethical issues here indicate an innovative adaptation of State
Enterprise to the fairness requirements of a public organization.

**Enforcement practices:** The EA team at State Enterprise also adapted several IT policies
into EA practices to increase compliance. Realizing the momentum and benefits of
having a State representative throughout other agency’s project lifecycles, State
enterprise architects are lent to agency’s projects to promote and ensure compliance.
While the Association and Federal EA frameworks often recommend including
checkpoints or milestones in the project lifecycle to check for compliance, the lending of
type enterprise architects is a much more effective way to ensure compliance for State
Enterprise. There are several reasons for this. The first reason is that State Enterprise has
a federated IT structure in which the agencies retain considerable autonomy. Thus,
having a top-down approach in which the central State IT unit review projects for EA
compliance may not work well. The early IT architecture policies perhaps suffered from
this issue as many agencies did not strictly honor the IT guidelines and standards set by
the central IT organization. The second reason is that State Enterprise is more interested in integrating the EA practices into agencies’ routines. In order to make the agencies take EA seriously and incorporate EA values into their practices, State Enterprise would need strong mechanisms to encourage agencies to use EA. Otherwise, the EA frameworks are only good ideas and concepts on paper. The EA director stressed:

*I think it’s really important that I get across is that there’re really two sides to an Enterprise Architecture. There’s conceptual side, which is the idea that you’re trying to achieve, like your goals and how you going to do that, right? Like how you come up with an HRM\(^6\) or why you come up with an HRM, which state? But the technical goals are, for State Enterprise, the immigration package to getting there and the technical standards and specifications that organizations are able to interact with. It works on paper, you know, or it looks great now on the Internet, right? But it stops. It’s all meaningless unless someone physically and basically can do it. Somebody has to actually take all those words, they have to consent them, and they have to actually physically implement a piece of technology that takes advantage of the concepts that are described in your documentation. Before that happens, you surely have nothing more than a really good set of ideas (State Enterprise interview #1, 1/2011) (emphasis added)*

**Summary.** In short, State Enterprise implemented several practices as suggested by the Federal and Association EA frameworks, but adapted these to better fit its circumstances. First, the inclusion of legal advice for EA development is a unique adaptation, almost an

---

\(^6\) See Appendix for detail on HRM (Human Resources Management)
that allows State Enterprise to maintain a just and fair status of a public organization. However, the evidence here is not conclusive to determine whether it is only an outlier or a unique reinvention, and future studies are needed to investigate this. At a minimum, it illustrates the importance of considering legal and ethical issues for public organizations. Second, State Enterprise borrowed enforcement ideas from its IT policies to enforce EA values, lending enterprise architects to State-funded IT projects. Table 3.5 provides a comparison of SEAF and the Federal and Association EA frameworks.

**Summary**

In this section I present EA adaptation and reinvention events at State Enterprise (see Table 3.6 for a summary). In general, most modification has been done to EA practices, with only a few changes made to EA concepts. However, those changes to EA concepts are more impactful, as they represent an innovative way that State Enterprise departs from the normative templates (i.e., the Federal and Association EA frameworks). Specifically, State Enterprise adopted SOA and open standards very early before most State governments. Their actions inspired a few other States to follow and therefore can represent a different way to implement EA. Changes in EA practices are smaller-scale and more gradual, representing a continuous adaptation process. However, one change stands out as a potential reinvention of EA practice (i.e., an innovative adaptation). At State Enterprise, the EA team includes legal advice in their EA development, a unique and innovative adaptation to preserve the fair and just status of a public organization. The evidence is not conclusive to determine whether this can be considered a unique feature to EA implementation, and future studies are needed to check the conjecture.
Magnitude of Innovation Changes at State Enterprise

At State Enterprise, one appropriated EA concept and one appropriated EA practice are not found in the normative EA implementation (i.e., Federal and Association EA frameworks). The first one is the use of SOA approach and open standards for EA development, and the second one is the inclusion of legal advices in EA standard development. The magnitude of these changes is discussed next.

SOA Approach and Open Standards

State Enterprise adopted the SAO approach and open standards in 2003-2004, being one of the few early States did so. At that time, both concepts were fairly new in the public sector. The Federal EA mentioned SOA in its 2004 SOA White Paper, but detailed guideline did not come out until 2008; and the Association EA only started to promote SOA in 2006. Similarly, the concept of using open standards for vendor independence was nowhere to be found and is still not mentioned in both Federal and Association EA today. In fact, the adoption of open standards was followed quite closely by other States at that time as it was predicted to have a ripple effect in other States. The media coverage at the national level provided a favorable condition for the concept to catch on with other States.

By 2014, the use of SOA and open standards started to take root in a few States. Today, three other States adopted SOA and/or open standards out of 23 States who implemented EA. Most of the three States did so around the time of State Enterprise’s adoption, 2003, or in later dates (e.g., 2006-2007). While there is no evidence of direct impact from State Enterprise’s adoption to other States, by being one of the very first pioneers who adopted and introduced these concepts, State Enterprise provided an example to attract other
States to follow. Thus, the reinvented EA concepts at State Enterprise, SOA and open standards, did have a spill-over effect on other States and exercise impact at the community level.

Legal Advice in EA Development

State Enterprise started to include legal advice in their EA development circa 2008. Today, to the best of my knowledge, no EA frameworks for public sectors mention the inclusion of legal advice in order to maintain the fairness status for public organizations. Therefore, this is an invention itself. However, there is no conclusive evidence that such practice is made known and adopted by other States. The difficulty is due to the magnitude of this change being mostly organizational level change. The practice is not documented explicitly, and only made known through interviews. Other States may have similar practices but do not document it explicitly either. Therefore, the impact of this innovation change is categorized at the organizational level rather than at the community level. Future studies can certainly examine other States to see if they find the similar practice.

Summary

Two innovation changes at State Enterprise depart from the normative template: the use of SOA and open standards, and the inclusion of legal advice in the EA development. While the latter has mostly organizational-level effect, the formal has an impact at the community as other States watched closely State Enterprise’s adoption of open standards and SOA, and some even followed in its footsteps. Thus, the evidence suggests that the reinvention events at State Enterprise can have both organizational- and community-level effects. Furthermore, under the right conditions (e.g., media coverage, momentum,
support), the reinvented changes can be picked up and adopted by others in the community.

**Discussion**

The topic of innovation change during implementation has only received modest attention in the literature, leaving theoretical gaps to explore. One important area of uncertainty involves the magnitude of changes. To date, scholars have convincingly pointed out that innovation changes happen in an episodic and punctuated pattern, involving two kinds of changes: small-scale, incremental changes and large-scale, radical changes (Leonard-Barton 1988; Lyytinen and Newman 2008; Lyytinen et al. 2009; Tyre and Orlikowski 1994). These studies mostly focus on the adaptation process, and have illustrated one dimension of the magnitude of change. Specifically, the organizational-level effects of changes as these changes influence the dynamics of innovation and organizational structures/processes for better alignments. However, such theoretical treatment leaves out another important dimension of the magnitude of change: the community-level effect of change. That is, large-scale, radical changes at the organizational level can have the potential to alter the nature of the innovation, introducing a new type of innovation and a technology discontinuity into the community. In this sense, these changes can be conceptualized as reinvention, changes that depart the innovation from the normative templates.

As a result, innovation changes can be thought of as including two possible processes: adaptation and reinvention. *Adaptation* is operationalized as changes that happen to the innovation and organizational structures/processes to overcome misfits, while *reinvention*
is operationalized as changes that alter the innovation significantly from the normative templates and might have community-level effects. In other words, reinvention equals large-scale, radical adaptation cycles. Both adaptation and reinvention can happen to three elements of an innovation: innovation concepts (e.g., fully integrated functions and data centralization in enterprise systems), innovation objects to provide the physical and material components for the innovation (e.g., Oracle databases, Cisco data centers, EA framework documents), and innovation practices that enact the innovation in organizational practices (e.g., generating customer reports using SAP). While all three elements are equal in potential to transform the innovation, it is argued that changes made to the innovation concepts have a higher chance to alter the nature of the innovation and push the boundary of changes to give rise to a new type of innovation.

The case of State Enterprise clearly illustrates that radical adaptation can reinvent an innovation and have not only organizational-level but also community-level effects. Furthermore, such reinvention is likely to have the most impact when done to the innovation concepts. At State Enterprise, the inclusion of legal advice in EA development is a reinvented EA practice. Yet, it has mostly an impact at organizational level, being a way to maintain the fairness status of State Enterprise. On the other hand, the reinvention of EA concepts to include an SOA approach and particularly open standards has a ripple-effect across the community and have the potential to become a new type of EA implementation. Therefore, the difference in magnitude of change here also suggests that changes made to different innovation elements have different impacts. The same can be expected from a more material technology such as ERP. One can imagine a situation in which a switch from using a central database to using cloud computing or artificial
intelligence can significantly change how ERP operates, and can have a ripple-effect to other organizations.

The findings here contribute to prior theories on innovation change (Lyytinen and Newman 2008; Lyytinen et al. 2009). When studying the implementation process, students of innovation change should pay attention to not only organizational-level effects (i.e., adaptation), but also community-level effects (i.e., reinvention). This will help to connect the micro-level changes to macro-level changes, explaining how organizational-level actions bring about community-level changes. Several studies have shown how the community-level ideas are translated into organizational-level ideas (Nielsen et al. 2013), how community-level ideologies shape organizational-level framing strategies (Barrett et al. 2012), or how community-level visions guide organizational-level adoption behaviors (Swanson and Ramiller 1997). Yet, only a limited number of studies have linked organizational-level changes to community-level effects (Barley and Tolbert 1997; Greenwood et al. 2002; Maguire et al. 2004). What’s more, most of these studies rely on discourse and framing as a strategy to bring about institutional changes. The findings in this study illustrate that changes made to innovation concepts can also have the community-level effects: bringing about institutional changes (i.e., normative implementation templates) under favorable conditions (e.g., momentum, support).

Furthermore, the findings help to shed light on how the innovation identity changes as it diffuses across organizations (Ansari et al. 2010). Innovation literature mostly assume that the nature and identity of an innovation would remain unchanged as it is being diffused. Yet, one can imagine that a radical reinvention at an organization, given
favorable conditions (e.g., media coverage, momentum, support) can ripple through the community and create a new type of innovation. This process has been illustrated with product innovations in which we can often see several waves of radical innovation before a technological breakthrough happens in an industry (Anderson and Tushman 1990). Future studies are sought to evaluate situations in which reinvention at the organizational-level brings about a new type of innovation or a new order of normative behaviors at the community-level.

Practical Implications

The findings suggest managers to be mindful about how adaptation and reinvention unfold over time. At State Enterprise, although the aggregate pattern of innovation changes is an episodic pattern as the literature predicts (Lyytinen and Newman 2008; Tyre and Orlikowski 1994), it looks different for each innovation element (Figure 3.4).

For EA practices, the change occurs in a much more continuous manner in which adaptation events unfolded gradually over time. On the other hand, EA concepts are reinvented in an episodic manner, often associated with critical events, or jolts, from the environment. Particularly, the reinvention events that include SOA and open standards were due to the adoption of SOA in the State HHS and the adoption of open standards outlined by the State CIO. In 2008, due to the negative feedback from stakeholders, State reinvented its EA concepts again to include industry interoperability standards beside open standards. These different temporal patterns suggest that managers need to be mindful about when to introduce changes. It would be more helpful to have radical and larger-scale changes coupled with major organizational changes in order to capture a “window of opportunity” that is more tolerant to big changes (Tyre and Orlikowski
1994). Of course, this is more of a suggestion, as many times managers cannot plan when and how radical changes happen and unfold.

Limitations

Several limitations in this study can offer other opportunities for future research. First, the study is one case study and therefore generalization is only limited to analytic generalization (i.e., generalize to a broader theory) (Yin 2009). Multiple case studies could offer additional strength to the findings here. Second, the study only looks at one particular type of innovation (i.e., IT management innovation) in a particular setting (i.e., U.S. public sector). While several lessons can be applied to other circumstances, and the theoretical conclusions can be linked to prior literature, additional studies of different kinds of innovation (e.g., process innovation, product innovation, system innovation) and/or in different settings (e.g., private, non-profit, E.U markets) will certainly validate the findings in this study and increase the generalization of the conclusions here.

Conclusion

Through an in-depth case study of Enterprise Architecture (EA) implementation in a medium-sized U.S. State government, I illustrated how adaptation and reinvention occur during the implementation process. Particularly, State Enterprise reinvented their EA concepts when they first adopted EA in 2003-2004, introducing the SOA approach and open standards as a way to increase vendor independence and take advantage of reusable components. Their reinvention inspired other States and have a community-level effects. At the time of my investigation, there were three more U.S. State governments that implemented the same type of EA as State Enterprise: utilizing open standards and/or an
SOA approach. That brings the total to four States out of 23 adopted States. Thus, while the number is still modest, the type of EA implemented at State Enterprise does have a potential to become a new type of EA on its own. However, its fate lies beyond the timeframe of my investigation, and I invite future researchers to visit the issue to validate the conjecture. At the minimum, this study calls for more attention from students of innovation changes to investigate not only organizational-level effects but also community-level effects of innovation changes—a topic that is largely overshadowed in the literature.
Chapter 4: Enterprise Architecture Alternative Designs

Organizations’ tendency to modify, adapt, and reinvent Enterprise Architecture during the implementation process explains the diversity in EA implementation across organizations. However, are these adapted EA implementations significantly different from each other? How would the different adapted EA be grouped at the community level? This chapter takes a broad look at the diversity of EA implementation at the community level to understand the similarities and differences between the adopted EA.
Alternative Designs for Widespread Adoption: Empirical Evidence from Enterprise Architecture Implementation in U.S. State Governments

Abstract

The dominant design perspective posits that widespread adoption of an innovation, at least for product innovations, happens when a vendor shakeout occurs and subsequently a dominant design of the product emerges. In this chapter, I investigate how the dominant design perspective holds for non-product innovations: could we expect widespread adoption to occur with alternative designs? Using data from the widespread adoption of Enterprise Architecture in a medium-sized population: the U.S. State governments, I illustrate that both premises of the dominant design perspective do not apply well. Despite the widespread adoption of Enterprise Architecture, there is no sign of a vendor shakeout and convergence in the vendor community, nor any sign of a dominant design implemented among State governments. On the contrary, alternative designs may have been more helpful to the diffusion process of Enterprise Architecture. The findings suggest new possibilities for innovation studies, to look at organizational profiles that promote certain innovation designs, or to identify conditions and trajectories under which alternative designs are more plausible than a dominant design.

Keywords: dominant design, alternative design, vendor shakeout, IT management innovations, Enterprise Architecture, U.S. State governments
Introduction

“So I went to replace my jeans after years and years of wearing these old ones, and I said, you know, I want a pair of jeans, here’s my size, and the shopkeeper said do you want slim fit, easy fit, relaxed fit? You want button fly or zipper fly? You want stone washed or acid washed? Do you want ‘em distressed? You want boot cut, you want tapered, blah blah blah... on and on he went. My jaw dropped, and after I recovered I said- I want the kind that used to be the only kind.”

This experience was described by Barry Schwartz, the author of *The Paradox of Choice* at a TED7 talk in 2005. Today, we are living in the world of choice, and it has been argued that excessive choice could paralyze our decision making, distort our expectations, even make us feel stressful and anxious (Schwartz 2004). In the innovation adoption literature, it is generally believed that at least for product innovations8, the presence of a dominant design—a single design architecture that establishes dominance in a product class—could help to encourage the widespread adoption of an innovation (Abernathy and Townsend 1975; Anderson and Tushman 1990; Murmann and Frenken 2006; Tushman and Murmann 1998). When an innovation is first introduced, many alternative designs subsequently emerge, representing different technological trajectories. Two events follow: First, a battle occurs between alternative designs, and a shakeout happens in the vendor community to give rise to a dominant design. Second, the dominant design would signal to potential adopters a period of stability and growth in

---

7 The Technology, Entertainment, Design (TED) conference [https://www.ted.com/](https://www.ted.com/)

8 In this study, the term “product innovation” refers to technological product innovation.
which continuous vendor support is ensured, economies of scale are possible, and exploitation is encouraged. As a result, the dominant design is widely adopted across organizations (Suárez 2004).

While empirical studies have found support for dominant designs, most of them have identified dominant designs for product innovations—ones that are made up from assembled physical components such as typewriters, automobiles, TV tubes, microprocessors (c.f., Murmann and Frenken 2006; Utterback and Suárez 1993). However, how does the theory hold for non-product innovations? Scholars have noted the difficulties in identifying dominant designs for complex innovations such as telecommunication systems (Murmann and Frenken 2006; Tushman and Murmann 1998) while others have observed variations in the implementation of complex innovations such as IS architectures (Bidan et al. 2012) or data warehouses (Bashein and Markus 2000).

For complex and conceptual innovations, the presence of various alternatives may actually promote the innovation. Due to the higher degree of complexity or the conceptual nature of the innovation, these innovations afford greater interpretive flexibility to adopters who may appreciate the possibility to adapt, modify, and reinvent the innovation the way they want. Thus, the various alternatives provide ambiguity, choices and interpretive templates that enable the adaptation of those innovations—something called interpretive viability (Ansari et al. 2010; Benders and van Veen 2001)—making the innovation more attractive and plausible to diffuse.

This chapter addresses this theoretical gap by asking: how do IT management innovations achieve widespread adoption? IT management innovations are a type of non-product innovation that focuses on management practice, process, structure, or technique of IT
activities (Birkinshaw et al. 2008). Put differently, they are innovative ideas about how to organize and govern IT activities, thus they are conceptual innovations. Examples include IT outsourcing models, IT shared services models, or the introduction of a CIO. These innovations are mostly ideas with limited or no IT artifacts and physical components. Thus, they provide a good setting to examine how the dominant design perspective holds for non-product innovations.

Specifically, this chapter investigates the widespread adoption in the case of Enterprise Architecture (EA) in 50 U.S. State governments. The case of Enterprise Architecture in the U.S. State governments is chosen because: first, Enterprise Architecture represents an instance of an IT management innovation, focusing on IT management issues from an enterprise perspective (Ross et al. 2006); and second, the U.S. State governments are a mid-sized population with signs of widespread adoption of Enterprise Architecture. Thus, it is an appropriate setting to investigate the research question. The findings indicate that currently, Enterprise Architecture is widely considered and adopted in the U.S. State governments (23 States have adopted and 22 States have initiated EA). Yet, the EA vendor community is still widely promoting three different ideal EA designs, and the States themselves adopt and adapt these ideal designs into four different designs, each with its own assumptions. The adoption of Enterprise Architecture illustrates that alternative designs may be more possible and even more desirable for conceptual innovations. Future studies are invited to validate the conjecture, and the possibility of alternative designs opens new research directions for future research: to examine the organizational profile that prefers certain innovation designs, or to identify conditions and trajectories under which alternative designs are more plausible than a dominant design.
Theoretical Background

In this section, I first revisit the dominant design theory and explain how widespread adoption occurs with dominant design. Two premises of the dominant design theory are discussed. Next, I compare IT management innovations and product innovations to assess the likelihood of the two premises of the dominant design theory in the case of IT management innovations.

Widespread Adoption with Dominant Designs

Dominant design is defined as a single architecture that establishes dominance in a product class and gets widely accepted as the industry standard (Tegarden et al. 1999; Tushman and Murmann 1998). Its occurrence is regarded as a milestone in an industry evolution when different technological trajectories converge and innovation is stabilized, enabling mass production, standardization, and economies of scale (Murmann and Frenken 2006; Suárez 2004; Tushman and Murmann 1998).

Suárez (2004) proposed a process through which dominant designs emerge. Figure 4.1 shows an adaptation of his model. Note that in this model the R&D phase is omitted as I am more interested in situations in which the innovations are introduced into a population rather than being developed—a condition that may not apply to non-product innovations. Five phases are included in the emergent process of dominant designs:

Phase I—Technical Feasibility: In this early phase, a working prototype of the innovation is introduced (Suárez 2004). This early design provides a demonstration of the innovation’s technical feasibility, thus attracting the attention of investors. For both product and non-product innovations, the possibility of the innovation is illustrated.
during this phase, but not yet the economic value. For example, in 1991, Motorola introduced the world’s first working prototype digital cellular system and phones using GSM standard in Hanover, Germany, but it was not until 1994 that they introduced the first commercial product of a handheld digital cellular system.

**Phase II—Market Creation:** As the technology gets better, the first commercial product would be introduced, and a new market is created. A few first-movers gain early advantages, and new entrants have to introduce different designs or maneuver strategically to differentiate themselves. During this phase, the number of alternative designs starts to increase. For example, Thomas Edison introduced the direct-current (DC) system in New York City in the 1880s (Hughes 1993). The Pearl Street station, finished in 1882 was the world’s first power station that provided electrical lighting to nearby restaurants and shops in the financial district in New York City. Although it suffered from multiple technical issues such as current leaking, inefficient generator connections, or faulty wiring, the station was a testament of a working central power system, signaling the feasibility of the technology as a commercial product. Subsequently, it inspired the building of power stations in London and Berlin in later years (Hughes 1993). A market was created for electrical power systems; and later, the alternate-current (AC) systems were introduced, providing alternatives to the DC systems.

**Phase III—Decisive Battle:** As the market is stabilized, more and more organizations enter into the market, introducing their own designs in order to capture market share. These different technology designs—alternative designs—supported by different firms and alliances, are engaged in direct competition for customer bases. They are different
designs of the same product innovation, representing different technological trajectories (e.g., VHS versus Beta format for video recording, iPod versus Microsoft Zune for portable media player, Google versus Bing search engines). During this phase, non-technological factors such as complementary assets, firm credibility, or network effects play an important role in the strength of a design (Suárez 2004). For example, the ecosystem that Apple created for the iPhone plays an important role in securing Apple’s dominant position in the smart phone industry. Users are attracted by the contents provided in the Apple Store and are more inclined to buy an iPhone.

*Phase IV—Vendor Shakeout:* This phase is not originally mentioned by Suárez (2004) but can be in fact a critical event for the widespread adoption process. The dominance battle can be decided when one of the two following events occur: a) the most closely competing alternative design acknowledges defeat and abandons the battle, and/or b) a design achieves a clear market share based on market trends. Examples include Sony’s acknowledgement of defeat in the battle between the VHS and Beta formats for video recording or the significant market share of PC over Mac computers. In both events, there will be a vendor shakeout in which the number of vendors, together with their designs, plummets. As the user base of the leading design increases, other vendors exit the market, or merge together to fight for survival. Eventually, when the leading design achieves a critical mass of users, it will be widely considered the dominant design, the industry standard, and drives out other alternative designs. New market entrants would only compete on incremental improvements and competence-enhancing features rather than introducing a new design (Anderson and Tushman 1990).
The vendor shakeout represents an important milestone in an industry as users see it as a sign of convergence in the industry. The winning vendors would be regarded as successful and capable of providing ongoing technical support for users. For product innovations, this is an important issue because if given a choice, no user would want to invest in a design that would potentially go out of business. If the system broke, or needed a replacement, it would be costly for users who invested in a design that is obsolete. Many users, therefore, prefer to wait rather than betting on the wrong horse (Borés et al. 2003). For example, the existence of incompatible receivers and proprietary Applications Programming Interface (API) in the German market caused inconvenience to consumers and potentially limited the acceptance rate. Thus, it can be inferred that before the vendor shakeout occurs, the number of adoptions would be quite low. As the number of designs decreases, public confidence would also increase, and the number of adoptions would increase accordingly (see Figure 4.1).

Phase V—Post-dominance: The winning design, one that amasses the necessary user base, would be hailed as the dominant design, the king of the hill until the next wave of technological innovation comes along. In the post-dominant phase, the emergence of a dominant design would encourage economies of scale and a period of stability (Murmann and Frenken 2006). More and more users would adopt the dominant design, and widespread adoption would occur. The network effects would be strongest in this phase as potential adopters perceive the increasing number of adoptions as a sign of the maturity, stability, and legitimacy of the innovation. During this phase, the dominant design remains mostly stable, and competition focuses on incremental changes, product
capabilities, and process innovations (Suárez 2004). This phase can last for a long time until a new wave of technological advancement starts a new dominance cycle.

Summary

Overall, the dominance cycle witnesses an increasing trend of alternative designs once the innovation is proven technically and economically feasible (phase I and II). The new market invites more investors, entering the market with their designs to compete for market share (phase III). These designs compete directly for the user base, and once a design takes a dominant position, a vendor shakeout occurs in which the number of vendors and alternative designs plummet (phase IV). After the shakeout, the dominant design is regarded as the industry standard, and encourages a period of stability and widespread adoption of the dominant design (phase V).

The dominant design perspective suggests two premises:

- Premise #1: There is a battle and a shakeout in the vendor community, which will give rise to a dominant design of a product innovation.
- Premise #2: The dominant design signals to prospective adopters a period of stability and growth in which continuous vendor support is ensured, economies of scale are possible, and exploitation is encouraged. As a result, the emergence of the dominant design subsequently leads to widespread adoption of the dominant design.

As a result, the adoption curve would remain mostly flat in the early phases and during the battle of designs (phase III). As the battle unfolds, a dominant design emerges, a vendor shakeout occurs, adoption rates pick up, and widespread adoption commences.
once the industry is left with a handful of vendors that are competing on incremental changes of the dominant design (figure 4.1). In the next sections, I describe the characteristics of a type of non-product innovation—IT management innovations—and assess how the two premises apply.

Implications from IT Management Innovations

Empirical studies have mostly found evidence of dominant designs for product innovations: typewriters, automobiles, TV tubes, microprocessors (c.f., Murmann and Frenken 2006; Utterback and Suárez 1993). How would the theory hold for non-product innovations? In this section, I look at one type of non-product innovation, IT management innovations, and assess how the dominant design perspective may (or may not) apply.

IT management innovations are a subset of management innovations. Birkinshaw et al. (2008) defined management innovation as innovative management practice, process, structure, or technique that is new to the state of the art and is intended to further organizational goals. Following their logic, IT management innovations can be considered as innovative management practice, process, structure, or technique about IT activities. In other words, they are new ideas about how to organize and govern IT activities. Compared to product innovations, IT management innovations have distinct characteristics that make their adoption unique. They are tacit in nature, have high interpretive flexibility, and require external support to overcome knowledge barriers during adoption.
First, IT management innovations are tacit in nature (Birkinshaw et al. 2008). In other words, they contain mostly conceptual components such as business models, management principles, or organizing ideas. Their adoptions do not require intensive capital investment, and their changes are less impacted by physical boundaries (e.g., hardware requirements, system specifications). For example, IT outsourcing models do not require any physical or material artifacts to implement. Rather, they provide a different model to organize and provide IT functions using external IT vendors. Organizations who adopt IT outsourcing would be more concerned with the vendor selection process, what would be outsourced, and how the vendor relationship would be governed. Although the implementation of IT outsourcing does impact the structure of IT artifacts (e.g., data centers, servers), they are not the essential elements of IT outsourcing models.

**Implication:** Due to the lack of physical and material components, adopters of IT management innovations are less dependent on IT vendors for ongoing technical support. This is different from product innovations as their adopters need to rely on their IT vendors for continuous technical support. Each time when there is a vendor shakeout, merger and acquisition, or formation of a strategic alliance, user organizations follow their vendor restructuring closely for potential changes in product quality, discontinuation of services, or unfavorable conditions (Elliott 1987). That is one of the reasons why widespread adoption does not generally catch on before there has been a vendor shakeout due to the fear of betting on the wrong horse (Borés et al. 2003). Given a choice, no user organization would want to invest in a design that would be discontinued or obsoleted in the future for
obvious reasons: costly adjustments, loss in investments, or a sense of betting on the losing team. On the other hand, IT management innovations would be more independent from IT vendors and therefore their adoption rate would potentially be less impacted by vendor shakeout.

Second, IT management innovations have high interpretive flexibility (Orlikowski 1992), or the involvement of adopters to constitute the realizations of the innovation. Because IT management innovations contain mainly conceptual components, they allow more subjective interpretations from prospective adopters (Birkinshaw et al. 2008), giving them the flexibility to interpret and comprehend the innovation in ways that most fit their needs. As a result, many find it easier to adapt, modify, and reinvent IT management innovations to fit their needs. For example, it is well-known that there are many different ways to implement IT outsourcing in organizations: deploying core competency strategies, using a centralized program management office, involving customer inputs, using fixed-price contracts, or adopting hybrid strategies to leverage in-house expertise (Lacity et al. 2012; Rottman and Lacity 2004).

**Implication:** The higher flexibility to adapt and modify IT management innovations will typically lead to greater variations in their adoptions. Coupled with the limited restrictions from physical boundaries, adopters can exercise their subjective interpretations to a far greater degree than for product innovations. It means there could be a possibility that we could expect widespread adoption of different implementation designs among adopters, not just a widespread adoption of a dominant design as in the case of product innovations. For example, the widespread adoption of the Total Quality Management (TQM) program is often
characterized by three popular approaches: Deming’s approach that emphasizes statistical tools and process heuristics, Crosby’s approach that focuses on training, and Juran’s approach that utilizes quality audits (Westphal et al. 1997).

Lastly, unlike product innovations which sometimes are developed using in-house expertise (e.g., R&D department), most organizations do not have a well-established and specialized expertise in the area of management innovation, which increases the uncertainty of the innovation and results in an increased need for external support (Birkinshaw et al. 2008). In addition, due to the lack of physical and material components, adopters are often left with abstract and theoretical principles to infer their own actionable items. Consequently, this leaves a huge knowledge burden on the adopters to figure out and accumulate the necessary know-how to carry out the adoption, something Attewell (1992) terms knowledge barriers. As a result, prospective adopters seek necessary knowledge from external sources, such as consulting firms, conferences, associations, or academic research (Birkinshaw et al. 2008). Many innovations rely intensively on management consultants, and give the impression of a management fad rather than a substantial change program (Currie 1999).

**Implication:** The thirst for know-how and practical guidelines in IT management innovation adoption could encourage the proliferation of vendors and promoters for IT management innovations, and together with this, alternative designs. If users of product innovations perceive such proliferation negatively (Borés et al. 2003), adopters of IT management innovations could take advantage of the abundant sources of knowledge to understand and mold a version of the innovation that fits well to their needs. For example, a recent survey from Gartner
found that up to 37% of Enterprise Architecture adoption used a homemade or hybrid framework in which the adopter combined best-of-breed elements from several branded frameworks to make their own (Gall 2012).

Summary

Compared to product innovations, IT management innovation adoption has different characteristics with unique implications. First, because of the lack of physical and material components, adoptions of IT management innovations are less dependent on vendors for continuous technical support. That makes vendor shakeout less impactful to the adoption rate. Second, IT management innovations afford a higher interpretive flexibility for their adopters, leading to a greater variation in their adoption. Subsequently, widespread adoption of IT management innovations could occur with more variation than for product innovations. Lastly, IT management innovation adoptions depend a great deal on external sources for know-how and practical guidelines. As a result, their adopters may welcome the proliferation of alternative designs as an abundant source of knowledge to learn how to adapt and modify the innovation to their needs. (See Table 4.1 for detailed comparison.)

In sum, those unique characteristics hint that the two premises from the dominant design theory may not apply well for IT management innovations.

- First, a vendor shakeout is not as impactful as for product innovations, and organizations can actually take advantage of the proliferation of alternative designs. Thus, widespread adoption for IT management innovations could happen without a vendor shakeout.
• Second, because of the discrepancy in implementation, widespread adoption could also happen with alternative designs without a clear winning design.

Therefore, in this paper, I argue that for non-product innovations, widespread adoption could occur through alternative designs, and that the _necessity_ of a dominant design is not the only way to encourage widespread adoption. While alternative designs may not be able to provide the stability and assurance that dominant designs do, alternative designs present choices and interpretive flexibility that help potential users navigate through adoption barriers. By having multiple alternative designs, a firm would have more flexibility to realize a design that better fits their needs (Benders and van Veen 2001)—perhaps one with less restrictive requirements—while minimizing the institutional pressure often associated with dominant designs. In the next section, I investigate the possibility of widespread adoption through alternative designs in the case of Enterprise Architecture adoption in the U.S. State governments.

**Method**

To understand how IT management innovations achieve widespread adoption, either through dominant design or alternative designs, I examine the widespread adoption of Enterprise Architecture in 50 U.S. State governments. Since 2000, U.S. State governments have increasingly embraced EA, in part due to the spill-over effect of mandatory regulations at the federal level and in part due to the encouragement of collective organizations such as the National Association of State Chief Information Officers (NASCIO). Because State governments do not face the legislature pressure that federal agencies do, but have the need to compete for resources (e.g., federal aid) and to
improve efficiency and effectiveness just like private corporations, the findings here also promise to be applicable to the private sector.

The purpose of the analysis is to examine the two premises of dominant design theory in the case of Enterprise Architecture. Specifically, I investigate:

1. Whether EA widespread adoption is occurring in the U.S. State governments
2. If widespread adoption exists, whether vendor shakeout is occurring among EA vendors
3. If widespread adoption exists, whether an EA dominant design exists among adopters

Data Collection

Eight most popular branded EA frameworks from EA vendors in the U.S. public sector as well as the private sector were collected. Then, the data on EA adoption for all 50 U.S. State governments was collected. The data collection took part mostly in 2013-2014.

Popular Branded EA frameworks

Numerous EA frameworks exist both in the public and private sector (see Table 4.2). For the U.S. public sector, eight frameworks are commonly found and mentioned by State websites, EA literature, and general reports (Gall 2012; Schekkerman 2004; Sessions 2007). They are:

1. The Zachman framework (Zachman): developed by John A. Zachman since 1987, it is often considered establishing the EA ontology for the field.
2. The Department of Defence (DoD) framework: developed by the U.S. Department of Defense in 1996, it was one of the first EA frameworks in the public sector.

3. The Open Group framework (Open Group): their framework inherits the work done by the U.S. Department of Defense to become one of the first EA frameworks in the private sector. The Open Group framework was started in 1994 and went through a major update in 2003.

4. The Spewak and Hill’s framework (Spewak): the Enterprise Architecture Planning (EAP) framework developed by Spewak and Hill (1993) was one of the first EA frameworks developed in the academic sphere.

5. The Federal EA framework (Federal EA): the official framework developed in 1999 by the U.S. CIO Council to encourage EA development in the federal agencies.

6. The NASCIO EA framework (Association EA): the set of frameworks and guidelines developed by the National Association of State CIOs (NASCIO) in 2000 for the U.S. State governments.

7. The MIT framework: developed by MIT’s Center for Information Systems Research in 2006. The framework and approach have been widely used by both the academics and practitioners.

8. The Gartner framework: developed by the consulting firm Gartner and has been quite popular after Gartner’s buyout of its competitor—the META Group in 2005.
Publications for each framework were collected from their website, from their archived websites in the Internet archival database (http://archive.org), and from the literature. Overall, more than 100 documents were collected with a total of more than 7,000 pages. Those documents provide a good understanding of the evolution of these frameworks.

State EA Adoptions

For State EA adoptions, a multiple-embedded case study approach was used (Yin 2009). For each State government, I used a mixed-method to collect the data. A team of three other researchers assisted in the data collection process as part of a bigger research project on IT management in U.S. State governments. The researchers used a theory-driven template to collect all possible evidence about EA adoption in a given State. Then, I revisited each State again and compared my data collection with theirs to address any discrepancy in the data. My data collection comes from three sources:

- Archival data: I collected EA related documents from publicly accessible sources such as State CIO websites, office of Chief Enterprise Architecture websites, State IT news announcements, and public reports. The collected documents include State EA White Papers and models, EA policies and standards, and EA-related announcements. In order to collect as many relevant documents as possible, I also used an Internet archival database which has archived snapshots or caches of numerous websites since 1996. By going back and forth between the archived web pages and the current web pages, I was able to retrieve multiple versions of EA-related documents and publications, thus gaining a considerable understanding of EA development efforts in State governments. For this study, I have collected data on Enterprise Architecture adoption of all 50 U.S. State
governments. Over 600 documents were collected with a total of more than 20,000 pages.

- Public reports: I collected reports on EA adoption pertaining to State governments such as NASCIO reports and GAO reports. I also searched for academic papers and dissertation manuscripts that are concerned with EA adoptions in U.S. State governments (e.g., Miller (2003)).

- Complementary interviews: In some States, I was able to conduct complementary interviews as part of a bigger research project focused on States’ EA adoption. The interviews were conducted in 4 States. These interviews were useful to inform the data collection process for any adjustment and correction.

Data Analysis

The first step of the analysis was to screen the collected data. For each State, I assessed the maturity of their EA program using six levels of maturity. These maturity levels are similar to ones found in popular EA frameworks (e.g., NASCIO) and academic research (e.g., Salmans (2010), Hirschheim et al. (2010)).

- Level 0: no EA program is established
- Level 1: initial EA program is mentioned in the State’s IT strategic plan. The State governments have the intention to develop EA frameworks but no formal program established yet
- Level 2: informal EA program is established with some collaborative work between agencies (e.g., steering committee), but there is no formal publication of an EA framework
- Level 3: a formal EA program is established, and draft of first version of EA framework is published
- Level 4: the EA program grows with several versions of EA framework published
- Level 5: the EA program is matured with well-established processes and practices

States with at least level 3 EA programs are classified as “have adopted EA” while States with levels 1 and 2 are classified as “have initiated EA.” The data is used and compared against Rogers’ framework of the distribution of innovation to assess whether EA widespread adoption has occurred in the U.S. State government population.

In the next phase of the analysis, the collected popular EA frameworks and State EA frameworks were analyzed to assess whether these frameworks represent one design or multiple designs of EA. The frameworks were coded and compared using the seven essential elements presented in Appendix D. Those seven essential elements are derived from EA literature, practitioners’ writings, and from analyzing popular branded EA frameworks (see table 4.3). They capture the ideologies and mechanisms of an EA framework, thus would be useful to determine whether one framework is substantially different from others. For each framework, seven data points, or variables, were captured. Each variable is a binary variable that assess whether a State’s EA program processes a particular essential element. Two analyses were then conducted:

- First, the popular branded EA frameworks were compared and grouped into similar clusters using the seven essential elements. This step allowed me to
distinguish possible ideal EA designs, that is, alternative designs that are promoted by EA vendors.

- In the second analysis, the State EA frameworks were compared and grouped into similar clusters using the seven essential elements. Out of 50 U.S. State governments, 23 States were selected and analyzed in this step (State EA programs with at least the maturity level 3). Their designs were also compared to the ideal EA designs that were identified from popular branded EA frameworks to: 1) identify whether they are identical to the ideal-type EA design, and 2) if there are differences, how much different they are from the ideal designs.9

In the next section, I present the findings from my analysis.

Findings

In this section, I first report the evidence of EA widespread adoption in the U.S. State governments. Then, I examine whether there are signs of convergence in the EA designs promoted by the EA vendors and in the EA designs implemented by the State governments. As suggested by the dominant design perspective, if there is a widespread adoption, one would expect to find two things:

1. A convergence of designs promoted by the vendor community as a result of the vendor shakeout.

---

9 To test the robust of the analysis, a cluster analysis was conducted on the seven EA essential elements. The results mostly remain the same, with only one State moves from one design to another.
2. A convergence of designs implemented in the organizational population due to the emergence of a dominant design.

Evidence of EA Widespread Adoption in the U.S. State Governments

Among 50 U.S. State governments, 23 States have already adopted and implemented EA. These States have each established a formal EA organization which has published at least one formal version of their EA framework. The other 22 States are still in an initial phase in which EA is mentioned or planned in the State IT strategic planning, or there are some initial State-wide EA developments without a formal publication of an EA framework. Figure 4.2 provides the overview of States’ EA initiation and adoption over time.

In Figure 4.2, the distribution of States’ EA initiation and adoption is also compared against Rogers’ framework of the distribution of innovation. According to Rogers, four types of adopters are found in a typical diffusion process: early adopters who account for 16% of the population, early majority adopters who account for 34% of the population, late majority adopters who account for 34% of the population, and the remaining 16% of the population are laggards (Rogers 2003). In the State government population, 8 States adopted EA by 2002 (16%); many of them did so before 2000 just when EA was first being promoted in the public sector around 1996. Thus, those States who adopted EA prior to 2003 are classified as early adopters.

An early majority of State governments considered and adopted EA during the 2003-2006 period. Out of 50 States, 12 States adopted and 5 States initiated EA developments during that period, accounting for an additional 34% of the population. A wave of late majority of States joined in during the 2006-2010 period when two States adopted EA.
while 10 States initiated their development. From 2010 until 2012, 8 more States initiated and adopted EA, bringing the total to ninety percent of the population.

The evidence here presents a strong case for widespread adoption of EA in the U.S. State governments. A majority of the States did so by 2006, with 50% of State governments having initiated or adopted EA by this date. The trend continues, even quite strongly after the 2008 Mortgage crisis with 16 more States having initiated and adopted EA since 2009, a 32% increase. In the next section, I report on the ideal EA designs as promoted by the EA vendors.

Ideal EA Designs Promoted by EA Vendors

Today, numerous EA frameworks are offered by multiple vendors and promoters, both in the private and the public sector (Schekkerman 2004). A premise of the dominant design perspective suggests that a shakeout in the vendor community precedes widespread adoption. During the shakeout, multiple designs converge to give rise to a dominant design (Anderson and Tushman 1990; Murmann and Frenken 2006; Tushman and Murmann 1998). Following this logic, given the widespread adoption of EA, it could be inferred that the many EA frameworks promoted by different vendors are only slight variations of the same design, that is, they are different in degree rather than in type.

In this section I compare the different branded frameworks often found in the U.S. public sector to see how different they are from each other. Eight different branded EA frameworks are commonly found not only in the public but also the private sector (Schekkerman 2004; Sessions 2007). (See the method section for a full list.) These eight frameworks are compared based on seven essential elements of EA (Appendix D). Table
4.4 provides the detailed comparison of the eight frameworks. (Note that the Open group framework is presented twice since they adjusted their framework in 2003).

Overall, the eight frameworks are different enough from each other to be classified into three ideal design types. Other studies have simultaneously found distinct EA types from branded frameworks based on their ideologies (Lapalme 2011), their management objectives and styles (Ahlemann et al. 2012), or their citation connections (Simon et al. 2013). The profile for the three ideal design types can be found in Table 4.5.

1. **Technical EA design:** frameworks that follow this design include the Zachman framework, DoD, Open Group prior to 2003, and the Spewak framework. Under this design, the focus is establishing the technical layers of the enterprise, specifically the Technology or Technical Architecture. Enterprise Architecture is seen as a job of the IS/IT organization, to identify the necessary IT components of the enterprise in order to reduce complexities and increase standardization. For example, the Zachman framework includes a matrix that suggests the specification documents for IT artifacts in an organizations from multiple perspectives (e.g., business, engineer, technical).

The technical EA design started in the early phase of the EA field and became dominant mostly during the 1990s. Many frameworks in this design type emphasize the establishment of a methodology and structure to allow organizations to transform from an As-Is to a To-Be stage. For example, the early Open Group framework consists of an Architecture Development Method that includes several transformative steps: creating a baseline, constructing gap
analysis, finding opportunities and solutions, planning the migration, implementing, and maintaining the architecture.

2. **Operational EA design**: frameworks that promote this design include the current Open Group framework, the Federal EA, and the Association EA framework. Those frameworks focus on an enterprise-wide and holistic approach toward EA development, stressing the development of not only technical but also business EA layers. Typically, those frameworks would start by defining the Business Architecture—the documentation of key business processes—which in turn determines the details of subsequent EA layers such as Application, Information, and Technical Architecture. In this design, the focus has been shifted from technical issues (e.g., complexity, redundancies) into establishing an IT foundation for smooth and effective operations.

In addition, operational EA frameworks emphasize not only IT artifacts and models, but also IT planning, implementation, and controlling from an enterprise perspective. Those frameworks emerged during the 2000s when EA professionals felt that the pure technical modeling approach of Technical EA design was not enough to bring about EA’s expected outcomes (Ahlemann et al. 2012). As IT investment increases, and the impact of IT is felt throughout the enterprise, there is an increasing need to involve non-IT stakeholders in the IT decision making process. As a result, governance mechanisms, accountability, and enforcement processes become important to manage EA developments.
3. **Strategic EA design**: frameworks that fit into this design include the MIT and Gartner framework. The rise of strategic EA design commences at the end of the 2000s until now. Those frameworks view EA as one of the many management and strategic planning tools that allow organizations to take advantage of their IT investments. The focus has now been shifted from establishing a good IT foundation to using and exploiting the IT capabilities of the built IT foundation. Thus, frameworks in this design are *not* particularly interested in establishing EA layers, documenting and specifying requirements—although they are still a part of EA professionals’ job—but more in the applications of EA values and principles to guide and drive the organizational transformation. For example, MIT framework does not mention what EA layers need to be developed, and Gartner stresses that what framework an organization chooses is not as important as using and adapting it to their needs (Robertson and Blanton 2008). The recent Strategic Enterprise Architecture Management literature stresses only the integration of EA into change management, project lifecycle, and strategic planning. No EA layer was discussed at all (Ahlemann et al. 2012).

As summarized by Table 4.5, despite the widespread adoption of EA in the public sector, there are still at least three ideal EA designs promoted by EA vendors, each different from the other in terms of their focus, features, and objectives. This goes against the premise from the dominant design, that widespread adoption is preceded by a shakeout in the vendor community. In fact, no EA vendor shakeout is evident, as new EA frameworks are still being introduced to the field, despite the widespread adoption of EA.
practices. (Recall that 50% of the States initiated and adapted EA in 2006 while the recent MIT and Gartner frameworks were introduced in 2005 and 2006 respectively). This suggests that despite widespread adoption of EA, a shakeout in the EA vendor community is still far from reality.

**EA Alternative Designs Implemented in the U.S. State Governments**

Another premise for the widespread adoption process of a product innovation is the emergence of a dominant design not only in the vendor community but also in organizations’ adoptions. It implies convergence in the adoption and implementation practices of organizations within the population due to the emergence of a dominant design. In this section, I report on the EA designs implemented in the U.S. State governments to verify whether there is a dominant design of EA implemented among the U.S. State governments.

The 23 States that have adopted and published their EA frameworks online were chosen and analyzed. Their frameworks were first described based on the seven essential elements of EA\(^\text{10}\), and then compared against the ideal EA designs promoted by EA vendors. Overall, four distinct EA designs were found in the U.S. State governments: technical EA design, operational EA design, technical-operational EA design, and strategic EA design (see Table 4.6).

**Technical EA Design**

There were eight instances of technical EA design implemented in the U.S State governments, although many of them are slight variations of the ideal technical EA

---

\(^{10}\) See Appendix D and chapter 2 for details of these seven essential elements
design promoted by the EA vendors. States with a technical EA design focus on creating IT models and documenting technical layers: Technical Architecture or various technical reference models. These technical models describe the legacy, current and upcoming standards, as well as provide best-practices and current IT trends in the States. For these States, EA is the drive to reduce IT costs as state-wide IT standards and procedures are perceived to minimize redundancies and increase interoperability.

Despite the agreement among EA vendors regarding the ideal technical EA design, States vary in their implementations. Most States established a governance mechanism to oversee the EA program and account for responsibilities of different stakeholders. Enforcement mechanisms are also common to ensure some level of compliance in State agencies. However, a few States do not have a clearly defined methodology, nor have they established a formal explicit process to set up EA standards. The vignette of the EA implementation in South Carolina illustrates how a State adapts their EA implementation as a variation from the ideal technical EA design.

**A Variation of Technical EA Design in South Carolina**

In 2006, the South Carolina State Budget and Control Board was charged with a responsibility to improve IT procurements. The responsibility was delegated to the State CIO, who subsequently established a State Enterprise Architecture (SCEA). It is defined as “…a body of guidelines and standards developed as the result of a statewide effort to ensure the state’s citizens receive the greatest possible value from investments in information technology” (State Strategic IT Plan 2009).
SCEA specifies major technology components utilized by most agencies on eight specific domains. Figure below illustrates an overview of SCEA.

The SCEA is overseen by a collective committee made up from seventeen IT representatives of different agencies. A Technical Compliance Assessment process was created to ensure the compliance of IT proposals to existing standards. Projects that have more than 1,000 working hours or $50,000 in budget are required to go through the review. While the enforcement mechanisms are clear, the methodology and EA lifecycle is less explicit. Although a process is created to change or add new enterprise standards to SCEA, the State still lacks an overall process and an enterprise-wide methodology to develop and implement EA.

Operational EA Design

Only two States, Colorado and Michigan, implemented an ideal operational EA design as promoted by EA vendors. In these States, both technical and business EA layers are
specified, and EA models often include Business, Solution, Information, and Technology architecture. Not surprisingly, these States often establish a set of state-wide guiding principles for EA developments, derived from States’ business objectives. EA processes are well defined to invite agency involvements, and inputs from agencies are exclusively sought. The EA team are active in offering their assistance to agencies in order to encourage EA usage. The case vignette of the State of Michigan illustrates how operational EA design is implemented.

**Ideal Operational EA Design Implemented in Michigan**

The State of Michigan developed and published its EA documents in 2007, defining EA as a “process that leverages our extensive planning in a way that aligns our technical investments to public service needs” (Michigan Enterprise Architecture – Strategic Approach, 2007). Their EA consists of four areas: Public Service Architecture which defines the necessary public services for citizens (equivalent to Business Architecture in other frameworks), Information Architecture, Solution Architecture, and Technical Architecture (see picture).
Michigan developed a thorough process to develop EA standards and models (see picture below). The core EA team consists of technical leaders and specialists from various functions and departments: Contracts and Procurement, Enterprise Security, Office Automation Services, Telecommunications, Data Center Services and each software development group serving the state agencies. Throughout the project lifecycle, the EA team also offers assistance and support to the agencies. A set of EA services is listed in the service catalog, covering the following:

- Alternatives Analysis Workshop
- Solution Assessment Workshop
- Solution Assessment Review
- Solution Remediation Service
- Portfolio Risk Analysis Workshop
- Issue Resolution Workshop
- Standards Exception Review Process
- Technology Life Cycle Roadmap Governance Service

Technical-Operational EA Design

Ten States implemented a hybrid design between the technical EA and operational EA design. This design focuses primarily on establishing IT models and standards (e.g.,
defining technical EA layers)—a key element of technical EA—but the design also emphasizes establishing governance mechanisms, enforcement processes, standard setting processes, and methodology—the essence of the ideal operational EA design. All ten States have a clearly defined methodology, a process to set up standards with inputs from agencies, a defined governance with clear authority, and enforcement mechanisms to check for EA compliance. The standards development often involves inputs from other agencies, even non-IT personnel. Unlike States with operational EA design, these ten States only define technical EA layers, emphasizing the focus on IT issues. The case of the North Dakota State illustrates how a technical-operational EA design is implemented.

**Technical-Operational EA Design in North Dakota**

In 2002, North Dakota started its EA development to develop a model that connects business objectives to IT strategy, and to create a communication structure that supports a common vision. EA is regarded as “a collaborative, consensus building alliance among agencies for aligning technology with business goals and for designing, implementing, and maintaining the underlying infrastructure to support information sharing and resource optimization.” As such, strong agency

---

11 [http://www.nd.gov/itd/services/enterprise-architecture](http://www.nd.gov/itd/services/enterprise-architecture)
participation and collaboration are key drivers for North Dakota’s EA. The EA development involves multiple entities and agency representatives (see picture).

The EA team consists of both Technical and Business teams that develop specifications for IT standards and guidelines. An Architecture Review Board (ARB) which consists of both IT and non-IT personnel (e.g., legislature and judiciary branch) oversee the EA development. The EA team reviews IT projects to ensure compliance to established standards.

Architecture Review Board membership consists of representatives from a minimum of ten (10) and not more than twelve (12) executive branch agencies at-large, one (1) member representing legislative council staff and one (1) member representing the judiciary branch, and one (1) member representing Information Technology Department (ITD) operations. At-large members should be selected based on commitment, agency size, agency function / category (i.e. public safety, regulatory, administrative, etc.), elected and appointed officials, and technologies deployed to ensure a diversity of interests are represented.

Strategic EA Design

Three States implemented a strategic EA design promoted by EA vendors, namely California, Minnesota, and Virginia. These States share similarities with the operational EA design, having a well-defined methodology, clear governance mechanisms, solid standard set up processes, as well as enforcement processes. However, in these three States, EA is used in the high-level IT strategic planning process that can drive the IT directions of the State. These States clearly focus on developing IT capabilities and
deriving benefits from an enterprise-wide architecture rather than simply setting up the IT standards and procedures. Although there is not yet enough evidence to support the benefits of a strategic EA design in these States, their implementations represent attempts by States to take a strategic- and value-oriented approach to EA development. For example, in the State of California, EA strategies and tactics are included in the development of this State’s IT strategic plan to ensure consistencies.

**Strategic EA Design in California**

In the State of California, EA development started in 2005. While the goal is to support business needs, California focuses on improving agencies’ capabilities, transforming government services, and cross-agency initiatives. The State strongly emphasizes shared services through Cross-Agency Initiatives (CAIs). EA services are offered to state agencies to ensure consistent implementation (e.g., assist with portfolio rationalization, standard establishment). Besides Technology Architecture, Business Architecture is also established to define key business processes and capabilities. The program is assessed using maturity model, and development phases are clearly defined.

*Enterprise Architecture (EA) identifies the business processes that execute or support an organization’s mission and defines how Information Technology (IT) assets directly enable those processes. The purpose of EA is to optimize and transform the often fragmented*
processes, information, application systems and technologies into an efficient and integrated environment supportive of the execution of business strategy.

The EA team reports to the State CIO, but cross-agency initiatives are reported to steering committees with involvement of agency representatives. Architects are involved in the project planning, assisting the formation of both business strategy and IT strategy. The State uses the Collaborative Planning Methodology which is designed to support integrated planning, implementation and measurement activities. During the process, the inputs from Enterprise Architects are sought, especially in the Define and Plan phase.

Summary

The four EA designs implemented in the U.S. State governments represent both variations and exact implementations of ideal designs promoted by EA vendors. Four
vignettes are used to illustrate their implementation. The implementation of the four designs indicate that there is no clear sign of a dominant design across U.S. State governments, despite the widespread adoption of EA. The evidence suggests that for an IT management innovation like Enterprise Architecture, widespread adoption occurs with the presence of alternative designs rather than a dominant design as in the case of product innovations.

Discussion

One popular explanation for the widespread adoption process of an innovation is the dominant design perspective (Anderson and Tushman 1990), influencing many studies since the 1990’s (Cusumano et al. 1992; McKenney et al. 1997; Murmann and Frenken 2006; Suárez and Utterback 1995). Throughout the innovation lifecycle, a dominant design, defined as a single architecture that establishes dominance in a product class and gets widely accepted as the industry standard (Tegarden et al. 1999; Tushman and Murmann 1998), emerges and subsequently leads to the widespread adoption of the innovation, that is, the dominant design of the innovation (Murmann and Frenken 2006; Suárez 2004). Two specific premises can be inferred from the dominance cycle: First, a battle between alternative designs will unfold, and a vendor shakeout occurs that gives rise to a dominant design at the end. Second, the winning design is perceived by users as a sign of stability and growth in the industry, and this encourages widespread adoption of the dominant design.

Empirical studies have found dominant designs for several product innovations (c.f., Murmann and Frenken 2006; Utterback and Suárez 1993), but how would the theory hold
for non-product innovations? In this paper, I particularly look at the adoption of IT management innovations, one type of non-product innovation. They are defined as innovative management practices, processes, structures, or techniques about IT activities (Birkinshaw et al. 2008). In other words, they are innovative ideas about how to organize and govern IT activities. Compared to product innovations, they have unique characteristics that imply different adoption patterns: IT management innovations contain mostly conceptual components (e.g., models, principles, ideas), have higher interpretive flexibility, and need a great deal of help from external sources to overcome knowledge barriers during adoption. Therefore, the two premises from the dominant design perspective may not apply well: First, IT management innovations require less technical support from IT vendors, and therefore, a widespread adoption of IT management innovations could happen without a vendor shakeout. Second, because of higher interpretive flexibility, IT management innovations afford their adopters more adaptation and modification opportunities. Thus, their widespread adoption could also happen with alternative designs rather than a dominant design.

The case of Enterprise Architecture adoption in the U.S. State governments illustrated well how widespread adoption of IT management innovations could occur without both vendor shakeout and convergence of innovation designs. (Table 4.7 provides a summary of the findings.) Out of 50 U.S. States, 23 have adopted EA, and 22 have initiated EA. The evidence supports a strong case of a widespread adoption of EA in the U.S. States population. Yet, despite the widespread adoption of EA, I observed three distinct ideal EA designs being promoted by EA vendors in the public as well as the private sectors. What’s more, new EA frameworks with different designs are still being introduced into
the community (e.g., CISR in 2006), and current EA frameworks are continuously refreshed. The vendor shakeout is still far from reality in the EA vendor community. Furthermore, the actual EA designs implemented in the U.S. State government population are both variations and the exact ideal EA designs as promoted by the EA vendors. This illustrates that there is no sign of a dominant design found in EA widespread adoption, either in the vendor community or in the actual user organization community.

The findings suggest two theoretical lessons about innovation designs in adoption decisions and divergence mechanisms in diffusion processes, discussed in detail below.

Innovation Designs in Adoption Decisions

For IT management innovations, widespread adoption can occur with alternative designs instead of a dominant design. For students of innovation diffusion, this directs attention from simple dichotomous adoption decisions and towards the question of what is being adopted in adoption decisions. In other words, an organization may indeed adopt an innovation, but the design and type of the adopted innovation can be different from others. Fichman (2004) suggested innovation studies focus on quality of the innovation, defined as the extent an organization has adopted the “right” innovation at the “right” time and in the “right” way. The concept, he argued, could provide insights on the organizational benefits received from the innovation. The process and concept of alternative designs proposed in this paper can provide a linkage to the quality of the innovation. It suggests that different organizational profiles would prefer certain designs of the innovation, and therefore would expect a certain kind of outcome (see Chapter 2).
For instance, in the case of EA adoptions, it can be expected that States who adopted business EA layers (i.e., operational and strategic EA designs) are typically more centralized than States that only adopted technical EA layers (i.e., technical and technical-operational EA designs). The reason is that EA is often considered an enterprise initiative that would encourage the centralization of IT management: IT standards are mapped and standardized, decision making processes are documents and unified, and business processes are scrutinized. Especially when business EA layers are implemented, managers of business units would feel their control is limited and decisions are now imposed on them (e.g., required to conduct business using regional services). As a result, States who have a more decentralized IT culture would either have a strong opposition from their agencies or do not feel a need to implement business EA layers. The State of Massachusetts, for example, has a federal IT culture in which the agencies retain a reasonable amount of autonomy. The State has implemented a mostly technical EA layer, and the topic of implementing a business EA layer has been mentioned for several years (at least five years), but no actual change has been realized yet.

In sum, the concept of alternative design suggests a possible research direction to look at how different organizational profiles prefer certain innovation designs. This allows innovation studies to move beyond the dominant paradigm of adoption studies—focusing only on the factors that impact the dichotomous adoption decisions (Fichman 2004)—and focus on the processes and factors that contribute to what exactly is being adopted, an area that has been largely ignored in the innovation literature.
Convergence and Divergence Mechanisms in the Diffusion Process

Theories in adoption and diffusion studies, for the most part, are concerned with mechanisms that lead to the convergence of the innovation: institutional pressures that leads to isomorphism (DiMaggio and Powell 1983), political regulations that result in policy convergence (Drezner 2001), or dominant designs that inspire widespread adoption of the dominant designs (Anderson and Tushman 1990; Tushman and Murmann 1998). However, just like all forces in life that have a counterpart, there are mechanisms that encourage divergence and celebrate proliferation: strategic contingencies that determine the “right” structural choice for a given situation (Child 1997; Miles et al. 1978), network effects that dictate how industry standards are diffused (Weitzel et al. 2006), or translation processes that inform organizations to implement innovations differently (Nielsen et al. 2013). And like the yin and yang forces of life, these mechanisms contribute to divergent and convergent behaviors in the innovation cycle: sometimes creating possibilities and discrepancies, at other times promoting harmony and unification across organizations (Van de Ven et al. 2008).

The story of alternative designs suggests the importance of attending to the divergence concepts: not just converging mechanisms, but also how having variations in innovation designs can contribute to widespread adoption. For conceptual innovations like IT management innovations, the different designs, while not providing stability like a dominant design does, can provide adopters a bigger pool of collective knowledge that allows them to overcome the knowledge barriers and adapt, modify, and reinvent a version that best fit their needs. That is, these different designs provide interpretive viability for adopters, leaving room for ambiguity to allow potential adopters to recognize
their own version of the innovation, and thus increasing the attractiveness of the innovation as well as increasing the size of potential markets (Benders and van Veen 2001). Ambiguity, in the right conditions, is actually a good thing for innovation diffusion. Future research is encouraged to investigate other diverging mechanisms that can provide adopters the right motivation to adopt an innovation.

To practitioners, the notion of alternative designs raises cautions about how innovation implementation is approached. It suggests that there are various possible designs of particular innovations, each with its own assumptions and subsequent outcomes. Therefore, organizations should be “mindful” in their adoption to understand the differences and choose the approach that best fits their circumstances. Even the presence of a popular design does not negate the potential of other designs. At the very least, practitioners should be mindful about different characteristics of the organizational situation in designing the innovation: either adhering to the ideal design or choosing and adapting other variations (Drazin 1997).

This study is not without limitations. It only focuses on one mid-sized population, the 50 U.S. State governments, and therefore generalization is limited. Nevertheless, the findings can potentially be applied to the private sector as widespread adoption of EA is more likely happening for several reasons: the public sector is commonly known to lag behind the private sector, and studies have shown various examples of EA adoption in the private sector (Bradley et al. 2011; Kettinger et al. 2010; Ross et al. 2006). Future studies are welcome to duplicate and expand the findings here.
Conclusion

In this paper, I argue that for IT management innovations, the presence of alternative designs could still encourage widespread adoption of an innovation. Adopters may welcome the proliferation that provides them with a rich pool of know-how to overcome the knowledge barriers, and therefore can adapt, modify, and reinvent the innovation in the way they want. This is in contrast to product innovations, which often enjoy the emergence of a dominant design that ensures adopters of ongoing vendors’ support and a period of stability and growth.

A simple anecdote can illustrate the point here. In the introduction, the reader was told the story of Barry Schwartz who was paralyzed because of the number of choices available when buying his jeans. A single type of jeans, as Barry put it, would make the decision much simpler and his life less complicated. Imagine now that Barry has to go to a barber shop to get a new haircut. This time, it is not a product, but a service that Barry is buying, and he has an idea about how the ideal haircut would look like. He could ask for the same haircut like everybody else, but that is less likely given his unique look from others (he wants to look good, doesn’t he?). The barber shows him a catalog of twelve different hair styles, and Barry can choose one, or combine several styles, or even make the adjustment as the barber gives him the haircut. In this situation, the catalog provides Barry a pool of knowledge from which he can choose, and the barber provides him a service that allow Barry to adjust the hair style during the process. Together, the various hair styles and the flexible process afford Barry the ability to get what he wants for a haircut, something that he cannot easily do with the jeans (i.e., no easy process to adjust
the jeans). Thus, Barry can leave the barber shop a happy man and look forward to coming back the next month.
Chapter 5: Enterprise Architecture Rhetorical Persuasion

The previous chapter suggests the possibility of alternative designs in EA widespread adoption. Many potential explanations exist, and one that stands out is the diversity in designs promoted by EA vendors. It suggests the important role of EA promoters, those who advocate EA and publish guidelines and instructions of how to implement EA. This chapter examines the dynamics of these EA promoters, investigating how their actions contribute to the diffusion of EA across organizations.
Rhetorical Persuasion throughout the Diffusion Process: Creating a Compelling Cognitive-Institutional Account for Widespread Adoption

Abstract

Recent innovation studies point out the importance of a cognitive-institutional account, or a collective adoption rationale, to guide innovation adoption across organizations. Yet, to be effective, a collective adoption rationale needs to be compelling and to evolve over time. As a result, the quest to create an effective account is a challenging and enduring task for many innovation promoters. Using the rhetoric issued by the National Association of State Chief Information Officers (NASCIO) in the last decade, this study unravels the struggles of NASCIO over time to create a compelling collective adoption rationale of Enterprise Architecture (EA) in the U.S. State governments. The findings show three periods of rhetorical changes in which NASCIO utilized different strategies and approaches to address their audience’s contingencies, aiming to increase the congruence of their rhetoric. Three elements of innovation rhetoric are found important: problem specification, innovation specification, and innovation justification. NASCIO’s struggles reveal important lessons for innovation promoters who seek to encourage innovation adoption in their domain.

Keyword: cognitive-institutional account, innovation rhetoric, problem specification, innovation specification, innovation justification, Enterprise Architecture
Introduction

Widespread adoption is a desirable end for most innovations. Yet, while many innovations are introduced, only a few can successfully reach that end of being widely adopted across organizations. For some time, innovation adoption studies have been examining the barriers and facilitators of that diffusion process (e.g., Rogers (2003), Markus (1983), Fichman (2000), Lyytinen and Damsgaard (2001), Newell et al. (2000)). Recently, many argue that for widespread adoption to occur within a community of organizations, it is crucial to have a cognitive-institutional account, that is, a collective adoption rationale, of the innovation; one that would inspire and guide adoption among organizations (Strang and Meyer 1993; Swanson and Ramiller 1997). For many innovation promoters, the implication is clear, that is, to create a cognitive-institutional account of the innovation to encourage adoption among prospective adopters (Currie 2004; Ramiller and Swanson 2003).

Regardless of the sheer efforts from innovation promoters, the quest to develop an effective cognitive-institutional account remains a challenging and enduring task. Two reasons are prominent. First, to be effective, the promoted cognitive-institutional account should appeal to the target audience. In other words, the account needs to be compelling enough to capture the attention of the audience and trigger adoption. For obvious reasons, this is not an easy task, and innovation promoters strive to do so using various strategies and tactics (Green et al. 2008; Pawlowski et al. 2006; Suddaby and Greenwood 2005).

---

12 Innovation promoters are those who seek to encourage the adoption of an innovation within a community of organizations. Examples are technology vendors, professional associations, or regulators.
Second, the process of creating a compelling account is a long process, often unfolding over months, or years. Because the audience’s preferences shift over time, the institutional environment changes, and the innovation itself evolves; it is inevitable that innovation promoters also need to adjust their strategies and tactics over time. Subsequently, innovation promoters may stumble, and fail to sustain a compelling-enough account for widespread adoption.

While prior studies have looked at the various strategies used by innovation promoters to generate the necessary cognitive-institutional accounts (Green et al. 2008; Suddaby and Greenwood 2005), relatively less attention has been paid to the innovation promoters’ struggles over time and their efforts to create a compelling account for widespread adoption. Thus, this paper aims to address that knowledge gap; and specifically, the question of interest is: how do innovation promoters create a compelling cognitive-institutional account over time? To answer this question, the paper examines the dynamics and struggles of the National Association of State Chief Information Officers (NASCIO) over a decade to promote the adoption of Enterprise Architecture (EA) among the 50 U.S. State governments. The findings show an evolution in rhetorical strategies used by NASCIO, and illustrate the importance of achieving rhetorical congruence, or a fit between the innovation rhetoric and the audience’s preferences.

The paper contributes to theory and practice in several ways. To theory, the paper presents a comprehensive framework to examine innovation rhetoric over time. Several problems for creating a compelling cognitive-institutional account are pointed out, and so are the dynamics of innovation rhetoric to address these problems. These problems and dynamics augment prior studies on the barriers and facilitators of the diffusion process.
To practice, the findings suggest the importance of presenting and justifying the innovation to the audiences, in contrast to previous suggestions that a popular and compelling problem is sufficient to attract audiences (Wang 2009).

**Toward Widespread Adoption: The Role of Cognitive-Institutional Accounts**

There are two main schools of thought on the reasons that organizations adopt innovations. The classic innovation studies perspective argues that economic reasons motivate firms to adopt or reject an innovation (Rogers 2003). Managers are assumed to be rational decision makers who use their internal and reflective calculations to determine the economic gains and losses of the innovation. On the other hand, institutional innovation theorists argue that firms are motivated by the social and symbolic benefits of an innovation (DiMaggio and Powell 1983). Within an organizational community, if an innovation is perceived to have legitimacy, organizations are more likely to adopt the innovation in order to ensure stability and survival (Meyer and Rowan 1977).

While these perspectives are often considered contradictory, several attempts have been made to reconcile them (Fligstein 1985; Tolbert and Zucker 1983). Recent innovation studies recognize that diffusion is a process to spread theoretical models or innovation concepts (Strang and Meyer 1993). What is being diffused are the innovative ideas, not the actual practices. As a result, many studies focus on the creation and diffusion of the innovation concepts at the collective level instead of innovation practices at the organizational level. For example, organizing vision theory (Swanson and Ramiller 1997) asserts that there is a collective social account of the innovation, represented as the
organizing vision, that articulates what the innovation is good for, and how it should be implemented. Technological action frame theory (Elliott and Kraemer 2008; Markus et al. 2008) contends that a technological action frame provides the core ideas about how an innovation works and how it should be envisioned. Similarly, institutional theory (Greenwood et al. 2002; Tolbert and Zucker 1996) suggests the necessity of a theorized model, which justifies the adoption rationale for prospective adopters.

These theories suggest two important observations. First, a cognitive-institutional account of the innovation is created and sustained at the collective level. This account is institutional because organizations construct it at the collective level through their discursive interactions (Elliott and Kraemer 2008; Markus et al. 2008). It is also a cognitive account because it provides a pool of knowledge that organizations can draw from to understand and learn about the innovation (Swanson and Ramiller 1997). Thus, it combines elements of both institutional diffusion studies, which argue for social influences, and classic diffusion studies, which argue for cognitive evaluations.

Second, a cognitive-institutional account at the collective level is crucial for the diffusion process. It provides the guidance and necessary information to prospective adopters in order to bypass the knowledge barriers of adopting an innovation (e.g., know-what, know-why, know-how types of knowledge) (Wang and Ramiller 2009). The account also provides examples and success stories that attract potential adopters; thus creating a momentum for adoption. A few examples have indicated that a troubled cognitive-institutional account can significantly hinder the diffusion process (Currie 2004; Huang and Zmud 2010).
The implication here is that for widespread adoption to occur, it is necessary to have a cognitive-institutional account created at the collective level. However, this is often a challenging and enduring task. To establish an effective cognitive-institutional account at the collective level, two problems are prominent: the persuasion problem and the evolution problem.

To be Effective: The Persuasion Problem

The mere existence of a cognitive-institutional account at the collective level does not guarantee widespread adoption (Strang and Meyer 1993). In other words, cognitive-institutional accounts are not sufficient for an innovation to diffuse; they need to be compelling to the relevant audiences. While current literature on cognitive-institutional accounts excels in explaining the roles and effects of collective accounts, and how those collective accounts are constructed through discourse, the literature falls short in examining how discourse makes a collective account compelling to relevant audiences.

Applying the rhetorical perspective to structural contingency theory, Sillince (2005) theorizes that adapting structures to environmental contingencies will be more likely to succeed if there is rhetorical congruence. Rhetorical congruence is a process in which an organization addresses the environmental contingencies through the use of language to initiate structure and strategy changes (Huang and Galliers 2010; Sillince 2005). In other words, managers must use rhetoric that effectively addresses the environmental contingencies. The rhetoric gives momentum to particular actions among managers, thus justifying their actions.
The seminal insight of the theory of rhetorical congruence is that rhetoric is created to fulfill different purposes. To make a rhetoric compelling to an audience, one of the purposes should be addressing the contingencies that the audience is concerned with. Put differently, the concerns and/or interests of the audiences must be the focal point of the rhetoric in order to make an argument relevant and persuasive, creating subsequent momentum for actions. Even in cases in which the rhetoric seeks to generate interest in an audience, the current concerns and interests of the audience should not be ignored and must be appropriately addressed in order for the rhetoric to gain necessary attention.

The process of rhetorical congruence has been observed in several cases. Throughout the diffusion of Enterprise Resource Planning (ERP) systems, discourse was extensively and intentionally used to persuasively address concerns and questions of prospective adopters (Markus and Tanis 2000; Wang 2009). Among the concerns was the question: “why do we need ERP?” In the early 1990’s, supporters of ERP had a hard time promoting ERP, and like other emergent concepts (e.g., EA), ERP was “a solution in search of a problem” (Wang 2009). Only when ERP was portrayed as a solution to the then-getting-widely-known Y2K problem, did business executives start to see ERP as a viable option.

Consulting firms, technology vendors, and the media press quickly jumped on the bandwagon, and ERP rhetoric converged to portray ERP as a “silver bullet” for replacing legacy systems while fixing the Y2K issue. Not long after, widespread adoption of ERP started, and by 1998, about 40% of companies with annual revenues of more than $1 billion had implemented ERP systems (Markus and Tanis 2000).

Thus, we propose that rhetorical congruence is necessary for widespread adoption. This means that innovation rhetoric needs to evolve around contingencies of prospective
adopters. As a result, cognitive-institutional accounts of emerging innovations should address adopters’ contingencies in order to be compelling and create momentum. The contingencies include both known facts, issues that are known to prospective adopters (e.g., low profitability), and unknown facts, issues that are made known to prospective adopters by innovation promoters (e.g., security problems). For either case, the contingencies should appear relevant and important to the audiences.

To be Effective: The Evolution Problem

Additionally, an effective cognitive-institutional account needs to evolve over time. Various examples found in the literature illustrate how and why innovation rhetorics evolve over time (Brown et al. 2012; Green 2004; Greenwood et al. 2002; Heracleous and Barrett 2001; Markus et al. 2008; Munir and Phillips 2005; Sillince and Barker 2012). These studies illustrate well how challenging it is to create an effective innovation rhetoric at the organizational level as well as at the collective level. As a result, innovation promoters need to constantly evolve their rhetoric over time.

Three reasons stand out. First, our understanding of the innovation evolves over time. An innovation is often not stabilized and completed when first introduced. Through feedback from prior adopters, continuous developments, and/or complementary innovations, an innovation becomes more stabilized and appeals to general audiences (Hughes 1993; Rogers 2003). As our understanding about the features and the uses of the innovation changes throughout this improvement process, the rhetoric also needs to evolve in order to reflect the new knowledge.
Second, innovation rhetoric is involved in a highly contested process of institutional change (Brown et al. 2012; Suddaby and Greenwood 2005). When a new innovation is introduced, it often replaces or improves a pre-existing practice. As a result, the innovation rhetoric is used to alter existing norms, therefore involving institutional change. This process is highly contested, characterized by rhetoric from innovation promoters, skeptics, and opponents. The outcome can be a compelling account for the innovation, or a failed attempt to overthrow old practices. What’s more, the process often unfolds over months, or years. Consequently, the innovation rhetoric needs to be constantly changed to reflect the ongoing dynamics of different participants throughout the institutional change process.

Finally, changes from socio-economic factors make the audience’s preferences a moving target, forcing the innovation rhetoric to change accordingly. Widespread adoption does not occur immediately, but takes time. During the process, various changes may occur at both the macro and micro levels: regulations, technological advancement, or unforeseen incidents. As a result, the interests and concerns of audiences fluctuate, making previous rhetoric obsolete or irrelevant (e.g., Munir and Phillips (2005)). Therefore, innovation rhetoric must be adjusted to changing circumstances in order to stay relevant and appeal to the target audiences.

Summary

In this section, we briefly examine the prior literature on innovation adoption. Adoption studies have illustrated the essential role of cognitive-institutional accounts at the collective level for widespread adoption (Strang and Meyer 1993; Swanson and Ramiller 1997). Yet, to be effective, these accounts face two prevalent problems: the persuasion
problem and the evolution problem. To be effective, cognitive-institutional accounts have to appear compelling to the audiences. One way to do so is to achieve rhetorical congruence, that is, making the innovation rhetoric relevant to the contingencies of the prospective adopters. Furthermore, to be effective, cognitive-institutional accounts have to evolve over time. Because of the increase in innovation knowledge, the ongoing dynamics of the change process, and the shifts in adopters’ preferences, innovation rhetoric has to be constantly refreshed and adjusted in order to appeal to prospective adopters until widespread adoption occurs. In short, the process of creating an effective cognitive-institutional account at the collective level is a challenging and enduring task for innovation promoters.

In the next section, I examine three theories that address cognitive-institutional accounts to see how the dynamics of innovation rhetoric are conceptualized.

**Theories on Cognitive-Institutional Accounts**

Three theories are possibly relevant to cognitive-institutional accounts. They are organizing vision theory from the IS literature (Swanson and Ramiller 1997), technological action frame theory from the social movement literature (Elliott and Kraemer 2008; Markus et al. 2008), and institutionalization theory from the organizational change literature (Greenwood et al. 2002; Tolbert and Zucker 1996).

**Organizing Vision Theory**

Built on the idea that an IT innovation is an emergent phenomenon that is evaluated collectively by an innovation community, a network of organizations with a variety of interests in a specific innovation, Swanson and Ramiller (1997) proposed the organizing
vision theory which asserts that an innovation community collectively creates an organizing vision that is used to shape the adoption and diffusion of an innovation. An organizing vision represents a focal community idea about applying an innovation in certain ways for certain purposes. The vision is endorsed by the community members and can influence the direction of the innovation adoption across organizations. The organizing vision is created very early in the diffusion process, right when the earliest adoptions occur. Thereafter, the organizing vision continues to grow, evolve, or even clash with other visions. Throughout its career, an organizing vision attracts followers through its distinctiveness, its intelligibility and informativeness, its plausibility, and its perceived practice value (Swanson and Ramiller 1997). Sometimes, the vision can lose its attractiveness, and fade away; while other times, it lasts to guide adoption behaviors of organizations across the community.

Despite what happens, the vision acts as a sense-making device for managers. Various empirical studies have shown the importance of an organizing vision for widespread adoption of a variety of IT innovations: professional services automation (Wang and Swanson 2007), application service provisioning (Currie 2004), Enterprise Resource Planning (Wang and Ramiller 2009), and shared IT infrastructures (Huang and Zmud 2010).

A premise of the theory is a focus on innovation specification. According to Swanson and Ramiller (1997), an organizing vision provides a collective belief about an innovation, defining its characteristics, features, benefits, and implementation process. It exists to provide a dialog space for organizations and without it, innovation cannot be “properly constituted” (Swanson and Ramiller 1997, p. 470). Thus, organizing vision represents
how organizations “talk” about the innovation in relation to the questions: what is the innovation? and how is the innovation implemented? Answering these two questions would help prospective adopters to understand more about the innovation, thus possibly making the innovation more attractive to audiences.

What makes an organizing vision successful? Huang and Zmud (2010) studied a failed organizing vision in the development of a shared IT infrastructure service, an instance of an IT management innovation, in multiple enterprises. Their findings indicate that an organizing vision needs to be strong and compelling in order to guide collective actions. To that end, two observations were made: 1) leaders need to develop an organizing vision that is interpretable and meaningful to all community members, and 2) members need to engage in rich discourse to negotiate the reinvention process (Huang and Zmud 2010). Put differently, to create a successful organizing vision, the discourse has to target particular interests/needs of community members.

While the concept of organizing vision has been found to be helpful in explaining adoption and diffusion processes, a few limitations exist. First, the theory lacks attention to problem specification and innovation justification. Even though the theory suggests that the organizing vision is constituted around a business problem, little has been done to examine the nature of the business problem, and how the innovation should be justified as a response to the problem. In fact, a majority of organizing vision studies focus on the role and lifecycle of the organizing vision throughout the diffusion process (Currie 2004; Pawlowski et al. 2006; Ramiller and Swanson 2003; Swanson and Ramiller 1997; Wang and Swanson 2007). Second, the theory provides limited details on the dynamics of innovation rhetoric over time. While the concept of an organizing vision career is helpful
to understand the construction of the vision, it is still not clear how different organizations interact and respond to environmental contingencies, thus constituting the organizing vision. Understanding these dynamics from the perspective of innovation promoters (or protesters and skeptics) will add insights to our knowledge of the overall diffusion process.

Technological Action Frame Theory

From the social movement literature, the technological action frame theory provides another cognitive-institutional account at the collective level. The technological action frame, that is, the cognitive-institutional account, is defined as “multi-dimensional composite understandings—constituted and circulated in language—that legitimate high levels of investment for potential users, and form the core ideas about how a technology works and how a future based on its use should be envisioned” (Iacono and Kling 2001, p. 75). The frame offers a socially constructed meaning of the innovation to the audiences, elaborating on what the innovation is and what potential the innovation holds. Technological action frames are built up in public discourse about an innovation, providing a dominant frame that influences how the innovation is used in organizational practices (Elliott and Kraemer 2008). And just like organizing visions, a technological action frame can also fade away, depending on its attractiveness.

Unlike organizing vision theory, the technological action frame theory emphasizes the discursive tasks or practices that constitute the frame. A technological action frame is constructed through a framing process, or a process of meaning construction (Benford and Snow 2000; Markus et al. 2008). There are three core tasks of framing: diagnostic framing, prognostic framing, and motivational framing. Diagnostic framing identifies and
attributes causes to a problem; prognostic framing articulates a solution to the problem and the strategies to carry out the solution; and motivational framing provides rationales to engage in the collective action to solve the problem. The three framing tasks are engaged in a frame construction process made up by three overlapping processes: discursive processes—talk and written communications, strategic processes—goal-directed and rational analysis, and contested processes—formulation of responses to challenges (Benford and Snow 2000).

What makes a frame effective, or appear attractive to audiences, depends on the degree of frame resonance (Benford and Snow 2000). There are two factors that account for the degree of frame resonance: frame credibility and frame salience. The credibility of a frame depends on its consistency or the congruency between claims and actions, its empirical credibility or the fit between claims and evidence, and the credibility of claim-makers. On the other hand, frame salience refers to how essential the claims are to the target, how plausible the claims are, and how congruent the claims are with cultural beliefs (Benford and Snow 2000). In other words, the degree of resonance depends largely on the fit between the frame and its audiences and their cultural beliefs.

In short, the notion of technological action frame shares some similarities with the notion of organizing vision. The frame is generated and sustained through public discourse to provide social meanings of an innovation for the collective, elaborating on what the innovation is and what potential the innovation holds. Thus, the technological action frame also focuses on innovation specification—a strength of the theory. Another strong point, one that sets it apart from the organizing vision theory, is that technological action frames emphasizes the dynamics in the constitution of the frame, usually from the
perspective of innovation promoters. Through framing tasks and framing processes, technological action frames are created. To attract followers, the frame needs to resonate well with the audiences and their overall cultural beliefs. Put differently, some level of congruence needs to exist between the frame and the audience.

On the other hand, technological action frame theory still provides limited details on problem specification and innovation justification. While the three core framing tasks include the role of business problems and the importance of articulating the solution to the problem, little has been done to further examine the connection between the framing tasks to generate an effective frame. This remains “an empirical question,” one that looks at “the correspondence between an SMO [social movement organization]’s diagnostic and prognostic framings. In other words, the identification of specific problems and causes tends to constrain the range of possible ‘reasonable’ solutions and strategies advocated” (Benford and Snow 2000, p. 616). As a result, this leads to a limited view on the dynamics of framing over time for the particular purpose of developing an effective collective frame. Most studies have focused more on the emergence of dominant technological action frames throughout social movements, such as the computerization movements in technological innovations (Elliott and Kraemer 2008) or in the mortgage industry (Markus et al. 2008).

Institutionalization Theory

In a parallel literature, institutional theory also talks about another kind of cognitive-institutional account in the diffusion process (Greenwood et al. 2002; Tolbert and Zucker 1996). Built on the work of Strang and Meyer (1993) and Tolbert and Zucker (1996), Greenwood et al. (2002) argued that, for widespread adoption to occur, an innovation
must be “theorized,” that is, to become abstract and relevant to the audiences. Theorization is defined as “the development and specification of abstract categories and the elaboration of chains of cause and effect” (Greenwood et al. 2002, p. 60). Through the theorization process, innovations at local settings are made into conceptual frameworks that can be understood and diffuse more easily across organizations (Hinings et al. 2004). Thus, the theorization process bears resemblance to the notion of organizing vision and technological action frame as they all assert that cognitive-institutional accounts are created in order to communicate the innovation to the audiences, that is, the potential innovation adoption community.

However, theorization stresses the “chains of cause and effect” of the innovation, or the justification for the adoption of the innovation (Greenwood et al. 2002; Hinings et al. 2004). As such, theorization specifies an adoption rationale for the innovation to answer the question: *why is the innovation needed?* Particularly, theorization justifies abandoning old practices in favor of new ones (Hinings et al. 2004). There are two major tasks in theorization: specification and justification. Specification identifies a general organizational problem that needs to be fixed by the innovation, while justification provides the reasons why the innovation is a solution to the identified problem. The outcomes are theorized models or abstract categories of adoption rationales. In other words, institutional theory emphasizes the problem specification and innovation justification and their interactions to create an adoption rationale account, something that is treated lightly in organizing vision theory and technological action frame theory.

An important observation made by Greenwood et al. (2002) is that theorization will more likely lead to success if the innovation is theorized (or framed) as a solution to a problem.
experienced by the adopters rather than as an opportunity which they can exploit. Their empirical findings indicated that the diffusion of a multi-discipline practice organizational format, a kind of management innovation, among professional business service providers in Canada only took place when the innovation was framed as a solution to a problem. Initial theorizers failed because no particular problem was specified. This observation illustrates a particular strategy that innovation promoters can utilize with problem specification and innovation justification in order to create an effective account for adoption.

A few limitations exist with institutional theory. First, there seems to be an over-emphasis on problem specification and innovation justification. Much less has been done to elaborate the innovation and its particular characteristics and potentials. This leads to a somewhat extreme claim that a popular business problem may be sufficient for widespread adoption (Wang 2009). For example, studying the diffusion of ERP systems, Wang (2009) noticed that ERP was widely diffused once recognized as the solution to the then-compelling Y2K problem. The finding led to the conclusion that “framing an innovation as the solution to a problem may not necessarily make the innovation concept popular. Rather, links to a widespread business problem that discourse highlights and brings to managers’ collective attention may popularize the innovation, even as an unintended or partial solution” (Wang 2009, p. 25). In this example, the innovation justification and problem specification is overplayed while the characteristics of the innovation is downplayed, implying that as long as the innovation is attached to a popular problem, it will have a higher chance to succeed.
Second, there is a lack of attention on the struggles that innovation promoters face over time and their resolutions to create an effective account. While institutional theory is helpful to point out the link between problem specification and innovation justification, and their impacts on adoption, it does not attend to the evolution of innovation rhetoric over time. Widespread adoption is less likely a result of innovation promoters choosing the “right” strategy from the beginning, but rather how they respond to environmental contingencies over time, rise above challenges, and come up with the appropriate strategies. Understanding such dynamics will allow students of adoption studies to draw much richer and insightful conclusions about the adoption and diffusion process.

Summary and Implications

In this section we review three different theories that have promoted cognitive-institutional accounts (see Table 5.1). Overall, the three theories suggest an essential role of collective-institutional accounts in the diffusion process. In addition, the theories emphasize three kinds of innovation rhetoric that appear to be important to the audience.

4) Problem specification: a rhetoric that specifies a business problem that is important and relevant to the audiences. The rhetoric explains what the problem is and why it is important to the audiences; thus, it represents a why-rhetoric of innovation adoption.

5) Innovation specification: a rhetoric that explains what an innovation is in terms of its distinct characteristics, its practical value (e.g., success stories), and its comprehensive how-to guidance. As such, the rhetoric is a what-rhetoric of innovation adoption.
6) Innovation justification: a rhetoric that explains how the innovation is the solution to the specified problem. The rhetoric establishes the cause-effect link between the problem and the innovation by elaborating the mechanisms through which the innovation can solve the problem. Therefore, the rhetoric is a how-rhetoric of innovation adoption.

Recalling from the previous discussion, to create an effective cognitive-institutional account, innovation promoters have to address the persuasion problem and the evolution problem. Regarding the first problem, the three theories excel in elaborating the elements that can constitute a compelling cognitive-institutional account. Organizing vision theory suggests that a vision should target particular interests and needs of community members (Huang and Zmud 2010; Swanson and Ramiller 1997). Technological action frame theory argues that the frame must resonate with the cultural beliefs of the audiences. Similarly, institutional theory asserts that a problem should be specified, and the innovation is justified as the solution to the problem. Taken together, the innovation rhetoric needs to have rhetorical congruence, or a fit between the rhetoric and the audience’s contingencies. That means problem specification, innovation specification, and innovation justification must also be congruent with the audience’s contingencies in order to be compelling.

Regarding the evolution problem, what seems to be lacking from the three theories is an in-depth view of the dynamics of innovation rhetoric over time. In other words, the theories overlook the evolution problem that innovation promoters have to face and only address the issue somewhat subtly. Organizing vision theory suggests the notion of an organizing vision career, but does not go into details of the career. Technological action
frame theory identifies the framing tasks but does not looking at the interactions and consequences of those interactions over time. Finally, institutional theory considers the diffusion process over time, but seems to overlook innovation specification.

To fill the gap, in this paper, I propose to look at the dynamics of innovation rhetoric over time (i.e., the what-, how-, and why-rhetoric), using the perspective of innovation promoters. It is important to identify the kind of issues they face and how they resolve these (through innovation rhetoric) to generate, sustain, or improve a compelling cognitive-institutional account. Especially to reach widespread adoption, the rhetoric needs to appeal to a wide audience. Since many audiences today are heterogeneous, insights on how innovation promoters approach their diverse audiences can be very useful. In the next section, we look at how an innovation promoter, the NASCIO, used their innovation rhetoric to try to create a compelling cognitive-institutional account for Enterprise Architecture adoption across the 50 U.S. State governments.

Method

To examine the use of rhetoric by innovation promoters to try to create a compelling account for adoption, we conduct a rhetorical analysis of the discourses used by the National Association of State Chief Information Officers (NASCIO) to promote the adoption of Enterprise Architecture in the U.S. State governments. The use of rhetorical analysis is common in social science to study the effects of discourse in the innovation adoption and diffusion process (Barrett et al. 2012; Heracleous and Barrett 2001).

NASCIO is a collective organization that acts as an innovation promoter in this case. By collective organization, we mean NASCIO is made up of representatives from various
U.S. State agencies as well as practitioners from the private sector. NASCIO was founded in 1969 as a non-profit, 501(c)(3) association that provides products and services to support the role of State CIOs. Its membership consists of State CIOs, State officials with or without executive responsibility, and business leaders. Through the years, the association has undergone major reforms, including two name alterations. NASCIO has been a flagship in IT initiatives, both between and within states, committing to “foster government excellence through quality business practices, information management, and technology policy”\(^{13}\). To many State CIOs, NASCIO serves in a similar capacity as professional associations to private sector CIOs, providing networking opportunities and supporting resources. Although NASCIO’s membership includes its audiences, NASCIO still needs to act as an innovation promoter in order to sell its ideas and practices to its members. As a result, NASCIO discourses reflect well the struggles that an innovation promoter has to go through in order to appeal to its various audiences.

**Coding for State CIOs’ Contingencies**

To identify the possible contingencies that the State CIOs have to face in adopting EA, we examine NASCIO publications on State CIOs’ priorities from 2002 to 2011\(^{14}\). These priorities are collected by NASCIO in their annual conferences to identify upcoming IT trends and concerns of State CIOs for the upcoming year. Therefore, they provide an ideal account of contingencies that State CIOs have to face. (See Appendix E for the detailed list.) I also conducted a review of major events at the State and Federal level that

\(^{13}\) NASCIO Mission [http://www.nascio.org/aboutNASCIO/ accessed 11/20/12]

\(^{14}\) I also examined the presentations, CIO roundtables, and discussions in NASCIO’s annual conferences for years that lack of data, that is, 2002 and 2004.
can influence how States prioritize their IT management efforts (Table 5.2). Then, I cross-checked the State CIOs’ priorities with the significant events in order to identify major contingencies that may hinder EA adoption in State governments.

Coding for Dynamics of Innovation Rhetoric

To examine how NASCIO uses rhetoric to try to create a compelling account for EA adoption, I examine the 38 publications of the NASCIO’s Enterprise Architecture and Governance Committee from 2000 to 2011. The Enterprise Architecture and Governance Committee (hereafter the Committee) was established around 1999-2000 as an effort to help States understand and adopt the Enterprise Architecture discipline. Therefore, it provides an excellent source of data on the role of rhetoric in the adoption of EA in U.S. State governments. The analysis followed two stages.

In the first stage, the discourse was read and coded at a high level. For each publication, I identified the general theme and purpose, EA definitions, the rationale for EA adoption, detailed description of EA frameworks, the vocabularies and tones, the problem that was introduced, the kind of justification, and the supporting evidence and claim. 38 publications were analyzed and entered into an Excel table. Together, they represent the evolution of NASCIO’s discourse rationale. (See Appendix F for simplified examples.) Each time the definition and adoption rationale for EA were adjusted, that would mark a

---


shift in NASCIO’s discourse rationale. In general, there are three major significant periods in NASCIO’s rhetoric:

1. Initial period: 2000—2004. NASCIO started to promote EA adoption among the U.S. State governments.


In the second phase, I carefully examined the dynamic of NASCIO’s rhetoric for each period to see whether NASCIO’s rhetoric has the elements of a compelling rhetoric as suggested by the discussed theories. These elements are 1) a *problem specification* that identifies an important and relevant business problem to the audiences (Swanson and Ramiller 1997), 2) an *innovation specification* that show the innovation’s distinct characteristics, its implementation process, and its value (e.g., success stories) (Benford and Snow 2000; Swanson and Ramiller 1997), and 3) an *innovation justification* that provides the reasons and motivations for the innovation to be the solution of the identified business problem (Greenwood et al. 2002). Next, those rhetorical elements were compared to the contingencies that State CIOs’ had during that period to assess how compelling NASCIO’s rhetoric was to its audience—the State CIOs. Table 5.3 provides a coding and analysis framework for this stage. In the next section, I present the findings.
Findings

In the next section, I present first the contingencies that State CIOs face in adopting EA before presenting the dynamics of NASCIO’s rhetoric in each of the three periods.

State CIO’s Contingencies Since 2000

In 2000, the State fiscal crises started, as the world economics got severely damaged by the dot-com bubble bursting. The budget crisis made it difficult for State CIOs to justify IT initiatives, especially the long-term strategic initiatives. State governments preferred short-term projects, which would yield quick and immediate results in order to justify their IT spending. IT outsourcing and efficient IT procurement became a viable solution for many States to ease the budget tension. At the same time, the 9/11 attack in 2001 and the enactment of the E-government Act of 2002 had significant impact on most State CIOs’ priorities. Homeland security and e-government became trendy topics, as States had to deal with public demands for tighter security, and the top-down pressure for better e-government solutions. As a result, from 2000-2004, the top priorities for State CIOs were IT outsourcing, IT procurement, homeland security, and e-government. The CIOs faced the contingencies of budget deficit and the competing priorities that made it difficult to justify, or even consider EA adoption at that time.

During the year 2004-2005, the State budget crises continued, with a total of $80 billion in shortfall reported for 2004 (McNichol et al. 2011). While the situation improved somewhat in 2005, the State CIOs continued to experience a shortfall in their IT budget. Some States looked at consolidation and shared services as potential solutions to the crisis, making the topics of interoperability, integration, and EA somewhat relevant
during this period. Nonetheless, as State governments started their e-government efforts, privacy and security laws became prominent due to regulations such as HIPPA or the Privacy Act. Therefore, this period witnesses a continuing trend of CIOs’ priorities in IT procurement, information security, privacy, interoperability and integration. State CIOs’ contingencies, that is, budget deficit and those competing priorities, continued to make it difficult to justify and adopt EA.

In 2005, some States experienced recovery in fiscal budgets, but the continuing years were among the worst. The Mortgage crisis of 2007-2008 made it one of the worst fiscal crises for State governments in years, with the shortfalls reaching the record high of $191 billion in 2010 (McNichol et al. 2011). Amidst the crisis, President Obama appointed the first CIO for the United States in 2009, aiming for IT management reform in the public sector. In 2010, the “25 Point Implementation Plan to Reform Federal IT Management” was issued, emphasizing consolidation, cloud computing, shared services, and collaboration among top priorities. Concurrently, the topics of consolidation, shared services, and budget control have been consistently the top priorities for State CIOs since 2009. Emerging concepts like cloud computing or mobile computing also increasingly capture the attention of State CIOs, making it ever difficult to convince States about EA adoption. Again, budget deficit and competing priorities are the contingencies that State CIOs have to face in adopting EA.

In general, since 2000, the State CIOs have faced the contingencies of budget deficit and competing priorities challenging their EA adoption. For each period, the priorities were different, depending on the environmental contingencies (see Table 5.4 for an overview). How do EA promoters, like NASCIO, use rhetoric to try to cope with these dynamic
contingencies, thus creating a compelling account for EA adoption? In the next section, we look at the dynamics of NASCIO’s rhetoric over the years.

Dynamics of NASCIO’s Rhetoric

Three periods are identified for NASCIO’s rhetoric: the Initial period, the Transition period, and the Stabilization period. For each period, I examine the dynamic of NASCIO’s rhetoric using three elements: 1) problem specification, 2) innovation specification, and 3) innovation justifications. Those elements are assessed to see how well they are related to the State CIOs’ contingencies at that time.


In 1998, NASCIO received a grant from the Department of Justice, Office of Justice Programs to facilitate and encourage information sharing in State governments. Subsequently, NASCIO conducted a research project on information sharing and published their findings in a 2000 report, *National Information Architecture: Toward National Sharing of Governmental Information*, which captured the attention of various State leaders on the topic. NASCIO reasoned that information sharing is important because sharing information increases accuracy, timeliness, completeness, and cost efficiency for governmental agencies. Among the many recommendations was a call to establish a national architecture for information sharing between governmental agencies. To do so requires a national telecommunication infrastructure, a nationwide sharing vocabulary, and a set of common sharing documents (NASIRE 2000).

Following the report, NASCIO recognized that Enterprise Architecture is a way to establish commonalities and necessary infrastructure for information sharing among State
governments. Thus, NASCIO started the Adaptive Enterprise Architecture Development Program to facilitate the development of Enterprise Architecture in State governments. To increase the States’ awareness and understanding, NASCIO issued a White Paper on EA in 2002, urging States to embrace EA. In 2004, a series of promotional videos were published to further encourage State adoption. Furthermore, NASCIO also realized that EA adoption requires know-what, know-how, and know-when. As a result, NASCIO published a series of tools to help States embracing EA: the Tool-Kit v.2.0 in 2002, the Readiness Assessment in 2003, and the Maturity Model in 2003.

**Problem specification** Information sharing and interoperability were portrayed as the problem that governmental agencies had to face. To provide the ground for their argument, NASCIO cited several mandates or regulations on information sharing, as well as showcased some successful information sharing cases to illustrate the benefits of information sharing (e.g., NLETS, NCIC, and CJIS-WAN as nationwide telecommunication networks for information sharing in the public safety domain). The rationale was that information sharing increases accurateness, completeness, timeliness, and cost efficiency of information.

*First, shared information is more accurate; it is collected once and used many times, thereby avoiding the misunderstandings and keying errors associated with multiple collection. Second, shared information is more timely; it can often be made available instantly rather than waiting for a separate collection effort. Third, shared information is more complete; information from multiple sources can be assembled into a full description. Finally, shared information is less*
expensive; it costs much less to store data and send it to another user than it does to collect it again (NASIRE 2000)

**Innovation specification** To establish information sharing between governmental agencies, EA was specified as an innovation that can establish the needed infrastructure, a plan to help design and maintain IT infrastructures that support business functions. In the EA Development Tool-Kit version 2.0, EA was defined as: “an overall plan for designing, implementing and maintaining the infrastructure to support the enterprises business functions and underlying networks and systems” (NASCIO 2002a, p. 234). The general approach was a technical-oriented approach in which EA was compared to a “blueprint” that increases integration between agencies, allowing data to flow across agencies:

*Enterprise Architecture Framework can be described as a methodology for developing an organization’s IT support functions...[EA] provides the blueprint for the integration of information and services at the design level across agency boundaries. Enterprise architecture is the blueprint for allowing data to flow from agency to agency...* (NASCIO 2002a, p. 8).

**Innovation justification** To justify EA adoption, EA was cited as a solution to information sharing. In the first report on information sharing issues, NASCIO argued that the solution to increase agencies’ sharing is to create a national architecture for information sharing. Such an architecture requires a national telecommunication infrastructure, a nationwide sharing vocabulary, and a set of common sharing documents (NASIRE 2000). Thus, by establishing Enterprise Architecture for each State government, this will create a blueprint for standardization and interoperability that
allows data to easily flow between agencies. In a White Paper published in 2002, NASCIO stressed:

*The development of enterprise architecture is essential to the success of information sharing needed to improve cross-jurisdictional information flow and process coordination (NASCIO 2002b, p. 1).*

This adoption rationale was supported by various authoritative sources: a letter from Chairman Tom Davis of the House Subcommittee on Technology and Procurement Policy that encouraged the consideration of NASCIO's EA program, or the intentions of other agencies to adopt NASCIO’s EA program:

*On April 16, 2002, Chairman Davis sent a letter to 30 federal agencies urging each to consider NASCIO’s cross-disciplinary architecture program “principles as they apply to your operation and information sharing needs.” Davis’ letter states that the NASCIO “initiative [holds] the potential for a jump-start in planning and implementation for all governmental disciplines.” NASCIO has received inquiries of interest from a variety of the 30 agencies with each stating they have reviewed the Tool-Kit (NASCIO 2002b, p. 2).*

**Summary** During the Initial period, NASCIO specified information sharing as a critical problem among agencies, and EA was justified as the solution—a blueprint that can integrate information and services, allowing data to flow easily between agencies. Events at the time seemed to support that assertion. Major public safety events (e.g. the 9/11 attack) had increased public awareness about the importance of governmental collaboration as well as public expectations about being able to access government
information in a timely way. Subsequent mandates, executive orders, and legislation were issued, resulting in the acceleration of existing collaborating efforts such as the Justice Information Exchange Model (JIEM) or the National Law Enforcement Telecommunication System (Nlets) (NASCIO 2005a).

However, NASCIO’s problem specification did not seem to align well with the actual contingencies that State CIOs had (see Table 5.5). During the Initial period, budget deficits and competing priorities made it difficult to justify EA adoption. The top IT priorities at that time were IT outsourcing, IT procurement, homeland security, and e-government. As a result, framing EA as a solution to information sharing did not resonate well with State CIOs since information sharing was not among their urgent needs. In addition, the specification of EA was more technical-oriented, making it less appealing to its audiences who were more concerned with business-oriented issues at that time.

Perceiving a slow adoption rate, NASCIO adjusted their approach in the next period.

**NASCIO Adjusted EA Approach: 2004-2005**

Continuing to promote information sharing, in 2004, NASCIO conducted an assessment tour among ten States, one county, and one federal agency. Through the tour, NASCIO learned that the typically short CIO tenure and State budget deficits were crucial factors in States’ adoption of EA as CIOs might have a difficult time justifying EA adoption due to funding shortages and a high-felt-pressure for short-term results (NASCIO 2004a). Shortly after the tour, NASCIO published its EA Tool-Kit version 3.0 in which the challenges were addressed, and a more business-focused and enterprise-wide approach to EA was utilized. EA was re-defined as an “operating discipline” and a program that links between business needs and technology solutions (NASCIO 2004b)— very different to
the Initial period in which EA was defined as a *methodology* and a *blueprint* to integrate IT services (NASCIO 2002a).

Under this new approach, NASCIO’s EA Tool-Kit also extended the architecture models to other areas. In the previous Tool-Kit versions, the EA framework consisted of an Architecture Blueprint, a Business Architecture Framework, a Technology Architecture Framework, and an Architecture Governance Framework. With the new Tool-Kit, NASCIO completely revised the framework to include other components: Architecture Governance, Business Architecture, Information Architecture, Technology Architecture, Solution Architecture, and the Enterprise Architecture Value Chain. This reflected the change to a more business-focused and enterprise-wide approach in NASCIO’s EA approach.

*Problem specification* While information sharing continued to be the business problem specified for EA, NASCIO attended more to other challenges that State CIOs had to face. Information sharing was no longer framed as the prominent problem that State agencies had, but instead was coupled with other issues, such as delivering government services or managing changes. Information sharing, for the first time, was recognized as more than a technology problem but as one that can improve service delivery and impact government as a whole.

...this [information sharing] is not a technology problem—it is an organizational problem, and a human problem (NASCIO 2005a, p. 8).
Sharing information makes better government. Shared information minimizes clerical errors, information discrepancies and government loopholes (NASCIO 2004b, p. 16).

Here, the problem specification in NASCIO’s rhetoric was switched from information sharing alone to include government services improvement. This allowed NASCIO to position EA more closely to the concerns of the State CIOs: delivering services efficiently. Yet, most of the evidence and support for the problem remained mostly for information sharing. Public safety cases were featured to show the importance of information sharing, and successful cases were used to show benefits of information sharing.

**Innovation specification** NASCIO’s rhetoric was also adjusted to focus more on business functions, defining EA as an “operating discipline” that takes a holistic approach to manage complexities.

\[
\text{[EA is] an operating discipline comprised of frameworks, methodologies, and delivery processes that can be leveraged to manage the complexities of government. Enterprise architecture can ultimately guide investments in business and technology solutions insuring these solutions are appropriately aligned with business needs (NASCIO 2004b)}
\]

During the Transition period, EA started to be viewed more as a planning process that provides supports and guidance to business investment decisions and technology solutions. In one way, these changes helped NASCIO to reframe EA as a business-oriented tool rather than a technical-oriented tool. For State CIOs who were already under
pressure to justify their investment decisions, such adjustments were hoped to make EA more compelling and encourage adoption.

In addition, more success stories were used to illustrate EA adoption. Examples of EA initiatives across the country were featured: the Federal EA Program Management Office, North Carolina’s Office of Enterprise Technology Strategies, and EA adoption in North Dakota and Missouri (NASCIO 2004b). These examples helped to signal to prospective adopters the viability of EA. The connection was drawn between EA adoption and the identified problem: improving governmental services.

*By implementing a blueprint for standards and methods that are agreed upon by all agencies, the state [Missouri] positions itself to save money, increase service, and gain a competitive advantage for the long term... The goal is always to provide the citizens of the State of Missouri with the most efficient and effective service possible (NASCIO 2004b, p. 36).*

**Innovation justification.** Similarly, NASCIO also adjusted their justification, or their why-rhetoric. During this period, EA starts to be framed as a solution to other business problems. NASCIO learned that framing EA as the solution to information sharing was a very limited and narrow problem to the State CIOs. Accordingly, their justifications were modified. While EA continued to be theorized as a solution to information sharing, other government-related issues were also linked to EA:

*Adaptive enterprise architecture effectively supports the business of government, enables information sharing across traditional barriers, enhances government’s ability to deliver effective and timely services, and supports agencies in their*
efforts to improve government functions and, thereby, services (NASCIO 2004b, p. 14).

To support the switch, successful EA initiatives, mentioned above, were featured to show the benefits of EA in improving governmental services. NASCIO reasoned that EA can create commonality in standards, thus allowing agencies to deliver services more effectively at lower cost:

_In fact, enterprise architecture standards create commonality, increasing the enterprise’s capability to provide effective information and services and to reduce the cost of delivering those services. Implementation of NASCIO’s adaptive Enterprise Architecture model provides this increased capability through familiarity_ (NASCIO 2004b, p. 15).

**Summary** In the Transition period, NASCIO learned of the adoption barriers that State CIOs have in considering EA. The ongoing fiscal crisis had impacted the way governments were conducting business, and State governments were no exception from the demands for better services from the citizens (NASCIO 2004a). Subsequently, NASCIO adjusted their rhetoric to frame EA as a business-oriented solution to not only information sharing, but also service delivery. Yet, the switch was not fully completed, with some disconnection in the specification of the problem as NASCIO did not make clear the need for better service delivery in their rhetoric. The justifications, while aligned better with the audience’s concerns, did not completely address the top priorities of the State CIOs at the time (see Table 5.6). In the next section, I examine how NASCIO better addresses the concerns of State governments after 2005.
NASCIO addressed concerns of States: 2005-2011

Lessons learned from the 2004 assessment tour had a great impact on NASCIO. In 2005, NASCIO conducted a survey to assess EA development in State governments and to learn of their experience with NASCIO’s EA framework. 37 States, together with the District of Columbia, responded to the survey, giving a reliable assessment of EA adoptions across U.S. State governments (NASCIO 2005b). In general, the survey concluded that there had been a strong adoption of EA across the States. However, most efforts were about technical architecture, while other architectural areas such as business, process, information, or security architecture were neglected. In addition, the program was still suffering from the why question, raising concern about the necessity and relevance of EA.

These concerns prompted NASCIO to adjust its EA approach. Since 2005, the rhetoric at NASCIO has focused more intensively on the value propositions of EA, explaining its benefits in supporting other management practices (e.g., GIS, data governance, and business analytics). Documents that explain the use of Service-Oriented Architecture were published. Additionally, the EA adoption rationale has been centered on government transformation and adjustments to the millennium changes, making EA a necessity for the new government. With the State fiscal crisis worsening, especially after the Subprime Mortgage crisis in 2007-2008, NASCIO placed even more emphasis on the governance of data and information in their publications.

Problem specification Although NASCIO continues to receive funding from the Bureau of Justice to promote information sharing, NASCIO concluded in their 2005 survey that it is important to seek funding that matches the concerns of the State governments. In other
words, information sharing should not be the primary focus, but should be something else that matches the priorities of State governments.

*Funding for the NASCIO EA program must match the priorities of the states and the federal government. Funding must encourage and enable the continued development and maturity of state enterprise architecture operating discipline.... A more diversified federal funding stream would enable NASCIO to emphasize more government lines of business (NASCIO 2005b, p. 32).*

That “something else” has been *government transformation*. Consequently, information sharing is no longer the primary problem specified in NASCIO’s rhetoric. Instead, the focus has been shifted to government transformation in coping with increasing pressure from budget deficit and citizens’ demands. Various challenges have been cited for government transformation, such as citizen expectations, economic development, public health, environmental protection, integrated justice, homeland security, global geo-political uncertainty, global economics, technology, inter-governmental relationships (NASCIO 2005b, p. 3). The logic is that government transformation is necessary to deal with the emerging challenges:

*NASCIO has conducted this assessment to answer the question, “what is the level of adoption of enterprise architecture?” But this begs the question, “why should we care?” Enterprise architecture is not an end in itself. Rather, it is the path to government transformation ... The requirements for improved government performance, reduced spending and greater accountability to the citizens calls for smarter management - which includes the adoption of EA (NASCIO 2005b, p. 3).*
Innovation specification Since 2005, NASCIO’s rhetoric has become more stabilized. Unlike the two previous periods in which the definition of EA was mentioned occasionally and unclearly, in this period, EA is repeatedly defined in several publications as a “management engineering discipline” that helps government transformation. This is a business-oriented approach to EA, viewing EA as a management planning process. NASCIO portrays State CIOs as change leaders, and urges them to view EA as a management discipline, and “not simply a methodology for managing technology” (NASCIO 2007d). This will allow the State governments to have the capabilities to match the goals and objectives of governors and State legislators, that is, to eventually overcome the crisis.

Enterprise Architecture is a management engineering discipline that presents a holistic, comprehensive view of the enterprise including strategic planning, organization, relationships, business process, information, and operations (NASCIO 2007a, p. 1).

Subsequently, NASCIO refresh their rhetoric by providing a series of new publications that elaborate how EA helps to solve State governments’ priority issues (e.g., electronic record management, data governance) and how to conduct those initiatives in relation to EA. In other words, these publications are not just about “how to do EA” but about “how to do other priority initiatives through/with EA.” They are the guidelines and evidence of how EA can help States address their challenges. This approach certainly helps NASCIO to focus on the priorities of State CIOs and avoid the problem of EA having to compete with other initiatives.
Innovation justification  To address the ongoing concerns of the State governments, NASCIO has also adjusted its justifications. If before, information sharing was the business problem that EA aimed to solve, today, EA aims to solve various problems that State governments face in order to transform. Examples include electronic record management, change management, data governance, GIS, IT governance, and business analytics. During this period, EA is justified opportunistically. NASCIO provides the justification of EA as a solution to areas that are of great concerns for State CIOs instead of targeting a particular issue like before (e.g., information sharing). Consider the following rhetoric that encourages the use of electronic record management:

Information contained in records are the subject of security, disaster management, privacy, identity management, and collaborative (cross boundary) information exchange... However, in State government, proactive management of electronic records is often overlooked as a potential resource, and as a necessary investment (NASCIO 2007b, pp. 1-2).

The most assured way for records management and preservation concerns to gain the proper attention is to link these enterprise requirements and enabling capabilities with the State’s enterprise architecture program. Enterprise architecture presents and maintains a comprehensive view of the enterprise. This view must recognize the knowledge assets of the enterprise and manage them as enterprise assets (NASCIO 2007c, p. 7).

In this example, electronic record management is identified as a necessary but often overlooked area that can address the priorities of the State CIOs. Then, EA is proposed as a solution, or a part of the solution that helps States establish electronic record
management successfully. States that are interested in electronic record management can recognize how EA is a way to help them achieve their goal. By using this strategy, NASCIO can build a more compelling message to the State CIOs.

**Summary** Since 2005, NASCIO’s rhetoric has been adjusted to focus more on the ongoing concerns of the State CIOs (see Table 5.7). In general, the rhetoric has been more stable during this period, with EA clearly and repeatedly defined as a management engineering discipline. Information sharing is no longer the specified problem, but it is government transformation and the subsequent issues of government transformation. To support that goal, EA is opportunistically framed as a complementary initiative that helps State governments to achieve top priority initiatives for government transformation. Such an approach allows EA to avoid competing with other priorities, and therefore is more likely to be accepted by State CIOs.

**Summary**

In this section, I presented the dynamics of NASCIO’s rhetoric over year to inform and persuade State CIOs to adopt and implement EA. The three periods of evolution illustrate how NASCIO’s rhetoric has become more compelling and aligned to its audience’s contingencies. During the Initial period, the State CIOs were concerned with budget deficits and competing priorities, issues that were not technical. However, NASCIO portrayed EA as a technical solution that can improve information sharing—an issue that was not high on State CIOs’ priority list. When NASCIO learned about the States’ concerns during the Transition period, they adjusted their rhetoric to include not only information sharing but also service delivery as the priority for EA adoption. EA was framed in a more business-oriented way, as an operating discipline that can increase
States’ capabilities. This approach, while considered better than the previous one, was still slightly misaligned with the State CIOs’ contingencies, as they needed to worry about priorities such as procurement, security, and privacy. Only during the Stabilization period, was NASCIO’s rhetoric more completely revamped and improved to fit better to their audience’s contingencies. State CIO’s priorities and government transformation are now the problem, and EA as a management practice can help State CIOs achieve their priorities, be it record management, data governance, or procurement. This approach certainly aligns very well with State CIOs’ concerns, making the rhetoric more appealing and compelling.

The findings here confirm the two prominent problems of creating a cognitive-institutional account for widespread adoption: the persuasion and the evolution problem. State CIOs’ contingencies change over time, and NASCIO learned to focus on these contingencies in order to be more compelling. In the Initial period, NASCIO had a difficult time to convince its audience (NASCIO 2004a; NASCIO 2005b). The specified problem, information sharing, though important was not the essential and central priority of State CIOs. Indeed, States were more concerned with budget deficits and other priorities. Only when NASCIO specifies government transformation as States’ primary concern and frames EA as a solution that helps State CIOs to achieve their priorities, do State CIOs become more receptive to EA adoption. More States are now more willing to embrace NASCIO’s rhetoric, such as adopting EA as a reference model for data governance. For example, the Enterprise Data Standards Framework at the State of Washington cited NASCIO as reference for data governance (ISB 2011), and the State of Hawaii set one of their goals to create data architecture and governance based on
NASCIO’s recommendations (IMT 2011). Figure 5.1 shows the adoption and consideration of EA in the U.S. State governments. The advent of NASCIO’s supporting tool-kit during 2000-2004 brought a surge of EA adoption and consideration among States. However, since 2005, the number has been steadily increasing, with the exception of 2008 as the Subprime Mortgage crisis hit. While this is not direct evidence for the persuasiveness and effectiveness of NASCIO’s rhetoric to the State CIOs, the figure illustrates a strong tendency of States to respond to changes in NASCIO’s rhetoric over time. Future research is necessary to examine more directly the effects of NASCIO’s rhetoric to its audience.

Discussion

In this paper, I examine the dynamics of NASCIO’s rhetoric over the years, showing their struggles in trying to create a compelling account for Enterprise Architecture adoption across 50 U.S. State governments. The evolution of NASCIO’s rhetoric can be classified into three periods: the Initial period, the Transition period, and the Stabilization period (see Table 5.8).

In the Initial period, NASCIO specified information sharing as the urgent problem that State CIOs have to deal with. EA was specified as a blueprint to integrate information and services across agencies. During this period, EA was prescribed as a technical-oriented solution that designs and maintains IT architectures. During 2004-2005, the Transition period, NASCIO learned from its members that the initial approach did not work well as State CIOs were under tight budget restrictions, had other higher priority initiatives, and needed to focus on projects with short-term returns. As a result, NASCIO
started to specify information sharing and service delivery as the problems for State CIOs. EA was framed as an operating discipline, a business-oriented approach, to establish commonalities and standards, thus creating government capabilities to deliver effective information and services and reduce operational costs. Since 2005 until 2011, the Stabilization period, NASCIO focuses the rhetoric to specify government transformation as the primary problem of State CIOs. EA is specified as a management engineering principle that helps State CIOs to achieve their priorities, thus supporting the transformation of government.

The findings here provide several implications to theory and practice. First, the findings illustrate the challenging and enduring processes of creating a compelling cognitive-institutional account for innovation adoption. This responds to Strang and Meyer (1993) who indicated that the mere existence of a collective adoption rationale would not be sufficient for diffusion, and that the rationale needs to be compelling to relevant audiences. In fact, in order to be effective, collective adoption rationales, or cognitive-institutional accounts, need to remain compelling and continuously evolve to their audience’ contingencies. Doing so increases the rhetorical congruence of the rationales, making it more relevant and appealing to their audiences. In the case of NASCIO’s rhetoric, by making their rhetoric attend to the State CIOs’ primary concerns, government transformation, NASCIO gets more positive responses in terms of EA adoption and consideration.

Second, the study presents a complete framework to analyze innovation rhetoric over time, using three elements: problem specification, innovation specification, and innovation justification (Figure 5.2). While prior theories suggest different elements of an
innovation rhetoric, none has combined and addressed all three elements together as part of an innovation rhetoric (see Table 5.1). Each of these elements plays different roles, and together they provide a collective interpretive frame, or a collective-institutional account, for a particular innovation. Furthermore, they need to fit with the audience’s contingencies in order to create rhetorical congruence, thus increasing the effectiveness of a collective-institutional account. Furthermore, while problem specification appears to be crucial, it should only be treated as a necessary rather than a sufficient condition. How the innovation is specified and justified also plays an important role in convincing audiences. For NASCIO, by providing examples and illustrations of how NASCIO can assist State CIOs to achieve other priorities, thus transforming governments, NASCIO is able to create a much more convincing case for EA adoption. Therefore, the findings here soften previous claims that a relevant business problem is what innovation promoters need to highlight (Wang 2009). In contrast, here we emphasize that while business problems play an important role, how the argument is structured and presented is just as important.

The account of three elements of innovation rhetoric and the importance of rhetorical congruence add insights to prior theories on rhetorical strategies in the institutionalization process. Studies have shown how different rhetorical strategies (e.g., logo, ethos, pathos) used in order to increase the legitimacy of certain organizational practices (Erkama and Vaara 2010; Green et al. 2008; Suddaby and Greenwood 2005). Similarly, in the innovation diffusion literature, studies on the role of rhetoric have been scarce (Green 2004), with the focus mostly on rhetorical strategies. The findings here illustrate that innovation characteristics matter, as they need to be elaborated and communicated to the
audience in order to gain sufficient momentum. Different rhetorical strategies can be used, separately and/or complementarily, but they should be used for the purpose of identifying the problem (i.e., problem specification), explaining the solution (i.e., solution specification), and communicating and justifying the solution to the problem of the audience (i.e., innovation justification). Otherwise, we run the risk of confusing the audience and subsequently hurting the diffusion process.

The evolution of NASCIO’s rhetoric also provides a good lesson for policy makers who are looking for ways to make successful policies, or policy interventions. It is a well-known fact that it is difficult to amass sufficient support for new policies. The framework for innovation rhetoric evolution in this paper suggests a way for policy makers to anchor and focus their policy rhetoric: a problem needs to be specified; the policy needs to be specified; justifications need to connect the policy to the problem; and the problem, policy, and justifications must adhere to the target audience’s contingencies. As researchers focus on creating socially responsible policies (Majchrzak and Markus 2014), or implementing smart practices in policy making (Bardach 2009), there should be a consideration for rhetorical strategies that put the audience’s contingencies at the center in order to connect the policies better to their target audiences.

Limitations and Future Research

The research is not without limitations. First, I only examine the evolution of NASCIO’s rhetoric over time to assess the persuasiveness of its rhetoric. While there is evidence for strong responses from the State governments to NASCIO’s rhetoric (Figure 5.1), there is no direct evidence for persuasiveness of the rhetoric to the audience over time. This indicates a direction for future research to examine how State CIOs perceive these
changes in NASCIO’s rhetoric, and how these changes affect their opinions on EA adoption.

Furthermore, NASCIO’s rhetoric is only evaluated at the structural level, assessing what elements of a compelling innovation rhetoric are present and how they are related to the audience’s contingencies. There is a need to evaluate the quality of NASCIO’s rhetoric at the discourse level. Toulmin’s structure of argument can be useful here to assess NASCIO’s rhetoric based on its claim, its supporting evidence, and its warrant (Berente et al. 2011). For example, even though NASCIO specified information sharing as a problem, how they presented information sharing can be important: was there any supporting evidence for information sharing, and how was the evidence connected to the information sharing problem? Future research can enhance the framework on innovation rhetoric evaluation by incorporating ways to assess the quality of the rhetoric as well as its structure.

**Conclusion**

In this paper, I use the case of NASCIO to present a struggling process in which NASCIO as an innovation promoter tries to create a compelling cognitive-institutional account for EA adoption for the U.S. State governments. A framework using problem specification, innovation specification, innovation justifications, and audience’s contingencies was used to evaluate the persuasiveness of NASCIO’ rhetoric over time. Needless to say, many other elements are necessary to make a successful case for widespread adoption, but I hope I have made a compelling argument for the importance of rhetoric and its elements in the diffusion process.
Chapter 6: Discussion and Conclusion

Overview

The dissertation investigates how and why IT management innovations diffuse. Focused on the adoption, implementation, and diffusion of Enterprise Architecture (EA) in the 50 U.S. State governments, four empirical studies were conducted to reveal how organizations can make sense of existing EA frameworks (study #1), how organizations adapt and reinvent EA (study #2), how the different EA designs help to diffuse EA (study #3), and how the EA promoters use rhetoric to encourage EA adoptions (study #4).

Overall, the findings from the four studies contribute to the collective knowledge about IT management innovations, an underexplored area in innovation studies. Furthermore, they provide additional insight to various theoretical gaps in the literature: the link between adopted EA and expected organizational benefits (Tamm et al. 2011), the processes that influence innovation changes in implementation (Lyytinen and Newman 2008), the role of alternative designs in widespread adoption of non-product innovations (Anderson and Tushman 1990), and the use of rhetoric for collective adoption rationales (Swanson and Ramiller 1997). These theoretical issues go beyond the Information Systems literature to apply to knowledge in management studies and organizational studies. The findings here also offer practical lessons to managers who are looking for ways to adopt and implement EA: what essential elements are important in EA implementation; why legal and ethical issues are critical in EA adoption for public organizations; what different EA designs mean in selecting EA frameworks; and how to use the know-how from the community.
In the following sections, I discuss the contributions for each study separately. Table 6.1 provides an overview of the contributions in this dissertation.

Study #1—EA Typologies Contributions

In the first study, the question is *how can organizations distinguish different types of EA frameworks?* Today, the number of existing EA frameworks is surprisingly high (Schekkerman 2004; Sessions 2007), and existing studies to make sense of and navigate these frameworks are far from satisfactory, with the focus mostly on the informative and descriptive levels. The first study seeks to overcome this empirical gap by proposing a typological theory of EA frameworks. Seven essential elements are suggested to inform organizations about how to distinguish existing EA frameworks and what elements are important to think about in relation to their adoption decisions. Together, these essential elements encapsulate the ideologies as well as the mechanisms of a given framework, allowing organizations to understand and distinguish EA frameworks. By understanding the different essential elements of frameworks, organizations can make better decisions in adapting or creating their own framework.

The seven essential elements provide a framework that goes beyond typical maturity models and links the type of EA adopted to the expected organizational benefits (Tamm et al. 2011). Most studies on EA frameworks have not linked the differences in EA frameworks (e.g., EA types) to reasons for EA adoption and/or to organizational benefits. In fact, it is generally believed that the types of outcomes will depend on the maturity of the EA program, i.e., *how well* or how intensively the organization adopts EA. The seven essential elements proposed here suggest that the benefits of EA implementation will
depend not only on *how well* the organization adopts EA, but *how* EA is implemented (i.e., what EA elements are adopted). For example, defining business EA layers would increase organizational alignment while defining technical EA layers would increase information availability. By understanding the differences in expected organizational benefits for each element, managers will have a better way to select and adopt an EA framework that fits their needs.

**Study #2—EA Adaptation and Reinvention Contributions**

The second study ponders *how do organizations adapt and/or reinvent IT management innovations (i.e. canonical EA frameworks)*? The findings help to clarify an important area related to innovation changes: the magnitude of change. This issue is important because the magnitude of change can clarify the nature and boundary of innovation changes. Furthermore, if organizations frequently adapt the innovation, a question arises as to what extent the innovation changes and at what point it becomes a different practice and can no longer be thought of as the same practice (Ansari et al. 2010). By distinguishing the magnitude, nature, and boundaries of innovation changes, one can then open the 'black-box' of innovation to understand the effects of changes.

The study suggests a reinvention process as an additional aspect to the typical adaptation process in the innovation change literature (Lyytinen and Newman 2008). The magnitude of innovation changes has two possible levels: organizational-level effects that can overcome misfits, and community-level effects that give rise to new types of innovation. Thus, adaptation can be operationalized as changes that are made to the innovation and organizational structure to overcome misfits, and their effects are organizational-level
effects. On the other hand, reinvention can be operationalized as changes made to the innovation can significantly move it away from existing normative implementation practices: that is, the way the innovation is often implemented in the community. Thus, reinvention involves large-scale adaptation events that have the potential to transform the innovation and have impacts at the community-level.

Lastly, the temporal patterns of innovation changes for each innovation element offer a potential research outlet. In the case studied, innovation practices follow an incremental change pattern while innovation concepts follow an episodic change pattern. Prior literature has suggested that the temporal patterns may depend on the nature of the technology: technology that has higher costs and more complexity to change may follow an episodic pattern while technology that has lower costs and higher malleability would incline toward a more continuous adaptation pattern (Majchrzak et al. 2000). The findings in this study suggest that the temporal patterns of change can also depend on what is being changed: innovation concepts, innovation objects, or innovation practices.

Study #3—EA Alternative Designs Contributions

Given the proliferation of existing EA frameworks (Schekkerman 2004), and the divergence of EA practices (Gall 2012), the third study examines how EA comes to achieve widespread adoption. Prior literature on dominant design suggests two premises: 1) a battle leads to a shakeout in the vendor community that will give rise to a dominant design of a product innovation; and 2) the dominant design signals to prospective adopters a period of stability and growth in which continuous vendors’ support is ensured, economies of scale are possible, and exploitation is encouraged. As a result, the
emergence of the dominant design subsequently leads to widespread adoption (Anderson and Tushman 1990; Suárez 2004; Tushman and Murmann 1998).

Lessons from examining the widespread adoption of EA in the U.S. State governments indicates that these two premises do not hold for IT management innovations. Despite the widespread adoption, no vendor shakeout is observed and several distinct ideal EA designs are currently promoted by EA vendors. Moreover, no convergence is observed in the actual EA implementations in the State governments. The findings suggest the possibility of alternative designs in widespread adoption of IT management innovations as opposed to a dominant design (Anderson and Tushman 1990).

Such possibility opens two immediate research opportunities for future studies. First, it allows innovation studies to move beyond the dominant paradigm of adoption studies—focusing only on the factors that impact dichotomous adoption decisions (Fichman 2004)—and to focus on the processes and factors that contribute to what exactly is being adopted, an area that has been largely ignored in the innovation literature. Future studies can identify organizational profiles that would favor certain innovation designs (e.g., decentralized IT organization would prefer technical EA design). Second, the possibility of alternative designs raises questions about factors and conditions that lead to alternative designs. Particularly, future studies can examine the diverging mechanisms that can still contribute to widespread adoption. In the case of EA, the different designs provide interpretive viability for adopters, leaving room for ambiguity to allow potential adopters to recognize their own versions of the innovation, and thus increasing the innovations’ attractiveness as well as increasing the size of potential markets (Benders and van Veen 2001).
Study #4—EA Rhetorical Persuasion Contributions

The last study focuses on the dynamics at the community level, asking *how EA promoters encourage EA adoption in a community*. The findings suggest that EA promoters rely on rhetoric to frame and encourage EA adoption in State governments. In particular, an effective collective adoption rationale needs to be developed and evolved to guide EA adoptions in a community. To make a compelling adoption rationale, the discourse provided by EA promoters needs to specify three elements of innovation rhetoric: problem specification, innovation specification, and innovation justification.

Furthermore, each of the elements needs to fit with the audience’s contingencies in order to create rhetorical congruence, thus increasing effectiveness of the collective-institutional accounts.

In addition, the study illustrates that while problem specification appears to be crucial, it should only be treated as a necessary rather than a sufficient condition. How the innovation is specified and justified also plays an important role in convincing audiences. Therefore, the findings here soften previous claims that a relevant business problem is sufficient for innovation promoters to promote the innovation (Wang 2009). On the contrary, while business problems play an important role, how the solution is structured and presented is just as important. In addition, the findings also suggest that innovation characteristics matter, and they should be considered in the rhetoric and presented in a way that fit to the audience’s contingencies.

The study confirms two prominent problems of creating a collective adoption rationale for widespread adoption: the persuasion and the evolution problem. This responds to
Strang and Meyer (1993) who suggested that the mere existence of a collective adoption rationale would not be sufficient for diffusion, and that the rationale needs to be compelling to relevant audiences. In fact, in order to be effective, collective adoption rationales, or cognitive-institutional accounts, need to remain compelling and continuously evolve to match their audience’s changing contingencies. Doing so increases the rhetorical congruence of the rationales, making it more relevant and appealing to the audience.

Future Research

The findings from this dissertation reveal valuable lessons about the adoption and diffusion of IT management innovations. The studies also suggest several potential future research opportunities.

Limited Diversity in Innovation Adoption

The example of EA implementation in U.S. States suggests that widespread adoption of IT management innovations can happen in the presence of alternative designs, where there is no sign of convergence. While this can partly be explained by the flexibility in IT management innovations, one is left wondering whether such limited convergence is more common than previously suggested. Prior theory (e.g., institutional theories, dominant design perspective, globalization studies) seems to suggest a convergence trend toward a dominant form of an innovation, or an isomorphic stage in which organizations embrace similar innovations due to institutional effects. I would like to further investigate this concept, asking in what situations we should expect convergence (i.e., dominant design) or diversity (i.e., alternate designs) in IT management innovation diffusion. This
question challenges conventional thinking that a single form of innovation is desired and expected by innovation promoters. On the contrary, it is possible that there are many but limited ways to adopt and reap the benefits of an innovation without forcefully going through one expected path. For example, in EA implementation, it has been argued that the degree of IT centralization in an IT organization would influence what EA design would be implemented (e.g., technical versus operational and strategic EA) (study #3). The reason is that EA is often considered an enterprise initiative that encourages the centralization of IT management: IT standards are mapped and standardized, decision making processes are documents and unified, and business processes are scrutinized. As a result, States that have a more decentralized IT culture would either have strong opposition from their agencies or do not feel a need to implement business EA layers (i.e., operational and strategic EA design); in this case having several different design options allows States to select options that suit their specific situations. Subsequently, possible opportunities for future research include considering the organizational profiles that favor certain innovation designs; factors and conditions that lead to alternative designs; and the adoption pattern with alternative designs.

Innovation Use Mechanisms and Organizational Outcomes

Like many other management innovations, IT management innovations also face the challenge of “a solution in search of a problem.” EA opponents have raised the issue of its value proposition, asking whether it can deliver the promised outcomes (Bradley et al. 2011; Tamm et al. 2011). The findings in this dissertation have suggested that the outcomes depend not only on how well an EA program is set up and developed (i.e., maturity model) but also how EA is implemented (study #1).
In addition, I argue that the expected outcomes also depend on how EA values are integrated into organizational practices (i.e., EA uses). The strategic EA design has focused exclusively on this issue, emphasizing ways that EA can be integrated into strategic planning and project lifecycles. However, what EA elements are implemented is only half of the battle, as true EA value can only come from its usage. And because usage is not built into systems by default (Markus and Keil 1994), EA architects also need to integrate usage into the systems. In recent years, EA scholars have promoted the need to link EA with other management practices as well as other IT initiatives (Kettinger et al. 2010; Ross and Beath 2006). These studies suggest the importance of investigating the different innovation usage mechanisms activated by the adopting organization to build usage into EA. By identifying these usage mechanisms, one can better explain the value proposition of EA.

Concluding Thoughts

The dissertation covers a wide range of issues in IT management innovation adoption and diffusion. In the end, some questions are answered (e.g., adaptation, reinvention, alternative designs, rhetorical persuasion), but new questions are also suggested (e.g., limited diversity, innovation use mechanisms). Yet, like an innovation journey that is dynamic and changes over time, the study of innovation also needs to remain active and evolve. To that end, this dissertation serves as a good theoretical foundation for future studies on innovation adoption and diffusion.
Chapter 1: Introduction

Table 1.1: Popular EA Frameworks in the U.S. Private and Public Sectors

<table>
<thead>
<tr>
<th>Private Sector Frameworks</th>
<th>Private Sector Frameworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Zachman Framework (<a href="http://www.zachman.com/">http://www.zachman.com/</a>)</td>
<td></td>
</tr>
<tr>
<td>• META’s Enterprise-wide Technical Architecture (EWTA)</td>
<td></td>
</tr>
<tr>
<td>• The Open Group Architecture Framework (TOGAF) (<a href="http://www.opengroup.org/togaf/">www.opengroup.org/togaf/</a>)</td>
<td></td>
</tr>
<tr>
<td>• Gartner Enterprise Architecture Framework (GEAF) (<a href="http://www.gartner.com/">http://www.gartner.com/</a>)</td>
<td></td>
</tr>
<tr>
<td>• Integrated Architecture Framework (IAF) (<a href="http://www.capgemini.com/">http://www.capgemini.com/</a>)</td>
<td></td>
</tr>
<tr>
<td>• Guide to the Enterprise Architecture Body of Knowledge (EABOK) (<a href="http://www2.mitre.org/public/eabok/">http://www2.mitre.org/public/eabok/</a>)</td>
<td></td>
</tr>
<tr>
<td>• The Federal of Enterprise Architecture Professional Organizations (FEAPO) (<a href="http://feapo.org/">http://feapo.org/</a>)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public Sector Frameworks</th>
<th>Public Sector Frameworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• DoD’s Technical Architecture Framework for Information Management (TAFIM)</td>
<td></td>
</tr>
<tr>
<td>• DoD’s C4ISR</td>
<td></td>
</tr>
<tr>
<td>• DoD’s Architecture Framework (<a href="http://dodcio.defense.gov/dodaf20.aspx">http://dodcio.defense.gov/dodaf20.aspx</a>)</td>
<td></td>
</tr>
<tr>
<td>• Treasury Enterprise Architecture Framework (TEAF)</td>
<td></td>
</tr>
<tr>
<td>• Federal Enterprise Architecture (FEA) (<a href="http://www.whitehouse.gov/omb/e-gov/fea">http://www.whitehouse.gov/omb/e-gov/fea</a>)</td>
<td></td>
</tr>
<tr>
<td>• NASCIO’s EA framework (<a href="http://www.nascio.org/resources/EAreources.cfm">http://www.nascio.org/resources/EAreources.cfm</a>)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Frameworks</th>
<th>Academic Frameworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Spewak’s Enterprise Architecture Planning (EAP) (Spewak and Hill 1993)</td>
<td></td>
</tr>
<tr>
<td>• MIT’s Center for Information Systems Research (CISR) framework (Ross et al. 2006)</td>
<td></td>
</tr>
<tr>
<td>• Extended Enterprise Architecture Framework (E2AF) (<a href="http://www.enterprise-architecture.info/">http://www.enterprise-architecture.info/</a>)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.2: Comparison of Three Streams of Diffusion Studies

<table>
<thead>
<tr>
<th>Definition</th>
<th>Classic diffusion Studies</th>
<th>Institutional Diffusion Studies</th>
<th>Cognitive-Institutional Diffusion Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A contact model of diffusion in which point-to-point</td>
<td>A macro model of diffusion in which the influences of context</td>
<td>A macro model of diffusion which focuses on processes that</td>
<td></td>
</tr>
<tr>
<td>Unit of Analysis</td>
<td>Questions</td>
<td>Causal Mechanism</td>
<td>Strengths</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Individuals</td>
<td>How is an innovation transferred between adopters?</td>
<td>Contagion mechanism which occurs when an adopter with actual or latent needs comes in contact with an innovation or representation of an innovation (e.g., a description, an advertisement) that meets the needs.</td>
<td>Focus on the direct benefits of innovations</td>
</tr>
<tr>
<td>Organizations in institutional contexts</td>
<td>How do institutional arrangements reproduce, diffuse, or decline in a population or organizational field?</td>
<td>Conformity mechanism which occurs when an organization complies with external influences or pressures. These influences or pressures can come from peers (i.e., imitation), from regulators or powerful organizations (i.e., coercion), or from standards and obligations (i.e., norms).</td>
<td>Focus on the indirect benefits of innovations (i.e., symbolic benefits)</td>
</tr>
<tr>
<td>Organizational community or population</td>
<td>How do institutions emerge to facilitate or constrain innovation adoption or social movements?</td>
<td>Social learning mechanism which occurs when prospective adopters obtain necessary knowledge and information from collective rationales.</td>
<td>Focus on institutional influences in decision making</td>
</tr>
</tbody>
</table>

**Triggers**
- Recognition of an innovation as a solution to particular needs.
- Concerns for the losses of non-adopter.
- The information threshold that the prospective adopter has to overcome in order to bypass certain levels of skepticism or concerns toward the innovation.

**Strengths**
- Focus on the direct benefits of innovations
- Focus on the indirect benefits of innovations (i.e., symbolic benefits)
- Focus on institutional influences in decision making

**Limitations**
- Limited consideration of institutional arrangements
- Overemphasize the effects of institutional arrangements
- Limited attention to adoption needs
institutional influences
• Assume with low uncertainty that the innovation is the solution
• Difficult to apply to complex innovation or organization-level adoption (Fichman 2000)

• Require presence of powerful regulators or organizations to exert their influences
• Assume high uncertainty for adoption to occur

• Limited attention to the fit between innovation characteristics and adopters

Examples

Classic model of diffusion (Rogers 2003; Ryan and Gross 1943)

Institutional theories (DiMaggio and Powell 1983; Tingling and Parent 2002), the management fashion theory (Abrahamson 1991)

Institutional work at macro level (Greenwood et al. 2002; Tolbert and Zucker 1996), the adaptive emulation model (Strang and Macy 2001), the organizing vision theory (Swanson and Ramiller 1997), technological action frames (Elliott and Kraemer 2008; Iacono and Kling 2001; Markus et al. 2008)

Table 1.3: Dissertation Studies Overview

<table>
<thead>
<tr>
<th>Study</th>
<th>Empirical Observations</th>
<th>Research Questions</th>
<th>Approach/Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1–EA typologies</td>
<td>Proliferation of EA frameworks in the field.</td>
<td>How can organizations distinguish the different types of EA frameworks?</td>
<td>A typological theory on EA frameworks (George and Bennett 2005).</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Study</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| #1–EA typologies | • Seven essential elements are recommended to make sense and distinguish EA frameworks.  
• Three types of EA frameworks are identified: technical EA, operational EA, and strategic EA.  
• Each type of EA framework can be linked to different organizational benefits. For example, technical EA frameworks will be more likely to increase information availability more than other frameworks. |
| #2–EA adaptation and reinvention | • Innovation changes include two possible processes: adaptation and reinvention.  
• Reinvention of innovation concepts is more likely to transform the innovation into a new type, pushing the boundary of innovation changes.  
• Legal and ethical issues are highly important for public organizations.  
• Changes happen in an incremental process for innovation practices while changes to innovation concepts often coupled with organizational jolts. |
| #3–EA alternative designs | • EA is widely initiated and adopted in the U.S. State governments, with 45 out of 50 States that have initiated or adopted EA.  
• Despite EA widespread adoption, there is no vendor shakeout. In fact, three ideal EA designs are widely promoted by EA vendors.  
• Despite EA widespread adoption, there is no convergence in U.S. State governments. Instead, four different EA designs are implemented in the States. They are both variations and exact designs promoted by EA vendors.  
• The existence of alternative designs may help to enrich the know-how and diffuse EA faster. |
#4—EA rhetorical persuasion
- EA promoters rely on rhetoric to frame and encourage EA adoption in State governments.
- The rhetoric needs to specify three elements: What is the business problem? What is the innovation? And how does the innovation address the problem?
- The framings need to evolve and adapt over time to the State CIOs’ contingencies to stay compelling.

Table 1.5: Summary of Contributions

<table>
<thead>
<tr>
<th>Study</th>
<th>Contributions</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1–EA typologies</td>
<td>Suggesting seven essential elements that inform organizations how to distinguish existing EA frameworks (Schekkerman 2004) and which elements are important to adopt. Providing a framework to go beyond typical maturity model and link the type of EA adopted to the expected organizational benefits (Tamm et al. 2011).</td>
</tr>
<tr>
<td>#2–EA adaptation and reinvention</td>
<td>Suggesting reinvention process as an additional aspect to the typical adaptation process in the innovation change literature (Lyytinen and Newman 2008). The magnitude of innovation changes has two possible levels: organizational-level effects that can overcome misfits, and community-level effects that give rise to new types of innovation. Specifying different elements in innovation changes, and theorizing that reinvention of innovation concepts has the most impact, and can push the boundary of innovation change to create a new type of innovation. Identifying legal and ethical dimensions of EA adoption as important issues for EA adoption in public organizations. Theorizing the different temporal patterns of innovation changes to different elements: innovation practices follow an incremental change pattern while innovation concepts follow an episodic change pattern.</td>
</tr>
<tr>
<td>#3–EA alternative designs</td>
<td>Identifying the possibility of alternative designs in widespread adoption of non-product innovations as opposed to a dominant design (Anderson and Tushman 1990). Opening the possibility for research on organizational profiles that favor certain innovation designs (e.g., decentralized IT organization would prefer technical EA design) as well as research on factors and conditions that lead to alternative designs.</td>
</tr>
</tbody>
</table>
#4 – EA rhetorical persuasion

- Suggesting a framework to study the evolution of innovation rhetoric at the community level. Four elements are needed: problem specification, innovation specification, innovation justification, and rhetorical congruence.
- Identifying two issues to which innovation promoters need to pay attention in their innovation rhetoric: being relevant to the audience’s contingencies and being adaptive to changes over time.

## Chapter 2: Enterprise Architecture Typologies

**Figure 2.1: EA Developments in the Public and Private Sector**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>Zachman’s IT Architecture paper</td>
</tr>
<tr>
<td>1989</td>
<td>TOGAF started</td>
</tr>
<tr>
<td>1994</td>
<td>MIT CISR’s EA approach</td>
</tr>
<tr>
<td>1996</td>
<td>DoD’s Architecture Framework</td>
</tr>
<tr>
<td>1997</td>
<td>DOAF v1.0</td>
</tr>
<tr>
<td>1999</td>
<td>FEAF v1.1</td>
</tr>
<tr>
<td>2003</td>
<td>NASCO’s EA Tool Kit v2.0</td>
</tr>
<tr>
<td>2005</td>
<td>Corner acquired META</td>
</tr>
</tbody>
</table>

Public Sector

Private Sector

Critical events in bold
Figure 2.2: Common EA Layers

Figure 2.3: TOGAF Methodology (left) and Enterprise Architecture Planning Methodology (right)

Table 2.1: Definitions of Enterprise Architecture

<table>
<thead>
<tr>
<th>References</th>
<th>EA Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zachman (1987)</td>
<td>Information Systems Architecture is made up from “a set of architectural representations” (p. 291) to “keep the business from disintegrating” (p. 276).</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Sowa and Zachman (1992)</td>
<td>Information Systems Architecture “provides a systematic taxonomy of concepts for relating things in the world to the representations in the computers ... It provides a way of viewing a system from many different perspectives and showing how they are all related” (p. 590).</td>
</tr>
<tr>
<td>Richardson et al. (1990)</td>
<td>Enterprise Architecture is “a dynamic information technology foundation that provides a direction for the deployment and integration of future technological and managerial developments...[It] defines and interrelated data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture” (p. 386).</td>
</tr>
<tr>
<td>2001</td>
<td>Enterprise Architecture defined as “a strategic information asset base, which defines the mission, the information necessary to perform the mission and the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs” (p. 5).</td>
</tr>
<tr>
<td>Bernard (2004)</td>
<td>Enterprise Architecture is “the analysis and documentation of an enterprise in its current and future states from an integrated strategy, business, and technology perspectives” (p. 31). “Enterprise Architecture is both a management program and a documentation method that together provides an actionable, coordinated view of an enterprise's strategic direction, business processes, information flows, and resource utilization” (p. 33).</td>
</tr>
<tr>
<td>GAO (2006)</td>
<td>“An enterprise architecture is a blueprint that describes the current and desired state of an organization or functional area in both logical and technical terms, as well as a plan for transitioning between the two states. Enterprise architectures are a recognized tenet of organizational transformation and IT management in public and private organizations” (p. 4).</td>
</tr>
<tr>
<td>Ross et al. (2006)</td>
<td>Enterprise architecture is “the organizing logic for business processes and IT infrastructure, reflecting the integration and standardization requirements of the company's operating model” (p. 9).</td>
</tr>
<tr>
<td>Lapkin (2006)</td>
<td>“Enterprise architecture is the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key principles and models that describe the enterprise’s future state and enable its evolution” (p. 3).</td>
</tr>
<tr>
<td>Kappelman et al. (2008)</td>
<td>“Enterprise Architecture has been suggested as the path to a comprehensive view of enterprise-wide requirements and thereby improved system interoperability and flexibility, as well as at least the onramps and signage on the highway to business-IT alignment” (p. 2).</td>
</tr>
<tr>
<td>Bradley et al. (2011)</td>
<td>“EA is the term used to describe the way in which a business logically organizes its IT infrastructure and business process capabilities to address its needs for IT and business process integration and standardization” (p. 73).</td>
</tr>
<tr>
<td>Tamm et al. (2011)</td>
<td>Enterprise Architecture (EA) is the “definition and representation of a high-level view of an enterprise's business processes and IT systems,</td>
</tr>
</tbody>
</table>
their relationships, and the extent to which these processes and systems are shared by different parts of the enterprise.” (p. 142).

### Table 2.2: Popular EA Frameworks in the U.S. Private and Public Sectors

<table>
<thead>
<tr>
<th>Private Sector Frameworks</th>
<th>Zachman Framework (<a href="http://www.zachman.com/">http://www.zachman.com/</a>)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>META’s Enterprise-wide Technical Architecture (EWTA)</td>
</tr>
<tr>
<td></td>
<td>The Open Group Architecture Framework (TOGAF) (<a href="http://www.opengroup.org/togaf/">www.opengroup.org/togaf/</a>)</td>
</tr>
<tr>
<td></td>
<td>Gartner Enterprise Architecture Framework (GEAF) (<a href="http://www.gartner.com/">http://www.gartner.com/</a>)</td>
</tr>
<tr>
<td></td>
<td>Integrated Architecture Framework (IAF) (<a href="http://www.capgemini.com/">http://www.capgemini.com/</a>)</td>
</tr>
<tr>
<td></td>
<td>Guide to the Enterprise Architecture Body of Knowledge (EABOK) (<a href="http://www2.mitre.org/public/eabok/">http://www2.mitre.org/public/eabok/</a>)</td>
</tr>
<tr>
<td></td>
<td>The Federal of Enterprise Architecture Professional Organizations (FEAPO) (<a href="http://feapo.org/">http://feapo.org/</a>)</td>
</tr>
<tr>
<td>Public Sector Frameworks</td>
<td>DoD’s Technical Architecture Framework for Information Management (TAFIM)</td>
</tr>
<tr>
<td></td>
<td>DoD’s C4ISR</td>
</tr>
<tr>
<td></td>
<td>DoD’s Architecture Framework (<a href="http://dodcio.defense.gov/dodaf20.aspx">http://dodcio.defense.gov/dodaf20.aspx</a>)</td>
</tr>
<tr>
<td></td>
<td>Treasury Enterprise Architecture Framework (TEAF)</td>
</tr>
<tr>
<td></td>
<td>Federal Enterprise Architecture (FEA) (<a href="http://www.whitehouse.gov/omb/e-gov/fea">http://www.whitehouse.gov/omb/e-gov/fea</a>)</td>
</tr>
<tr>
<td></td>
<td>NASCIO’s EA framework (<a href="http://www.nascio.org/resources/EAresources.cfm">http://www.nascio.org/resources/EAresources.cfm</a>)</td>
</tr>
<tr>
<td>Academic Frameworks</td>
<td>Spewak’s Enterprise Architecture Planning (EAP) (Spewak and Hill 1993)</td>
</tr>
<tr>
<td></td>
<td>MIT’s Center for Information Systems Research (CISR) framework (Ross et al. 2006)</td>
</tr>
<tr>
<td></td>
<td>Extended Enterprise Architecture Framework (E2AF) (<a href="http://www.enterprise-architecture.info/">http://www.enterprise-architecture.info/</a>)</td>
</tr>
</tbody>
</table>

### Table 2.3: Typical Roles and Governance Bodies in an EA Organization

<table>
<thead>
<tr>
<th>Roles/Governance bodies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Chief Architect or an EA Director</td>
<td>Act as a single contact point for the EA program. Oversee the EA development.</td>
</tr>
<tr>
<td>Several enterprise architects</td>
<td>The architects document and maintain different EA layers.</td>
</tr>
</tbody>
</table>
Enterprise Architecture Council (EAC) or Enterprise Architecture Steering Committee | Serves as the principal oversight body for enterprise architecture. It is charted with the implementation and governance of EA standards within the organization. The EAC often reports directly to a senior sponsor (e.g., CIO, CFO, CEO), and the Chief Architect is often the chair of EAC.

Architecture Review Board (ARB) | The ARB consists representatives from key functions to review and approve architecture standards, enforce standards, and provide guiding principles.

Architecture Forum | The forum provides a collaboration space for architects from different business units to unite and work on a mutual topic of interests, such as infrastructure standards or network standardization. The forum is optional and formed in voluntary basis.

<table>
<thead>
<tr>
<th>Essential Elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>The EA framework only specifies technical layers that define the hardware and software infrastructure (e.g., Technical Architecture), structure and relationship of information assets (e.g., Information Architecture), and the repositories of enterprise applications and their relationships (e.g., Application Architecture).</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td>The EA framework includes business layers that defines business organization, strategies, and models. They are clustered into domains based on their accountabilities and similarities over business processes.</td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>The methodology outlines the guideline or general approach of how to implement EA. Examples include transition plan or migration plan to move from an as-is to a to-be architecture.</td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td>The framework identifies the governance and decision-rights in order to create accountabilities and establish authorities for the program. For example, the creation of a Chief Enterprise Architect, or the establishment of an Enterprise Architecture Council.</td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td>The framework describes processes to operate and monitor EA development such as setting up new standards, providing exceptions, and evaluating EA development.</td>
</tr>
<tr>
<td>Enforcing EA values</td>
<td>The framework suggests mechanisms that can enforce EA values such as integrating EA into project lifecycle or investment lifecycle.</td>
</tr>
</tbody>
</table>

Table 2.4: Essential Elements of EA Frameworks
The framework recommends different ways to integrate EA values into strategic planning processes such as using EA documentation in the strategic planning and strategic formation processes.

**Table 2.5: Comparison of Popular Branded EA Frameworks in the Public Sector**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Enforcing EA values</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Integrating EA values</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.6: Profile of Ideal EA Types Promoted by EA Vendors**

<table>
<thead>
<tr>
<th></th>
<th>Technical EA (prior to 2000)</th>
<th>Operational EA (since 2000)</th>
<th>Strategic EA (since 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Enforcing EA values</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Integrating EA values</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Typologies</strong></td>
<td>Typologies based on essential elements</td>
<td>Typologies based on citation connections</td>
<td>Typologies based on management objectives</td>
</tr>
<tr>
<td><strong>Technical EA</strong></td>
<td><strong>Frameworks focus on technical layers and methodology</strong></td>
<td><strong>Research that provides the foundational structures of EA frameworks.</strong></td>
<td><strong>EA as advanced IS engineering, mostly developed using enterprise modelling techniques.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>E.g., Zachman, DoD, Open Group before 2003, Spewak</strong></td>
<td><strong>E.g., Zachman, Federal EA, Open Group</strong></td>
<td><strong>E.g., Zachman, Federal EA</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operational EA</strong></td>
<td><strong>Frameworks focus on all layers and establishing EA processes and governance</strong></td>
<td><strong>Research on design and operations of EA management which provides the details on EA management activities.</strong></td>
<td><strong>EA as advanced IS management that emphasize defining role models, designing IT processes, and defining decisions rights.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>E.g., Open Group after 2003, Federal EA, Association EA</strong></td>
<td><strong>E.g., Niemann (2006)</strong></td>
<td><strong>E.g., Open Group</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strategic EA</strong></td>
<td><strong>Frameworks focus on no particular layers but on strategic value of EA</strong></td>
<td><strong>Some research on EA conception and modeling concerns the use of EA models for decision making.</strong></td>
<td><strong>EA as strategic business management that focuses on aligning business-IT strategy, executing and transforming the enterprise, and including top managers in the EA development processes.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>E.g., MIT, Gartner</strong></td>
<td><strong>E.g., Johnson and Ekstedt (2007)</strong></td>
<td><strong>E.g., PwC framework, EBS Business School</strong></td>
</tr>
</tbody>
</table>
Table 2.8: Findings Summary

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>How can organizations discern the different types of EA frameworks?</td>
<td>Organizations can use seven essential elements identified in this paper to distinguish different EA frameworks.</td>
</tr>
<tr>
<td>What are the main types of EA frameworks commonly found in the field?</td>
<td>Three ideal types of EA frameworks are found: technical EA, operational EA, and strategic EA frameworks.</td>
</tr>
<tr>
<td>What are the expected organizational benefits for different types of EA frameworks?</td>
<td>Technical EA frameworks would increase information availability while operational and strategic EA frameworks would increase organizational alignment, resource portfolio optimization, and resource complementarity.</td>
</tr>
</tbody>
</table>

Chapter 3: Enterprise Architecture Adaptation and Reinvention

Figure 3.1: IT organizational structure of State Enterprise (with EA organization)
Figure 3.2: Adoption Events in the State Enterprise

- 1996: First…
- 1996: IT Architecture and Enterprise Policies created
- 1998: First CTO appointed
- 2000: SEAF v1.0 published
- 2000: SEAF v2.0 published
- 2002: SEAF v3.0 published
- 2002: SEAF v3.5 published
- 2004: SEAF v4.1 published
- 2004: SEAF v5.0 published
- 2006: SEAF v5.1 published
- 2006: State IT Consolidation

* Critical events are in bold
**Figure 3.3: EA Concepts and EA Practices Appropriated by the State Enterprise**

**Highlighted Text:**
- SEAF included open standards
- SEAF utilized a SOA approach
- SEAF includes both open standards and industry interoperability best practices
- 1998 IT Architecture and enterprise policies created
- 1996 first CIO appointed
- 1999 Federal EA started 2002 Association EA started
- State CTO appointed to oversee EA
- EA program created
- 2003 IT Commission Report
- 2003 CIO announced plan to adopt open standards
- HHS adopted SOA successfully
- 2004 Federal EA promoted SOA
- 2006 Association EA promoted SOA
- EA standards conformation required for IT proposals
- Enforcement lessons from state-funded projects
- Enterprise architects lent to agencies
- Legal advice sought for EA standards
- Decision Process created for agencies’ inputs
- Negative feedback on open standards
Figure 3.4: Temporal Patterns of Adaptation and Reinvention Events in State Enterprise

Table 3.1: Different Literature on Innovation Changes During Implementation Process

<table>
<thead>
<tr>
<th>Study</th>
<th>Conceptualization of innovation change</th>
<th>Definition</th>
<th>Innovation or technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice and Rogers (1980)</td>
<td>Reinvention</td>
<td>Reinvention is “the degree to which an innovation is changed by the adopter in the process of adoption and implementation after its original development” (p. 500-501). Reinvention may refer to both the changes in the innovation itself or in its usage.</td>
<td>Any innovation</td>
</tr>
<tr>
<td>Blakely et al. (1987)</td>
<td>Reinvention</td>
<td>“…reinvention could occur either as an addition to the original model or as a modification of existing program components” (p. 259).</td>
<td>Social program innovations</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Concept</td>
<td>Definition</td>
<td>Examples</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Leonard-Barton (1988)</td>
<td>Mutual adaptation</td>
<td>Implementation is a process of <em>mutual adaptation</em> that</td>
<td>Technical innovations such as expert systems, MRP program, automated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>includes the re-invention of the technology and the simultaneous adaptation of the organization (p. 253) between the technology and its environment.</td>
<td>purchasing system, CASE tool, structured system analysis, production process, and electromechanical pump.</td>
</tr>
<tr>
<td>Glick and Hays (1991)</td>
<td>Reinvention (vs. extension of innovation)</td>
<td>“reinvention is the modification by a user of a core innovation during the diffusion process; [extension of innovation] is the degree of adoption of a ‘constant’ innovation” (p. 837).</td>
<td>Policy innovations (e.g., living will laws).</td>
</tr>
<tr>
<td>Lewis and Seibold (1993)</td>
<td>Modification</td>
<td>Innovation modification is measured based on two dimensions: fidelity or degree of the innovation-in-use matches the intended use by designers, and uniformity or degree of the innovation-in-use varies across users.</td>
<td>Program innovation (a new line technician program for a production plant).</td>
</tr>
<tr>
<td>Poole and DeSanctis (1990); DeSanctis and Poole (1994)</td>
<td>Appropriation</td>
<td>Appropriation is defined as “the mode or fashion in which a group uses, adapts, and reproduces a structure” (Poole and DeSanctis 1990)(p. 184).</td>
<td>Group decision support systems.</td>
</tr>
<tr>
<td>Tyre and Orlikowski (1994)</td>
<td>Adaptation of technology-in-use</td>
<td>Technological adaptation refer to “adjustments and changes following installation of a new technology in a given setting” (p. 99).</td>
<td>Technological innovation (production equipment, CASE tools, personal computing tools).</td>
</tr>
<tr>
<td>Source</td>
<td>Type</td>
<td>Description</td>
<td>Context</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Czarniawska and Joerges (1996)</td>
<td>Translation</td>
<td>Innovation ideas are objectified, traveled across organizations, and translated into local meanings and materialized into local practices.</td>
<td>Any innovation.</td>
</tr>
<tr>
<td>Majchrzak et al. (2000)</td>
<td>Technology adaptation</td>
<td>“Adaptation is a process of modifying existing conditions in an effort to achieve alignment” (p. 572).</td>
<td>Technological innovations in malleable environment (collaborative technologies for virtual teams).</td>
</tr>
<tr>
<td>Ansari et al. (2010)</td>
<td>Adaptation</td>
<td>Adaptation “refers to the process by which an adopter strives to create a better fit between an external practice and the adopter's particular needs to increase its ‘zone of acceptance’ during implementation” (p. 71).</td>
<td>Any innovation.</td>
</tr>
<tr>
<td>Fedorowicz and Gogan (2010)</td>
<td>Reinvention</td>
<td>Reinvention refers to the changes or modifications made to an innovation following its adoption and the processes by which the innovation is changed by its adopters (p. 81).</td>
<td>Inter-organization IS innovations (Bio-Terror Surveillance System).</td>
</tr>
</tbody>
</table>
Table 3.2: Adaptation versus Reinvention

<table>
<thead>
<tr>
<th></th>
<th>Adaptation</th>
<th>Reinvention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>The process to change innovation and organizational structures/processes, usually for better fit.</td>
<td>The process by which innovation are changed from normative templates.</td>
</tr>
<tr>
<td>Focus</td>
<td>How the organizational structures/processes as well innovation are changed to address misfits. Organizational-level effects of changes.</td>
<td>How the modified innovations are different from normative templates or original designs. Organizational-level and potential community-level effects of changes.</td>
</tr>
<tr>
<td>Operationalization</td>
<td>Identify different misfits (e.g., technical, cultural, and political) and analyze how changes in innovation and organizational structures/processes overcome those misfits.</td>
<td>Identify core components or normative templates and compare them to the organization’s version for discrepancies.</td>
</tr>
<tr>
<td>Underlying theory</td>
<td>Structuration theories</td>
<td>Diffusion of innovation theories.</td>
</tr>
<tr>
<td>Key citations</td>
<td>Leonard-Barton (1988); Tyre and Orlikowski (1994); Majchrzak et al. (2000); Lyytinen and Newman (2008); Ansari et al. (2010).</td>
<td>Rice and Rogers (1980); Bauman et al. (1991); Lewis and Seibold (1993); Fedorowicz and Gogan (2010).</td>
</tr>
</tbody>
</table>

Table 3.3: Coding framework

<table>
<thead>
<tr>
<th>Coding Elements</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contextual events</td>
<td>Any significant events that were either mentioned by interviewees or had an impact on the EA development at State Enterprise.</td>
<td>The creation of the EA organization.</td>
</tr>
<tr>
<td>EA concepts</td>
<td>The ideas of how EA would be appropriated in State Enterprise.</td>
<td>It can include causal models that describe how EA works, guiding principles that explains how EA should be developed, or abstract models of IT functions. For example, a causal model of EA is the use of open standards for vendor independence.</td>
</tr>
</tbody>
</table>

231
EA practices | The actual organizational practices that are created and carried out as outcomes of EA implementation. | It includes changes to the governance and structure, or organizational routines to implement EA. For example, the formation of the Enterprise Architecture Committee or the conformity to EA standards in project proposals.

| Table 3.4: State Enterprise EA Concepts Compared to Association and Federal EA Concepts |
| --- | --- | --- |
| **Definition (What)** | Federal EA | Association EA | State EA (SEAF) |
| | EA is conceptualized as a strategic information asset base that defines business and technology to support operations (2001)(p. 5). | EA is conceptualized as a standard blueprint that supports the integration of information and services across agencies (NASCIO 2004b)(p. 12). | EA is conceptualized as an architectural framework that identifies the standards, specifications, and technologies for the State’s computing needs. |
| **Motivation (Why)** | EA will encourage IT-business alignment, integration, facilitating change, reducing development time, and converging standards. | EA will encourage information sharing, inter-agency collaboration, interoperability, and system integration. | The goals are to increase application integration, inter-agency collaboration, interoperability, responsiveness to changing needs, expand technology possibilities, reduce costs and enable consolidation of infrastructure. Furthermore, to achieve vendor independence, the State Enterprise emphasizes the use of open standards and industry interoperability best practices. |
| **Approach (How)** | Federal EA emphasizes establishing standards for cross- | Association EA emphasizes a holistic approach to managing the enterprise. More | The State Enterprise utilizes a hybrid approach in which the State specifies high-level.
<table>
<thead>
<tr>
<th></th>
<th>Federal EA</th>
<th>Association EA</th>
<th>State EA (SEAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set up</strong></td>
<td>An EA program should be created with defined responsibilities.</td>
<td>An EA program should be created with defined responsibilities.</td>
<td>State EA program was created and headed by State CTO. State Enterprise Architects are in charge of developing standards.</td>
</tr>
<tr>
<td></td>
<td>An Enterprise Life Cycle that defines the processes of changing the enterprise’s existing elements over time.</td>
<td>An Architecture Lifecycle Processes document the processes and templates used to develop architecture standards.</td>
<td>A Decision Process was created to allow new standards discussed and turned into enterprise standards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Legal advices are sought for EA standards to avoid future complications.</td>
</tr>
<tr>
<td><strong>Enforcement</strong></td>
<td>Integration of EA standards into Capital Planning and Investment Control process.</td>
<td>Unclear. There is an Architecture Compliance Process but only to determine the business case for any variation from the established standards.</td>
<td>State Enterprise Architects are lent or assigned to agencies’ projects that are large or use State IT funding.</td>
</tr>
</tbody>
</table>

*Table 3.5: State Enterprise EA Practices Compared to Association and Federal EA Practices*
Conformity to EA standards is required in new IT project proposals (from both agencies and vendors).

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Reinvention of EA concepts</td>
<td>A SOA approach was adopted for SEAF, one of the first States did so in the public sector. The Federal EA and Association EA did not have details on SOA at the time of SEAF’s SOA adoption.</td>
</tr>
<tr>
<td>2004</td>
<td>Reinvention of EA concepts</td>
<td>SEAF adopted open standards for its frameworks, being one of the first, and still among a few States that do so in the U.S. The Federal EA and Association EA did not have anything on open standards at that time.</td>
</tr>
<tr>
<td>2004</td>
<td>Adaptation of EA practices</td>
<td>State follows a hybrid approach between top-down and bottom-up instead of a holistic approach with tendency toward a top-down approach. The hybrid approach fits better to the Federal IT structure in State Enterprise.</td>
</tr>
<tr>
<td>2004</td>
<td>Adaptation of EA practices</td>
<td>State Enterprise only focuses on developing the Technology EA layers. This sufficiently accommodates the lack of power in the central IT unit.</td>
</tr>
<tr>
<td>2006</td>
<td>Adaptation of EA practices</td>
<td>Agencies are now required to comply with State EA, especially for projects that receive State IT funding or exceed $100,000 in IT proposals.</td>
</tr>
<tr>
<td>2006</td>
<td>Adaptation of EA practices</td>
<td>Learned from other IT policies, EA team lent out enterprise architects to agencies that receive State IT funding or exceed $100,000 in IT proposals.</td>
</tr>
<tr>
<td>2008</td>
<td>Reinvention of EA concepts</td>
<td>Industry interoperability best practices are included in SEAF’s standards in response to negative feedback on open standards.</td>
</tr>
<tr>
<td>2008</td>
<td>Adaptation of EA practices (Potentially a reinvention)</td>
<td>Due to the long debate over open standards, legal advice is now sought frequently for new standards introduced by SEAF.</td>
</tr>
</tbody>
</table>

Table 3.6: Summary of Adaptation and Reinvention Events at State Enterprise
Chapter 4: Enterprise Architecture Alternative Designs

Figure 4.1: Emergence of a Dominant Design Compared Against Adoption Curve

Figure 4.2: Number of State Initiated and Adopted EA by Year (45/50 States)
### Table 4.1: Comparing Product Innovations and IT Management Innovations

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Product Innovations</th>
<th>IT Management Innovations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definitions</strong></td>
<td>“A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses” (2005)(p. 48).</td>
<td>Innovative management practice, process, structure, or technique about IT activities (adopted from Birkinshaw et al. 2008). In other words, new ideas about how to organize and govern IT activities.</td>
</tr>
</tbody>
</table>

| Examples | Microprocessor, smartphone (e.g. iPhone). | IT outsourcing models, IT shared services model. |

| Characteristics | | |
|-----------------|-----------------|
| **Characteristics** | • Physical and material artifacts | • Conceptual components (e.g., models, principles, ideas) |
|                  | • Resource and capital intensive | • Knowledge intensive with high interpretive flexibility |
|                  | • Internal development (e.g., R&D) and/or external support (e.g., vendors) | • External influences (e.g., consultants) and internal appropriation |

| Implications to the Adoption | | |
|-----------------------------|-------------------|
| **Implications to the Adoption** | • Need continuous vendors’ support | • Less dependent on vendors’ support |
|                             | • Lock-in after purchase, limited adaptation and reinvention | • Higher chance of adaptation and reinvention |
|                             | • Rely on both internal and external sources for know-how | • Rely on external sources for know-how |

### Table 4.2: Commonly Found EA Frameworks

<table>
<thead>
<tr>
<th>Private Sector Frameworks</th>
<th>Zachman Framework (<a href="http://www.zachman.com/">http://www.zachman.com/</a>)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>META’s Enterprise-wide Technical Architecture (EWTA)</td>
</tr>
<tr>
<td></td>
<td>The Open Group Architecture Framework (TOGAF) (<a href="http://www.opengroup.org/togaf/">www.opengroup.org/togaf/</a>)</td>
</tr>
<tr>
<td></td>
<td>Gartner Enterprise Architecture Framework (GEAF) (<a href="http://www.gartner.com/">http://www.gartner.com/</a>)</td>
</tr>
<tr>
<td></td>
<td>Integrated Architecture Framework (IAF) (<a href="http://www.capgemini.com/">http://www.capgemini.com/</a>)</td>
</tr>
<tr>
<td></td>
<td>Guide to the Enterprise Architecture Body of Knowledge (EABOK) (<a href="http://www2.mitre.org/public/eabok/">http://www2.mitre.org/public/eabok/</a>)</td>
</tr>
<tr>
<td></td>
<td>The Federal of Enterprise Architecture Professional Organizations (FEAPO) (<a href="http://feapo.org/">http://feapo.org/</a>)</td>
</tr>
</tbody>
</table>
Public Sector Frameworks

- DoD’s Technical Architecture Framework for Information Management (TAFIM)
- DoD’s C4ISR
- DoD’s Architecture Framework (http://dodcio.defense.gov/dodaf20.aspx)
- Treasury Enterprise Architecture Framework (TEAF)
- Federal Enterprise Architecture (FEA) (http://www.whitehouse.gov/omb/e-gov/fea)
- NASCIO’s EA framework (http://www.nascio.org/resources/EArerources.cfm)

Academic Frameworks

- Spewak’s Enterprise Architecture Planning (EAP) (Spewak and Hill 1993)
- MIT’s Center for Information Systems Research (CISR) framework (Ross et al. 2006)
- Extended Enterprise Architecture Framework (E2AF) (http://www.enterprise-architecture.info/)

<table>
<thead>
<tr>
<th>Essential Elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>The EA framework only specifies technical layers that define the hardware and software infrastructure (e.g., Technical Architecture), structure and relationship of information assets (e.g., Information Architecture), and the repositories of enterprise applications and their relationships (e.g., Application Architecture).</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td>The EA framework includes business layers that defines business organization, strategies, and models. They are clustered into domains based on their accountabilities and similarities over business processes.</td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>The methodology outlines the guideline or general approach of how to implement EA. Examples include transition plan or migration plan to move from an as-is to a to-be architecture.</td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td>The framework identifies the governance and decision-rights in order to create accountabilities and establish authorities for the program. For example, the creation of a Chief Enterprise Architect, or the establishment of an Enterprise Architecture Council.</td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td>The framework describes processes to operate and monitor EA development such as setting up new standards, providing exception, and evaluating EA development.</td>
</tr>
</tbody>
</table>
Enforcing EA values | The framework suggests mechanisms that can enforce EA values such as integrating EA into project lifecycle or investment lifecycle.

Integrating EA values | The framework recommends different ways to integrate EA values into strategic planning processes such as using EA documentation in the strategic planning and strategic formation processes.

**Table 4.4: Comparison of Popular Branded EA Frameworks in the Public Sector**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enforcing EA values</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrating EA values</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

**Table 4.5: Profile of Ideal EA Alternative Designs Promoted by Vendors**

<table>
<thead>
<tr>
<th></th>
<th>Technical EA (prior to 2000)</th>
<th>Operational EA (since 2000)</th>
<th>Strategic EA (since 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Enforcing EA values</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Integrating EA values</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Table 4.6: EA Alternative Designs Implemented in the U.S. State Governments

<table>
<thead>
<tr>
<th></th>
<th>Technical EA (N = 8)</th>
<th>Operational EA (N = 2)</th>
<th>Technical-Operational EA (N = 10)</th>
<th>Strategic EA (N = 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR, CT, DE, IL, MA, OR, SC, VT</td>
<td>CO, MI</td>
<td>AZ, KS, KY, MD, MO, NM, NC, ND, UT, WA</td>
<td>CA, MN, VA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Defining EA technical layers</th>
<th>Defining EA business layers</th>
<th>Creating EA methodology</th>
<th>Organizing EA structure</th>
<th>Operating and monitoring EA</th>
<th>Enforcing EA values</th>
<th>Integrating EA values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>some</td>
<td>x</td>
</tr>
</tbody>
</table>

Table 4.7: Summary of Findings

<table>
<thead>
<tr>
<th>Findings</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA widespread adoption has occurred in the U.S. State government population.</td>
<td>By 2006, 50% of State governments have initiated or adopted EA. By 2012, 45 States have done so, accounting for 90% of the population.</td>
</tr>
<tr>
<td>Despite widespread adoption, vendor shakeout has not yet happened, and multiple ideal designs are still being promoted by EA vendors.</td>
<td>New EA frameworks are still being introduced into the field, and current frameworks have been refreshed frequently. Three ideal designs are identified, each has different features, assumptions, and approaches.</td>
</tr>
<tr>
<td>Despite widespread adoption, no convergence in EA adoptions is observed, and multiple designs are being implemented by U.S. State governments.</td>
<td>Four EA designs are identified, representing variations and exact adoption of the ideal designs promoted by EA vendors.</td>
</tr>
</tbody>
</table>
Chapter 5: Enterprise Architecture Rhetorical Persuasion

Figure 5.1: EA Adoptions and Considerations over the Year in the U.S. State Governments

Figure 5.2: A Framework to Evaluate Innovation Rhetoric Over Time
Table 5.1: Comparison of the three theories on cognitive-institutional account

<table>
<thead>
<tr>
<th>Reference</th>
<th>Organizing Vision Theory</th>
<th>Technology Action Frame Theory</th>
<th>Institutionalization Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive-Institutional Accounts</td>
<td>Organizing vision based on discourse about the innovation.</td>
<td>Technology action frames that provide social meanings of the innovation.</td>
<td>Theorized models which are abstract categories of adoption rationales.</td>
</tr>
<tr>
<td>Emphasis</td>
<td>What is the innovation? And how is the innovation implemented?</td>
<td>What is the innovation? And what potential does the innovation holds?</td>
<td>Why is the innovation needed?</td>
</tr>
<tr>
<td>Compelling Elements</td>
<td>The discourse should targets the audiences, and a business problematic that determines the vision’s perceived practical importance.</td>
<td>The frame needs to resonate well with the audiences and the overall cultural beliefs.</td>
<td>Theorizing (or framing) the innovation as a solution to a specified problem.</td>
</tr>
<tr>
<td>Strengths</td>
<td>Focus on innovation specification Pay attention to changes over time (i.e., career of the organizing vision).</td>
<td>Focus on innovation specification Focus on the perspective of innovation promoters in the constitution process.</td>
<td>Focus on problem specification and justification Utilized a perspective of innovation promoters.</td>
</tr>
<tr>
<td>Limitations</td>
<td>Lack attention on problem specification and justification. Lack details of the rhetorical dynamics over time.</td>
<td>Less details on problem specification and justification. Less emphasis on the rhetorical dynamics over time.</td>
<td>Lack attention on innovation specification, overemphasize problem specification. Lack focus on rhetorical dynamics over time.</td>
</tr>
</tbody>
</table>
Table 5.2: Significant Events at the U.S. State and Federal Governments Level

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>William J. Clinton takes office as the President of the U.S.</td>
</tr>
<tr>
<td>1995</td>
<td>The Internet era commenced with rapid growth of dot-com companies.</td>
</tr>
<tr>
<td>1996</td>
<td>The Clinger-Cohen Act enacted to reform IT management in federal agencies.</td>
</tr>
<tr>
<td>1999</td>
<td>The Federal Enterprise Architecture Framework v. 1.1 released to promote inter-agency collaboration.</td>
</tr>
<tr>
<td>1999</td>
<td>President Clinton’s Memorandum on e-government, first concrete attempt at government level.</td>
</tr>
<tr>
<td>2000</td>
<td>Dot-Com Bubble burst, and commencement of state fiscal crisis.</td>
</tr>
<tr>
<td>2001</td>
<td>George W. Bush takes office as the President of the U.S.</td>
</tr>
<tr>
<td>2001</td>
<td>9/11 attack, public safety and information sharing become crucial.</td>
</tr>
<tr>
<td>2004</td>
<td>Service Component-based Architectures White Paper released, encouraging shared services and reusable components.</td>
</tr>
<tr>
<td>2008</td>
<td>Subprime Mortgage crisis deepened budget deficit and triggered government transformation movement.</td>
</tr>
<tr>
<td>2009</td>
<td>Barack H. Obama takes office as the President of the U.S.</td>
</tr>
<tr>
<td>2009</td>
<td>First CIO of the United States was appointed.</td>
</tr>
<tr>
<td>2010</td>
<td>“25 Point Implementation Plan to Reform Federal IT Management” was issued, emphasizing consolidation, cloud computing, shared services, and collaboration.</td>
</tr>
</tbody>
</table>

Table 5.3: Coding and Analysis Framework

<table>
<thead>
<tr>
<th>Problem Specification</th>
<th>State CIOs’ contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What are the issues that State CIOs mostly concerned with?</td>
</tr>
<tr>
<td>• What are the problems specified in NASCIO text?</td>
<td></td>
</tr>
<tr>
<td>• How are the problem related to the State CIOs’ contingencies?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation Specification</th>
<th>State CIOs’ contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How are EA defined and specified in NASCIO text?</td>
<td></td>
</tr>
<tr>
<td>• How are EA framings (or specifications) related to the State CIOs’ contingencies?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation Justification</th>
<th>State CIOs’ contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How does NASCIO text relate or justify EA as the solution to the specified problems?</td>
<td></td>
</tr>
<tr>
<td>• How are the justification related to the States’ contingencies?</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.4: State CIOs' Contingencies

<table>
<thead>
<tr>
<th>Period</th>
<th>Environmental contingencies</th>
<th>State CIOs’ top priorities</th>
<th>State CIOs’ contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition Period: 2004-2005</td>
<td>State fiscal crises were worsen, and states needed to comply with privacy and security laws (e.g., HIPPA, the Privacy Act).</td>
<td>IT procurement, information security, privacy, interoperability and integration.</td>
<td>Budget deficit and competing priorities continue to make it difficult to justify and adopt EA. Some states also looked at consolidation and shared services as potential solutions for the crisis.</td>
</tr>
<tr>
<td>Stabilization Period: 2005-2011</td>
<td>The Subprime Mortgage crisis in 2008 made it one of the worst fiscal crises for state governments.</td>
<td>Consolidation, shared services, and budget control are the new top priorities for state CIOs.</td>
<td>Budget deficit and competing priorities continue to make it difficult to justify and adopt EA. Emerging concepts like cloud computing or mobile computing also increasingly capture the attention of state CIOs.</td>
</tr>
</tbody>
</table>

Table 5.5: NASCIO Rhetoric During the Initial Period: 2000-2004

<table>
<thead>
<tr>
<th>Problem Specification</th>
<th>State CIOs’ Contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Information sharing and interoperability between government agencies are important issues for governmental agencies.</td>
<td>• Budget deficit and competing priorities make it difficult to justify and adopt EA.</td>
</tr>
<tr>
<td>• Information sharing can increase accurateness, completeness, timely, and cost efficiency</td>
<td>• Top priorities for State CIOs: IT outsourcing, IT procurement, homeland security, e-government.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation Specification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• EA is a blue print to integrate information and services.</td>
<td></td>
</tr>
<tr>
<td>• EA can enhance government functions and allow data to flow from agency to agency.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation Justification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• EA is essential to create cross-jurisdictional. information flow and process coordination.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5.6: NASCIO rhetoric during the Transition Period: 2004-2005

<table>
<thead>
<tr>
<th><strong>Problem Specification</strong></th>
<th><strong>State CIOs’ Contingencies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• A need to improve information sharing and</td>
<td>• Short CIO tenure, budget deficit and competing priorities continue to make it difficult</td>
</tr>
<tr>
<td>service delivery among agencies.</td>
<td>to justify and adopt EA.</td>
</tr>
<tr>
<td>• Sharing information makes better government,</td>
<td>• Top priorities for State CIOs: IT procurement, information security, privacy, interoperability</td>
</tr>
<tr>
<td>minimizes clerical errors, information</td>
<td>and integration.</td>
</tr>
<tr>
<td>discrepancies, and government loopholes.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Innovation Specification</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• EA is an operating discipline to manage business</td>
<td>• EA can establish commonalities and standards.</td>
</tr>
<tr>
<td>and technology solutions.</td>
<td></td>
</tr>
<tr>
<td>• EA can establish commonalities and standards.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Innovation Justification</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• EA enables information sharing, and improves</td>
<td>• EA helps states to establish initiatives (e.g., change management, electronic record</td>
</tr>
<tr>
<td>government functions and services.</td>
<td>management) that transform the government.</td>
</tr>
<tr>
<td>• EA can create commonality, increase capability</td>
<td></td>
</tr>
<tr>
<td>to deliver effective information and services,</td>
<td></td>
</tr>
<tr>
<td>and reduce operation costs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 5.7: NASCIO rhetoric during the Stabilization Period: 2005-2011

<table>
<thead>
<tr>
<th><strong>Problem Specification</strong></th>
<th><strong>State CIOs’ Contingencies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Government transformation and top priorities</td>
<td>• Budget deficit and competing priorities continue to make it difficult to justify and adopt</td>
</tr>
<tr>
<td>for State CIOs are critical issues for State</td>
<td>EA.</td>
</tr>
<tr>
<td>governments.</td>
<td>• Top priorities for State CIOs: consolidation, shared services, and budget control.</td>
</tr>
<tr>
<td>• Those various challenges require government</td>
<td></td>
</tr>
<tr>
<td>transformation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Innovation Specification</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• EA is a management engineering discipline.</td>
<td>• EA can help States to manage government complexities.</td>
</tr>
<tr>
<td>• EA can help States to manage government</td>
<td></td>
</tr>
<tr>
<td>complexities.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Innovation Justification</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• EA helps states to establish initiatives (e.g.,</td>
<td>• EA helps states to establish initiatives (e.g., change management, electronic record</td>
</tr>
<tr>
<td>change management, electronic record management)</td>
<td>management) that transform the government.</td>
</tr>
</tbody>
</table>
Table 5.8: Evolution of NASCIO’s Rhetoric (2000-2011)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment contingencies</td>
<td>State fiscal crises, 9/11 attack, E-Government Act</td>
<td>State fiscal crises, privacy and security regulations</td>
<td>Subprime Mortgage crisis</td>
</tr>
<tr>
<td>CIO contingencies and top priorities</td>
<td>Budget deficit and competing priorities (outsourcing, procurement, security, e-government)</td>
<td>Budget deficit and competing priorities (procurement, security, privacy, interoperability and integration)</td>
<td>Budget deficit and competing priorities (consolidation, shared services, and budget control)</td>
</tr>
<tr>
<td>Problem specification (why-rhetoric)</td>
<td>Information sharing</td>
<td>Information sharing and service delivery</td>
<td>Government transformation and top CIO priorities</td>
</tr>
<tr>
<td>Innovation specification (what-rhetoric)</td>
<td>EA as a blue print (technical-oriented)</td>
<td>EA as an operating discipline (business-oriented)</td>
<td>EA as a management engineering discipline (business-oriented)</td>
</tr>
<tr>
<td>Innovation justification (how-rhetoric)</td>
<td>EA increases integration of information and services</td>
<td>EA increases capabilities to deliver effective information and services</td>
<td>EA helps to achieve top initiatives that transform the government.</td>
</tr>
</tbody>
</table>

Chapter 6: Discussion and Conclusion

Table 6.1: Summary of Contribution

<table>
<thead>
<tr>
<th>Study</th>
<th>Contributions</th>
</tr>
</thead>
</table>
| #1–EA typologies               | • Suggesting seven essential elements that inform organizations how to distinguish existing EA frameworks (Schekkerman 2004) and what elements are important to adopt.  
• Providing a framework to go beyond typical maturity model and link the type of EA adopted to the expected organizational benefits (Tamm et al. 2011). |
| #2–EA adaptation and reinvention | • Suggesting reinvention process as an additional aspect to the typical adaptation process in the innovation change literature (Lyytinen and Newman 2008). The magnitude of innovation changes has two possible levels: organizational-level effects that can overcome misfits, and community-level effects that give rise to new types of innovation. |
| #3–EA alternative designs | • Specifying different elements in innovation changes, and theorizing that reinvention of innovation concepts has the most impact, and can push the boundary of innovation change to create a new type of innovation.  
• Identifying legal and ethical dimensions of EA adoption as important issues for EA adoption in public organizations.  
• Theorizing the different temporal patterns of innovation changes to different elements: innovation practices follow an incremental change pattern while innovation concepts follow an episodic change pattern.  
| #4–EA rhetorical persuasion | • Identifying the possibility of alternative designs in widespread adoption of non-product innovations as opposed to a dominant design (Anderson and Tushman 1990).  
• Opening the possibility for research on organizational profiles that favor certain innovation designs (e.g., decentralized IT organization would prefer technical EA design) as well as research on factors and conditions that lead to alternative designs.  
• Suggesting a framework to study the evolution of innovation rhetoric at the community level. Four elements are needed: problem specification, innovation specification, innovation justification, and rhetorical congruence.  
• Identifying two issues to which innovation promoters need to pay attention in their innovation rhetoric: being relevant to the audience’s contingencies and being adaptive to changes over time.  

Appendix A: Data Sources

<table>
<thead>
<tr>
<th>#</th>
<th>Informant</th>
<th>Positions held</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Director of State EA team</td>
<td>Department EA development Director of State EA team</td>
<td>Jan 2011</td>
</tr>
<tr>
<td>2</td>
<td>EA team member #1</td>
<td>EA team member</td>
<td>March 2011</td>
</tr>
<tr>
<td>3</td>
<td>EA team member #2</td>
<td>EA team member&lt;br&gt;EA liaison for two departments</td>
<td>March 2011</td>
</tr>
<tr>
<td>4</td>
<td>State CTO&lt;br&gt;Office visit #1</td>
<td>State CTO&lt;br&gt;Department CTO</td>
<td>April 2013</td>
</tr>
<tr>
<td>5</td>
<td>Department EA team leader&lt;br&gt;Office visit #2</td>
<td>Department EA team leader</td>
<td>April 2013</td>
</tr>
<tr>
<td>6</td>
<td>Formal State deputy CIO</td>
<td>Formal State deputy CIO</td>
<td>September 2013</td>
</tr>
<tr>
<td>7</td>
<td>Formal State CIO</td>
<td>Formal State CIO&lt;br&gt;Formal agency CIO&lt;br&gt;Formal bureau CIO</td>
<td>September 2013</td>
</tr>
</tbody>
</table>

Appendix B: Interview Questions

The interview questions were semi-structured based on the following categories with sample questions:

1. The definition/meaning of EA in the state:
   - What is the role/involvement of the interviewee to EA efforts?
   - What does EA mean to the State government? Any change over time?
   - Why does EA have that meaning/role? How is the concept of EA developed? How is it motivated? Any change over time?
   - How is your EA framework different from other frameworks that you know of?

2. The implementation of EA concepts
   - How is EA implemented in your State? And why?
   - What is the structure of your organization? What is the structure of your EA team? What is the role of EA in the State management plan/practice? What is EA’s role in relation with other initiatives?
   - How is EA practices implemented in other agencies? How do you have their support?

3. The benefits/outcomes of Enterprise Architecture in the state
   - What are the results and outcomes from EA implementation? Immediate and/or indirect results. Reasons for those results?
   - Do you feel EA fulfill the original objectives? Why or why not?
4. Concluding notes:
   - Any further development, implementations come out of EA (e.g. data management, business analytics, geospatial data)
   - Any significant events about EA over the year? How is EA doing in general?
   - Any suggestions for interview? Anything that I’ve missed? Who can I talk to for further understanding?

Appendix C: Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Association EA</td>
<td>The EA frameworks developed by the National Association of State Chief Information Officers (NASCIO) Source: <a href="http://www.nascio.org/resources/EAresources.cfm">http://www.nascio.org/resources/EAresources.cfm</a></td>
</tr>
<tr>
<td>Blanket Purchase Order</td>
<td>A purchase order with specific suppliers, often negotiated with predetermined terms and conditions Source: <a href="http://en.wikipedia.org/wiki/Blanket_order">http://en.wikipedia.org/wiki/Blanket_order</a></td>
</tr>
<tr>
<td>COBIT</td>
<td>The Control Objectives for Information and related Technology (COBIT) is a framework for the governance and management of enterprise IT. Source: <a href="http://www.isaca.org/COBIT/Pages/default.aspx?cid=1003566&amp;Appeal=PR">http://www.isaca.org/COBIT/Pages/default.aspx?cid=1003566&amp;Appeal=PR</a></td>
</tr>
<tr>
<td>Enterprise Service Bus</td>
<td>Enterprise Service Bus is a software architecture model that allow communication between software applications in a Service-Oriented Architecture (SOA) Source: <a href="http://en.wikipedia.org/wiki/Enterprise_service_bus">http://en.wikipedia.org/wiki/Enterprise_service_bus</a></td>
</tr>
<tr>
<td>Federal EA</td>
<td>The EA frameworks developed for federal agencies by the Federal CIO Council and later by the U.S. Office of Management and Budget Source: <a href="http://www.whitehouse.gov/omb/egov/fea">http://www.whitehouse.gov/omb/egov/fea</a></td>
</tr>
<tr>
<td>Human Resources Management (HRM)</td>
<td>Human Resources Management System is an enterprise system that provides the HR functions (e.g., payroll, time management, benefits administration) Source: <a href="http://en.wikipedia.org/wiki/Human_resource_management_system">http://en.wikipedia.org/wiki/Human_resource_management_system</a></td>
</tr>
<tr>
<td>IT Center</td>
<td>The central IT organization that acts as an oversight unit for State Enterprise’s IT needs.</td>
</tr>
<tr>
<td>ITIL</td>
<td>The Information Technology Infrastructure Library (ITIL) offers a set of best-practices for IT service management. Source: <a href="http://www.itil-officialsite.com/">http://www.itil-officialsite.com/</a></td>
</tr>
<tr>
<td>SOA</td>
<td>Service-Oriented Architecture (SOA) is a software design approach that utilize pieces of software providing application functionality as services</td>
</tr>
<tr>
<td>EA Framework</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>State EA of SEAF</td>
<td>The EA frameworks developed by the State Enterprise.</td>
</tr>
<tr>
<td>UDDI</td>
<td>Universal Description, Discovery, and Integration services provide organizations the capability to store and share information about web services within the organization’s intranet or on the Internet. The UDDI services allow developers to search for and reuse programmatic resources (e.g., development code) in order to improve productivity. More info: <a href="http://msdn.microsoft.com/en-us/library/cc731374.aspx">http://msdn.microsoft.com/en-us/library/cc731374.aspx</a></td>
</tr>
</tbody>
</table>

### Appendix D: Essential Elements of EA Frameworks

Numerous EA frameworks are found in both the public and private sectors (Schekkerman 2004; Sessions 2007; Simon et al. 2013). Do they represent different designs of EA, or are they only variations of the same type? To compare the different EA frameworks, it is necessary to identify their essential elements.

In the policy research literature, in order to evaluate and compare different policies, Bardach (2009) suggests that a policy can be characterized by its essential and supportive elements. Essential elements provide the causal mechanisms for the intended values, while supportive elements are optional to the intended benefits of a policy. For example, a milestone payment program would include several essential elements: defining milestones, describing milestones, measuring and assessing the effectiveness of the milestones. On the other hand, having a one-to-one discussion while defining milestones would be an optional and supportive element. By identifying essential elements for a policy, one would be able to compare across the implemented policies for discrepancies.
In the context of Enterprise Architecture—an IT management program—several essential elements have been commonly found across EA frameworks as well as been discussed by the academics and practitioners. They are described in details below.

(1) **Defining EA layers:** One of the tasks of an EA framework is to establish the different EA layers to guide IT standards and procedures (Simon et al. 2013). Four layers are commonly found: Business, Information, Application, and Technical or Technology. They can be presented in architecture forms—documentation about processes, strategies, models, and standards, or in reference forms—taxonomy of common terms and definitions. The reference models can also be used to categorize and group similar processes, strategies, and models that specified by the architectures. The four layers are described as below:

- **Business EA layers** commonly specify business organization, strategies, and models (Simon et al. 2013). They group business functions and related objects into clusters (or domains) that can provide accountabilities and commonalities over business processes (Versteeg and Bouwman 2006). For example, a business architecture for a global enterprise can divide their processes into geographical locations such as world level (e.g., global sales function, account management function), regional level (e.g., EU product processor), and country level (e.g., domestic payment, collections, claims) (Versteeg and Bouwman 2006).

- **Application EA layers** define the necessary applications to support the business processes, and specify the relationships between those applications and/or how to develop them. For example, the NASCIO EA framework suggests to build the Application Architecture around the following constructs: an enterprise
application portfolio that provides the inventory of current applications, design models that guide the development processes, and design patterns that specify pre-defined configurations for the development (NASCIO 2004b).

- Information EA layers provides an organization of the enterprise information assets (structured, unstructured, or semi-structured information) that is needed for the business processes and enterprise applications. They outline how the enterprise data and information are stored and accessed, as well as their relationship to business processes, business management, and IT systems. For example, the Information Architecture can specify the physical repositories for operational and analytical data (e.g., customers, products, sales) in different formats (e.g., documents, images, web), as well as define the schema, data flows, and logical models to map the applications to those repositories (Leganza 2010).

- Technical EA layers describe the hardware and software infrastructure that support applications and their interactions. Different IT standards, structures, and relationship between technologies are included in technical EA layers. Thus, they provide a blueprint for IT at different levels. For example, NASCIO defines five levels in their Technical Architecture: domains, disciplines, technology areas, product components, and compliance components (NASCIO 2004b).
Furthermore, the EA literature has also distinguished between Business Architecture and other layers. Scholars have argued that Business Architecture is a distinct layer that can differentiate EA implementations (Bouwman et al. 2011; Ulrich and McWhorter 2010; Versteeg and Bouwman 2006). The Business Architecture enables a stronger connection between IT-business strategies and signal an enterprise approach rather than a silo technical approach. Thus, for the first essential element, I also distinguish between business EA layers (e.g., Business Architecture) and technical EA layers (e.g., Technical Architecture, Information Architecture, Application Architecture). The element is split into two:

**1) Defining EA technical layers**: The EA framework only specifies technical layers such as Technical Architecture, Information Architecture, and Application Architecture.

**2) Defining EA business layers**: The EA framework includes business layers such as Business Architecture or Business Reference Model.
(3) Creating EA methodology: Another essential task of an EA framework is to create a methodology that provides an outline or general approach toward developing EA, often represented in meta-models (Simon et al. 2013). The methodology presents a transitional plan to move from as-is to to-be architectures, or a migration plan to step-by-step transform the architecture. For example, TOGAF includes an Architecture Development Method for EA developments which starts with creating architecture vision, establishing different EA layers, setting migration plan, creating implementation governance, and incorporating change management. The Enterprise Architecture Planning method proposed by (Spewak and Hill 1993) follows a “layer cake” approach in which development activities are divided into layers of priorities: getting started (layer 1); modeling current business and technology systems (layer 2); defining future architecture for data, applications, and technology (layer 3); and outlining an implementation plan (layer 4).

Figure D.3: TOGAF Methodology (left) and Enterprise Architecture Planning Methodology (right)
(4) **Organizing EA structure**: An EA framework needs to define the governance and decision-rights in order to create accountabilities and establish authorities for the program. The EA organization includes several positions, each with specific responsibilities. Examples of this step include setting up a Chief Enterprise Architecture, identifying sponsor, or assigning enterprise architects. Table 9 provides a list of typical roles and governance bodies in an EA organization (2001; Ahlemann et al. 2012; NASCIO 2004b).

**Table D.1: Typical Roles and Governance Bodies in an EA Organization**

<table>
<thead>
<tr>
<th>Roles/Governance bodies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Chief Architect or an EA Director</td>
<td>Act as a single contact point for the EA program. Oversee the EA development.</td>
</tr>
<tr>
<td>Several enterprise architects</td>
<td>The architects document and maintain different EA layers.</td>
</tr>
<tr>
<td>Enterprise Architecture Council (EAC) or Enterprise Architecture Steering Committee</td>
<td>Serves as the principal oversight body for enterprise architecture. It is charted with the implementation and governance of EA standards within the organization. The EAC often reports directly to a senior sponsor (e.g., CIO, CFO, CEO), and the Chief Architect is often the chair of EAC.</td>
</tr>
<tr>
<td>Architecture Review Board (ARB)</td>
<td>The ARB consists representatives from key functions to review and approve architecture standards, enforce standards, and provide guiding principles.</td>
</tr>
<tr>
<td>Architecture Forum</td>
<td>The forum provides a collaboration space for architects from different business units to unite and work on a mutual topic of interests, such as infrastructure standards or network standardization. The forum is optional and formed in voluntary basis.</td>
</tr>
</tbody>
</table>

(5) **Operating and monitoring EA processes**: The next essential element of an EA framework is the processes to operate and monitor EA development. Those processes often include suggesting new standards, evaluating the proposed standards, exempting agencies from certain standards, and continuously assessing the standard development
processes. For this purpose, Ahlemann et al. (2012) suggested to incorporate EA values into change management processes, using four steps: collecting change requests, assessing changes, implementing changes, and monitoring EA. Several maturity models have also been proposed to assess the development of an EA program (e.g., FEA maturity model, Gartner maturity model).

(6) Enforcing EA values: In order to have an effective EA program, additional steps need to be taken to enforce EA values. Most EA frameworks suggest an integration of EA milestones into project lifecycle or investment lifecycle (1999; Ahlemann et al. 2012). Overall, there are three modes of EA integration in the project lifecycle (Ahlemann et al. 2012):

- Advising: the enterprise architects assist with and advise on project execution. Depending on projects, the architects can provide needed information, give advice, and help monitor the project execution.
- Participating: when the management support is sufficient, the enterprise architects can exercise certain control over project execution such as voting on project decisions or issuing rules for project execution.
- Managing: in cases where EA team has strong influence, they can actively engage in the management of project execution and even drive the implementation process (e.g., defining EA-related project goals, creating EA reporting processes)

(7) Integrating EA values into strategic planning: Many scholars have recommended another essential element to realize the benefits of an EA program is to integrate EA values into strategic planning processes (Ahlemann et al. 2012; Weiss et al. 2005). This allows organizations to make strategic directions that are coherent to the enterprise
directions and exploit the capabilities created by Enterprise Architecture. Following this approach, the EA practices would complement other management practices (e.g., strategy planning, strategy formulation); the EA documentation would be a collaboration between managers, architects, documentation, and employees; top management is involved throughout the development, and strategic initiatives is guided by EA values. Similarly, the Gartner Consulting team suggested that architecting IT models was only a small part of enterprise architects’ job, and that much of their time should be spent on strategizing, communicating, leading and governing (James et al. 2005; Lapkin 2005).

All together, the seven essential elements of an EA framework and an EA program are summarized in Table D.2.

Table D.2: Essential EA Elements

<table>
<thead>
<tr>
<th>Essential Elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining EA technical layers</td>
<td>The EA framework only specifies technical layers that define the hardware and software infrastructure (e.g., Technical Architecture), structure and relationship of information assets (e.g., Information Architecture), and the repositories of enterprise applications and their relationships (e.g., Application Architecture).</td>
</tr>
<tr>
<td>Defining EA business layers</td>
<td>The EA framework includes business layers that defines business organization, strategies, and models. They are clustered into domains based on their accountabilities and similarities over business processes.</td>
</tr>
<tr>
<td>Creating EA methodology</td>
<td>The methodology outlines the guideline or general approach of how to implement EA. Examples include transition plan or migration plan to move from an as-is to a to-be architecture.</td>
</tr>
<tr>
<td>Organizing EA structure</td>
<td>The framework identifies the governance and decision-rights in order to create accountabilities and establish authorities for the program. For example, the creation of a Chief Enterprise Architect, or the establishment of an Enterprise Architecture Council.</td>
</tr>
<tr>
<td>Operating and monitoring EA</td>
<td>The framework describes processes to operate and monitor EA development such as setting up new</td>
</tr>
</tbody>
</table>
standards, providing exception, and evaluating EA development.

<table>
<thead>
<tr>
<th>Enforcing EA values</th>
<th>The framework suggests mechanisms that can enforce EA values such as integrating EA into project lifecycle or investment lifecycle.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrating EA values</td>
<td>The framework recommends different ways to integrate EA values into strategic planning processes such as using EA documentation in the strategic planning and strategic formation processes.</td>
</tr>
</tbody>
</table>

### Appendix E: State CIOs’ Priorities over the Year

Since 2005, NASCIO has regularly asked their State CIO members to identify upcoming IT trends and IT management concerns for the upcoming year in their annual conference. These issues were combined as the top priorities faced by State CIOs in the U.S. governments in a given year. I collected these priorities from NASCIO’s websites (http://www.nascio.org/publications/) as well as the Internet archival database (https://archive.org/web/). For years that lack of data (i.e., before 2005), I examined the presentations, CIO roundtables, and discussions in NASCIO’s annual conferences. The top ten State CIO’s priorities are listed below.

<table>
<thead>
<tr>
<th>Priority</th>
<th>2002</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E-government</td>
<td>IT Governance</td>
<td>Information Security</td>
</tr>
<tr>
<td>2</td>
<td>Homeland Security</td>
<td>IT Procurement</td>
<td>IT Procurement Reform</td>
</tr>
<tr>
<td>3</td>
<td>Outsourcing</td>
<td>Privacy</td>
<td>Privacy</td>
</tr>
<tr>
<td>4</td>
<td>Relations with the private sector</td>
<td>Economic Development: E-government</td>
<td>Interoperability and Integration</td>
</tr>
<tr>
<td>5</td>
<td>IT spending plans and priorities</td>
<td>Homeland Security</td>
<td>Enterprise Architecture</td>
</tr>
<tr>
<td>6</td>
<td>CIO roles and responsibilities</td>
<td>Interoperability and Integration</td>
<td>IT Governance and Services Reform</td>
</tr>
<tr>
<td>Priority</td>
<td>2006</td>
<td>2007</td>
<td>2008</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------</td>
<td>---------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Consolidation</td>
<td>Information Security</td>
<td>Consolidation</td>
</tr>
<tr>
<td>2</td>
<td>Information Security</td>
<td>Consolidation</td>
<td>Information Security</td>
</tr>
<tr>
<td>3</td>
<td>Enterprise Architecture and Standards</td>
<td>Shared Services</td>
<td>Disaster Recovery/Business Continuity</td>
</tr>
<tr>
<td>4</td>
<td>Disaster Recovery/Business Continuity</td>
<td>Cross-boundary Collaboration</td>
<td>Electronic Records Management/Preservation/e-Discovery</td>
</tr>
<tr>
<td>5</td>
<td>IT Governance Structure</td>
<td>Disaster Recovery/Business Continuity</td>
<td>Health Information Technology</td>
</tr>
<tr>
<td>6</td>
<td>ERP Implementation</td>
<td>Health Information Technology</td>
<td>Shared Services</td>
</tr>
<tr>
<td>7</td>
<td>Strategic IT Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Health Information Technology</td>
<td></td>
<td>IT Governance</td>
</tr>
<tr>
<td>9</td>
<td>Interoperability</td>
<td></td>
<td>Interoperability</td>
</tr>
<tr>
<td>10</td>
<td>Infrastructure Modernization</td>
<td></td>
<td>Human Capital/ IT Work Force</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Priority</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consolidation</td>
<td>Budget and Cost Control</td>
<td>Consolidation/Optimization</td>
</tr>
<tr>
<td>2</td>
<td>Shared Services</td>
<td>Consolidation</td>
<td>Budget and Cost Control</td>
</tr>
<tr>
<td>3</td>
<td>Budget and Cost Control</td>
<td>Shared Services</td>
<td>Health Care</td>
</tr>
<tr>
<td>4</td>
<td>Security</td>
<td>Broadband and Connectivity</td>
<td>Cloud Computing</td>
</tr>
<tr>
<td>6</td>
<td>ERP Strategy</td>
<td>Security</td>
<td>Governance</td>
</tr>
<tr>
<td>7</td>
<td>Green IT</td>
<td>Transparency</td>
<td>Security</td>
</tr>
<tr>
<td>8</td>
<td>Transparency</td>
<td>Infrastructure</td>
<td>Broadband and Connectivity</td>
</tr>
<tr>
<td>9</td>
<td>Health Information Technology</td>
<td>Health Information Technology</td>
<td>Legacy Modernization</td>
</tr>
<tr>
<td></td>
<td>Governance</td>
<td>Governance</td>
<td>Data and Information Management</td>
</tr>
<tr>
<td>---</td>
<td>------------</td>
<td>------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix F: NASCIO Coding Examples

<table>
<thead>
<tr>
<th>Publication</th>
<th>Purpose</th>
<th>Problem Specification</th>
<th>EA Specification</th>
<th>Justification</th>
<th>Supporting evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Information Architecture: Toward National Sharing of Governmental Information (2000)</td>
<td>A report on establishing a national architecture on information sharing between governmental agencies.</td>
<td>Information sharing was viewed as a way to manage data more accurately, more timely, more completely, and less expensive. The future trend, a must to have information sharing. It is the right thing to do, not just for condition-tagged money, calling for cooperation efforts.</td>
<td>National Information Architecture is “the nationwide sharing of information collected by governmental agencies at all levels” (p. 4).</td>
<td>National information sharing requires: 1) A national telecommunication infrastructure 2) A nationwide sharing vocabulary 3) A set of common sharing documents</td>
<td>• Various examples were used to demonstrate the needs of information sharing. E.g., sharing criminal records, sharing public safety information • Examples of successful information sharing were featured: NLETS, NCIC, and CJIS-WAN as nationwide telecommunication networks in public safety domain</td>
</tr>
<tr>
<td>White Paper on Enterprise Architecture (2002)</td>
<td>A whitepaper on Enterprise Architecture concept in state agencies.</td>
<td>Information sharing was framed as a technical and economic advancements: “shared information is more accurate, timely and complete, as well as cost effective”” (p. 1).</td>
<td>“The development of enterprise architecture is essential to the success of information sharing needed to improve cross-jurisdictional information flow and process coordination” (p. 1).</td>
<td>Letter from Chairman Tom Davis of the House Subcommittee on Technology and Procurement Policy that encouraged the consideration of NASCIO's EA program. 30 agencies were cited as being interested in the EA Tool-Kit.</td>
<td>N/A</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information sharing as the problem: as expectations from citizens increased, information sharing was inevitable. Focusing on the end goal of creating better government. “Sharing information makes better government. Shared information minimizes clerical errors, information discrepancies and government loopholes” (p. 13). Stating the needs for information sharing were found at all levels of government, and state and federal legislative mandates (e.g., HIPAA) built a strong case for an adaptive enterprise-wide architecture.</td>
<td>&quot;Enterprise Architecture Framework can be described as a methodology for developing an organization's IT support functions…[EA] provides the blueprint for the integration of information and services at the design level across agency boundaries. Enterprise architecture is the blueprint for allowing data to flow from agency to agency...” (p. 8). Value-based justification: &quot;Simply stated, adopting adaptive enterprise architecture will greatly enhance government’s ability to deliver effective and timely services and to support agencies in their efforts to improve the overall functioning of government&quot; (p. 13). Framing EA as an opportunity for technical and business improvements. &quot;Adaptive enterprise architecture effectively supports the business of government, enables information sharing across traditional barriers, enhances government’s ability to deliver effective and timely services, and supports agencies in their efforts to improve government functions and, thereby, services&quot; (p. 11). Some success stories were used to illustrate the benefit of EA: “The state of Kansas has reduced its IT project procurement cycle by an average of 41% since its implementation of enterprise architecture” (p. 12).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
References


Hinings, C.R., Greenwood, R., Reay, T., and Suddaby, R. 2004. "Dynamics of Change in Organizational Fields," in Handbook of Organizational Change and Innovation,


Vita

Quang N. Bui graduated from Brigham Young University, Hawaii campus with a Bachelor of Science in Information Systems in 2006. He worked in the IT industry for both private and non-profit organizations in a number of roles including web designing, system administration, project management, procurement, quality inspection, and market research. He earned his Master in Management Information Systems from Brigham Young University, Provo, Utah in May 2009. In September, 2009 he entered the Bentley University Ph.D. Program.

Permanent Address: 46 Phuong Liet, Thanh Xuan, Ha Noi, Vietnam

This manuscript was typed by the author.