

# The IBIT Report

A Publication of the Institute for Business and Information Technology

Min-Seok Pang  
Fox School of Business  
Temple University



# Is Government IT Spending Worth It?

WHAT GOVERNMENT LEADERS NEED TO KNOW ABOUT RETURNS ON IT INVESTMENTS

# The IBIT Report

## **Bruce Fadem**

Co-Editor-in-Chief  
Retired VP and CIO, Wyeth

## **David Schuff**

Co-Editor-in-Chief  
Associate Professor  
Fox School of Business, Temple University

## **Laurel Miller**

Managing Editor  
Director, Fox School of Business, Temple University

## **Munir Mandviwalla**

Publisher  
Executive Director, Fox School of Business,  
Temple University

## **Kent Seinfeld**

Associate Editor  
Retired CIO, Commerce Bank

## BOARD OF EDITORS

### **Andrea Anania**

Retired VP and CIO, CIGNA

### **Michael Bradshaw**

VP & CIO, Mission Systems & Training,  
Lockheed Martin

### **Jonathan A. Brassington**

Founding Partner and CEO, LiquidHub Inc.

### **Larry Dignan**

Editor-in-Chief, ZDnet  
SmartPlanet Editorial Director, TechRepublic

### **Niraj Patel**

Chief Strategy Officer, Elsag North America

### **Joseph Spagnoletti**

Senior VP & CIO, Campbell Soup Co.

### **Stephanie Bradford**

Editorial Consultant

© 2015 Institute for Business and  
Information Technology, Fox School of  
Business, Temple University, Philadelphia,  
PA 19122, USA. All rights reserved. ISSN  
1938-1271.

**The IBIT Report** is a publication for the members of the Fox School's Institute for Business and Information Technology. IBIT reports are written for industry and based on rigorous academic research and vendor neutral analysis. For additional reports, please visit our website at <http://ibit.temple.edu>.

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the Publisher. Requests to the Publisher for permission should be addressed to Institute for Business and Information Technology, Fox School of Business, Temple University, 1810 N. 13th Street, Philadelphia, PA 19122, USA, 215.204.5642, or [ibit@temple.edu](mailto:ibit@temple.edu).

Disclaimer: The conclusions and statements of this report are solely the work of the authors. They do not represent the opinion of Temple University or the members of the Fox School's Institute for Business and Information Technology (IBIT).

Review process: IBIT reports are sourced, reviewed, and produced as follows. The managing editor oversees this process. The editor and editor-in-chief consult on topics and identify new sources of reports. The editor typically works with authors who are interested in writing reports and provides feedback on initial drafts. Completed reports are first screened by the editor-in-chief. After approval the report is sent out for review to two members of the editorial board. The editor-in-chief assesses the completed reviews and provides further guidance to authors. Final reports are then professionally produced and made available to IBIT members.

# Foreword

## The failures associated with the FBI's next-generation digital case management

system (Sentinel) and the HHS Federal Health Insurance Marketplace (Healthcare.gov) shined a spotlight on the government's large scale information technology (IT) projects. They again raise the question of whether Federal and state governments are capable of managing these initiatives and achieving successful financial returns.

The question of the effectiveness of IT spending is the subject of this IBIT Report. We know that quantifying the benefits of IT projects in financial terms, for both governments and companies, can be complex and often difficult to disentangle from the larger environment. This report details rigorous analytical research on the costs and benefits of U.S. state government IT investments to get at these effects. The conclusions may surprise you and provide valuable insight for both government and private sector management.

**Bruce Fadem**

Co-Editor-in-Chief

**David Schuff**

Co-Editor-in-Chief

October 2015

# Introduction

## Are tax dollars spent on information technologies (IT) worth it? In a word: yes.

New research shows that, on average, **a \$1 increase in the budget of state chief information officers (CIO) leads to a \$4.05 decrease in current expenses and capital depreciations.**

Governments at all levels spend a considerable amount of revenue on IT every year. For example, the amount of IT spending in the U.S. federal government in 2014 was as much as \$75 billion, according to the Federal IT Dashboard [1]. But, is this substantial investment well-made? Recent news of notable IT failures in the public sector, including a troubled launch of the Federal Health Insurance Marketplace (Healthcare.gov) in 2013, cast doubts on the government's ability to manage large-scale IT investments.

This report details how much return state governments in the U.S. can generate on IT investments that create greater efficiency. Using IT budget data from 44 U.S. states in 2001-2005, obtained from the National Association of State Chief Information Officers (NASCIO) [3], this study estimates the amount of cost reduction from IT expenditures.

### Key Finding In This Report



- The amount of cost reduction depends on several external and internal factors including: state population, private-sector IT industries, the authority and power a state CIO is given by the state legislature and the source of IT budgets managed by the CIO.
- A state CIO's IT expenditures lead to greater savings when 1) the state has large population, 2) more state residents live in rural areas, and 3) the state has bigger private-sector IT industries.
- Internal IT governance factors play an influential role in returns on state IT investments. A state government can expect more cost reduction from IT investments when the position of the state CIO is formally established by state laws and a nominee for the state CIO is approved by the state senate.
- The estimated cost reduction is greater when the state CIO's IT budget relies less on fee-for-services from state executive agencies.



# How Can IT Save States Money?

Anecdotal evidence suggests that state IT investments can create value to the state and the public through four mechanisms.

## Automate

IT investment can lead to an improvement in state cost efficiency by automating business processes, **many of which are still manual, laborious, and paper-based**. For instance, in 2013, the Pennsylvania Department of Transportation implemented a mobile application for highway inspection processes [4]. Inspecting conditions for roads, bridges, signs, and other transportation infrastructures had been a labor-intensive, manual process. Inspectors wrote reports on papers that were later entered into the system manually. With a mobile application, the inspectors can transmit information for infrastructure conditions immediately to the central database.

North Carolina implemented the eCITATION system in 2007, which digitized and integrated a citation process that spans the State Highway Patrol and the State Court System [5]. Before eCITATION, citations were issued by police officers on paper, which were physically delivered in-person to courts and entered manually into the system. Now, all citations issued by officers are wirelessly transmitted to the Highway Patrol and the Court System instantly saving substantial costs in materials, storages, and person-hours.



# Digitize Citizen Services

State governments can digitize not only internal business processes but service delivery to the public. **Directing citizen-customers from offline offices (e.g. municipal buildings) to online can bring substantial savings in costs to both state governments and citizens who spend time and efforts in visiting the offline offices.**

The Utah Department of Public Safety introduced the On-the-Spot (OTS) Renewal system to automate vehicle registration renewals in 2005 [6]. Utah law requires vehicle owners to receive annual safety and emission testing from certified inspectors around the state. Upon passing the tests, owners had to visit DMV offices to renew their vehicle registrations. The OTS system is open to the inspection stations, which process registration renewals on the spot on behalf of the state.

This automation and integration reduces service volumes for DMV offices and improves convenience for the vehicle owners.



The screenshot shows the Missouri Accountability Portal Expenditures page. It features a navigation menu with options like Employees, Expenditures, Budget Restrictions, Federal Grants, Bonds, Stimulus, Tax Credits, Financial Reports, and Who Is Not Paying. The main content area displays 'Agency Payments by Category' for the fiscal year 2015. A table lists various categories such as Building Lease Payments, Communication Service & Supplies, Computer Equipment, Debt Service, Equipment Rental & Leased, Fuel & Utilities, Housekeep & Janitor Services, Miscellaneous Expenses, Motorized Equipment, and Office Equipment, along with their respective payment totals.

Category Description	Payments Total
BUILDING LEASE PAYMENTS	\$2,818,912.87
COMMUNICATION SERVICE & SUPPLIES	\$308,937.56
COMPUTER EQUIPMENT	\$153,304.00
DEBT SERVICE	\$1,979.81
EQUIPMENT RENTAL & LEASED	\$132,235.23
FUEL & UTILITIES	\$17,959,804.89
HOUSEKEEP & JANITOR SERVICES	\$813,320.80
MISCELLANEOUS EXPENSES	\$2,474,260.49
MOTORIZED EQUIPMENT	\$781,537.19
OFFICE EQUIPMENT	\$47,875.58

# Be Transparent

An increasing number of governments are proactively publishing information and data assets for the public via the Internet, an initiative called open government data [7]. Many state governments post data on administration, expenditures, and performance, in an effort to improve transparency of the administration and thereby curb excessive spending by government officials.

The State of Missouri operates the Missouri Accountability Portal (MAP, <http://mapyourtaxes.mo.gov/>, Figure 2), in which **all expenditures and salary data is published on a daily basis. Anyone can look at how the state budgets are used-- by whom, for what, and how much.**

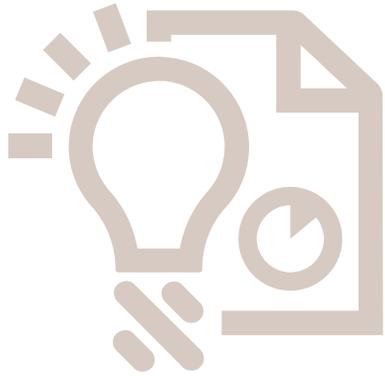
State spending information can be accessed for state agencies, contracts, or vendors, and the salary information of all state employees can be searched as well.

Effective information transparency can not be achieved without statewide integration of data collection

# Analyze Big Data

Analytics of big data, abundant in state enterprise systems, can be used to make state government operations more efficient. One notable example is social services, in which there is large room for fraud and mismanagement. **Just as financial institutions like banks and credit card companies use data analytics to prevent fraud and criminal activities, so can state social service agencies with their data resources.**

The Minnesota Department of Human Services initiated Program Integrity Efforts in 2005 [8], which aimed to prevent and eliminate fraudulent payments to welfare recipients and other misconducts. Integral to this project were enterprise data warehouses and analytics of records from state public welfare programs such as Medicaid, food banks, and subsidies to low-income families. The state was reportedly able to save considerable expenses associated with benefit investigations and enforcement that otherwise would have incurred due to insufficient, or incomplete, data.



# Methodology

Anecdotal evidence illustrates positive returns on state IT investments. But it

does not tell us whether such savings take place in all states for all cases and, if they do not, how states can expect higher returns on IT. To provide more concrete answers to these questions, a rigorous econometric analysis-- to estimate returns on state IT spending- was employed.

---

**ECONOMETRIC ANALYSIS  
IS THE APPLICATION OF STATISTICAL AND  
MATHEMATICAL THEORIES TO ECONOMICS.**

---

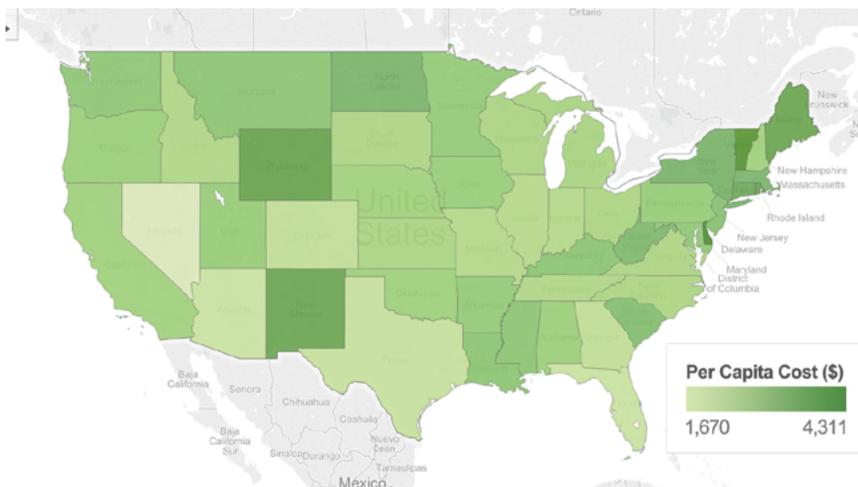
All 50 states were compared to a theoretical, most cost-efficient state. Efficiency was measured by looking at how much money various states spend to produce the same level of government services and comparing each state to the theoretical ideal. Then the level of IT spending was looked at, to calculate the cost savings. Finally, spending data, from 2001-2004, from 44 U.S. state governments, was compared.

# The Analysis:

## Step 1. Estimation of state government cost inefficiency

For each of the 50 states in 2003-2007, cost inefficiency was calculated with an econometric technique called a stochastic frontier analysis [2].

Conceptually, this analysis estimates a hypothetical amount of the minimum costs that could produce the given amount of outputs, which is called “the cost frontier.” Essentially, the cost frontier represents a hypothetical state with the lowest level of expenditures—salaries, payments to vendors, capital depreciation and other expenses- that still achieves mandated outputs. The inefficiency score of this “state” is one because it is perfectly efficient.

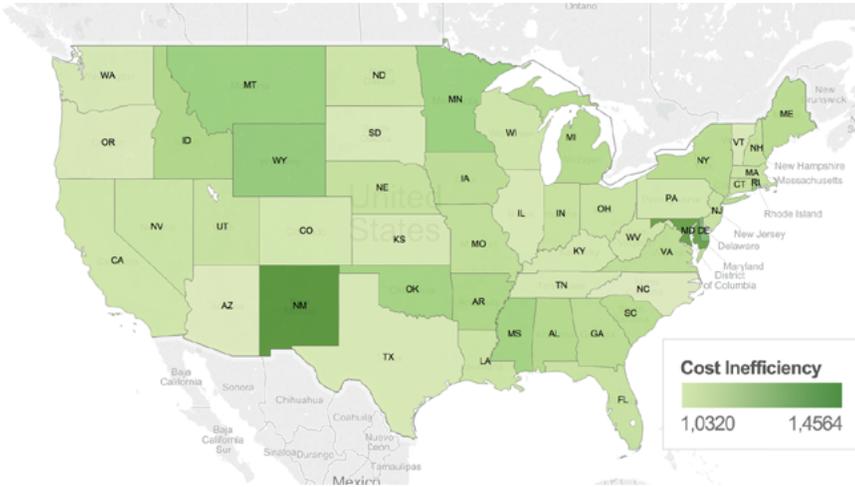


THIS STUDY MEASURES STATE GOVERNMENT COST BY THE SUM, PER CAPITA, OF THE FOLLOWING:

- ➔ Operational expenses (including salaries, payment to vendors, and other expenses) and
- ➔ Capital depreciation (buildings, equipment, and fixtures).

OUTPUT MEASURES INCLUDE THE FOUR MOST REPRESENTATIVE OUTPUTS OF STATE GOVERNMENTS:

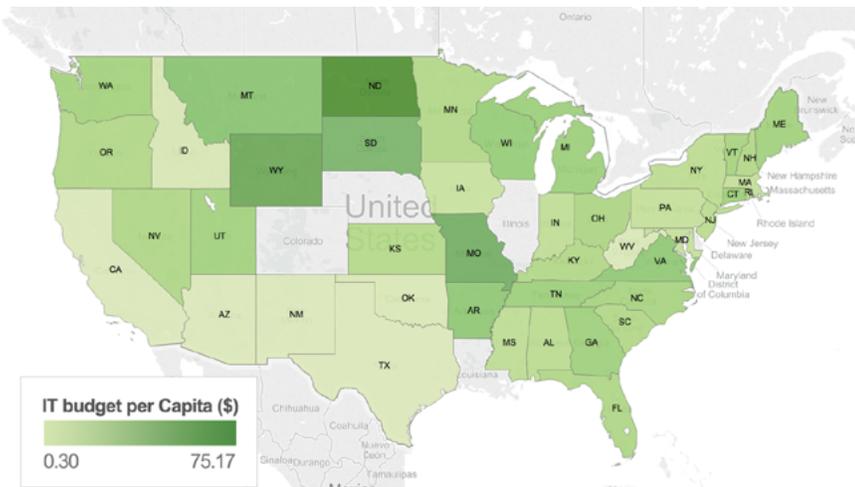
- ➔ Public university enrollment
- ➔ Highway length
- ➔ Medicaid beneficiaries
- ➔ Inmates in state-owned prisons



For example, the estimated inefficiency score of Missouri is 1.10, meaning that it incurs 10% more than the minimum possible costs (cost frontier) that could produce the same amount of outputs.

The average amount of per capita costs in U.S. states in 2001-2009. On average, a U.S. state spends \$2,901.76 per capita. Per capita costs range from \$1,670 (NV) to \$7,924 (AK). The average cost inefficiency of each of the 50 states in 2001-2009. The average inefficiency score of all 50 states is 1.12. The most efficient state is North Carolina (1.032), while the most inefficient is Hawaii (1.635).

## Step 2. Measurement of cost reduction from IT investments



The second step compares state cost inefficiency scores to the budgets managed by state CIOs. State government IT spending figures in 44 states were obtained from NASCIO Compendium of Digital Governments in States [3].

The budget figures endowed to state CIOs in 2001-2005 are shown here. CIO IT spending ranges from \$584,000 to \$469 million. Per capita, the average IT spending by a CIO in 44 states is \$20.54, ranging from \$0.04 (Arizona) to \$89.22 (North Dakota).

**The study analyzes the relationship between IT investments made by state CIOs and state cost inefficiency, and found an inverse relationship.** In other words, the larger budgets a state CIO manages, the more cost-efficient the state government becomes.

# Step 3. What Are The Variables to Improvements in Cost Efficiency?

This step focuses on the impact of the three external factors and the three internal factors:



The three external factors indicate the demographic and economic environment of a state government. The three internal factors represent the IT governance structure in a state. In many states, state CIOs are in charge of statewide IT infrastructures, enterprise systems, technology standards, and IT strategic planning.

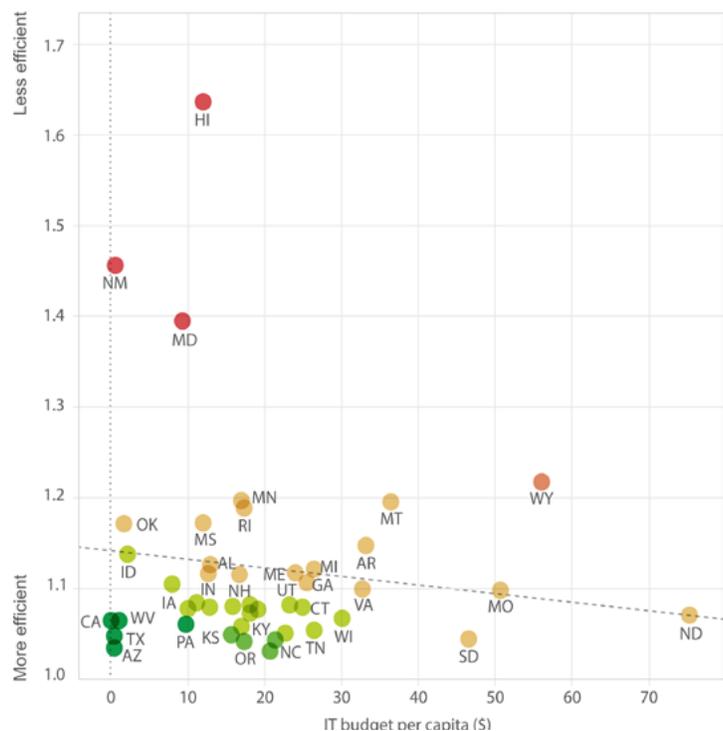
The state CIO has more formal authority over statewide IT management when their position is established formally by state laws and when they are approved by the state senate [9]. Also, a powerful state CIO could secure IT budgets under his/her purview directly from the legislatures or the governor as a form of state general funds, rather than relying on fees from peer state executive agencies.

The Michigan Executive Order No. 2001-3 creates the Department of Information Technology, which is headed by the state CIO. It mandates that “the Department shall lead state efforts to re-engineer the state’s information technology infrastructure with the goal of achieving the use of common technology across the executive branch

## Step 4. The Bottom Line

The direct effect of IT expenditures on state cost inefficiency is shown in this scatter plot of inefficiency scores and per capita IT spending by state CIOs

As the trend line shows, states whose CIO invests more in IT demonstrate higher efficiency in costs. On average, a \$1 increase in per capita IT spending by a state CIO leads to a reduction of \$4.05 per capita. Hence, investments made by a state CIO in IT are found to bring a substantial amount of cost savings to the state.







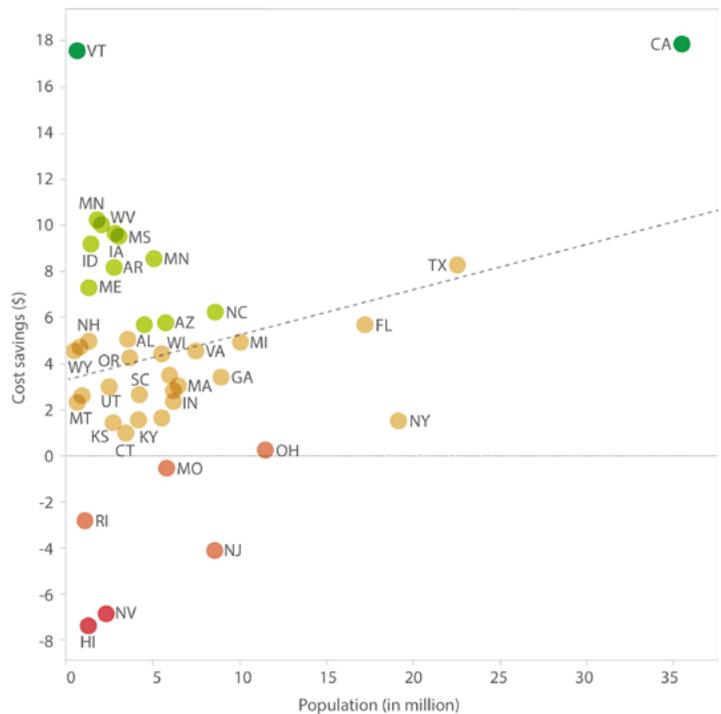
# Factoring in the externals and internals.

## Impact of the Three External Factors

### POPULATION

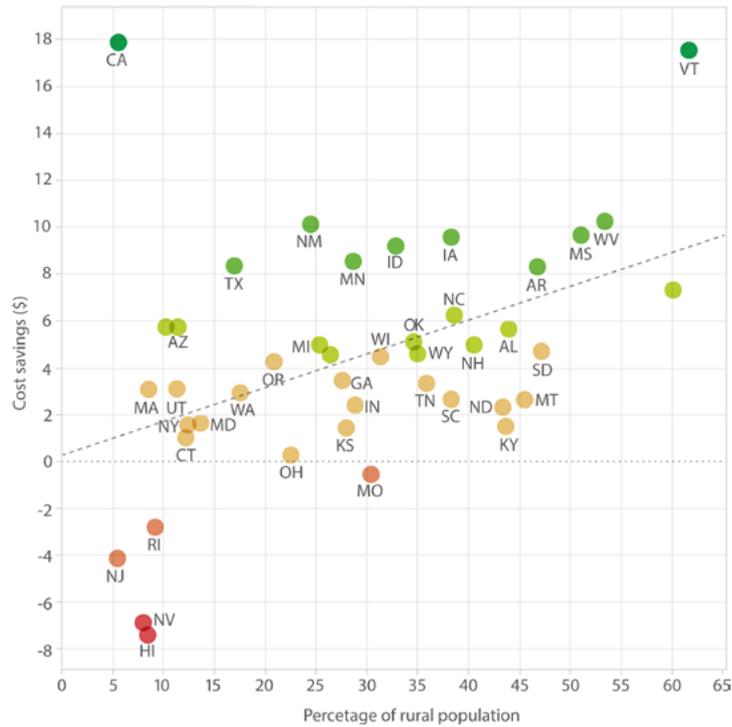
The bigger a state's population, the larger its return on IT spending.

In states whose population is less than 5 million (e.g. Maine, Utah WHERE IS UTAH?), the amount of expected cost savings from \$1 IT budget is \$4.08, while the return is as much as \$5.70 in states with population greater than 10 million (e.g. Florida, Ohio).



# DEMOGRAPHICS

A similar effect is observed regarding rural population. When less than 20% of the state population lives in rural areas (e.g. Maryland, New York), expected return on \$1 IT investment is \$1.16. But, in a state where the rural population share is greater than 30% (e.g. North Carolina, Iowa), the average return rises to \$5.66. This finding illustrates that IT spending can lead to greater cost savings when a state manages a large scale of operations that serve larger population or geographically dispersed residents.



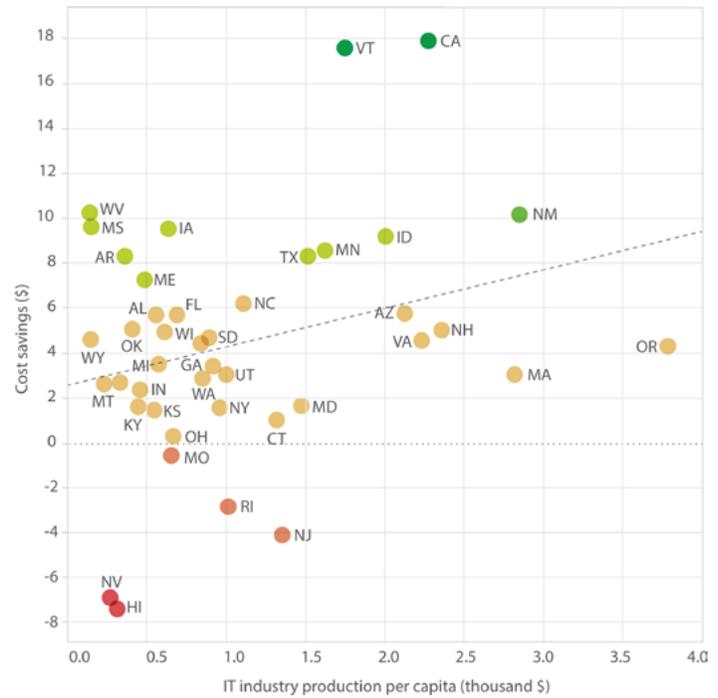
The state government would have to operate a greater number of state offices such as local DMV offices, court houses, and state police precincts [2], since the demand for convenient access to the state services comes from all residents, whether they live in rural or urban areas. In such an environment, state governments would have more room to realize cost-reduction benefits (via greater economies of scale) from digitizing administrative processes.. Furthermore, providing state services via the Internet to the state's rural residents can save expenses for both the government and residents.

# ACCESS TO PRIVATE SECTOR IT INDUSTRIES

The presence of large private-sector IT industries within a state's boundary boosts returns to IT. In states in which IT industry production is less than \$600 per capita (e.g. South Carolina, Oklahoma), the average return to CIO IT spending is estimated to be \$2.82. In contrast, in states with IT production of more than \$1,200 per capita (e.g. Virginia, Minnesota), estimated savings from \$1 IT investment is \$6.43.

A state government can enjoy greater cost savings from IT spending when it has easier access to competitive private-sector IT industries as well as to high-quality IT talent [2].

**Large local IT industries provide the state government a greater pool of both capable IT vendors with state-of-the-art IT products and services and superior local IT talent.** Such local IT professionals can bring their knowledge and experiences from the private sector to state IT management. The larger local IT industries therefore enable state governments to reap greater cost savings from IT expenditures.



## Impact of the Three Internal Factors

Several interesting results were obtained from analysis of the internal IT governance factors. First, as Figure 12 demonstrates, **a state enjoys higher returns on IT investments when its state CIO position is formally established by legislation**, rather than by an executive order by the governor. **In states with legislatively established CIO positions (e.g. Oregon, Georgia), the average cost reduction from \$1 CIO budget amounts to \$5.10.** Surprisingly, in the other states without legislative formation of a CIO position (e.g. Missouri, New Jersey), the expected return is negative – -\$1.26. Likewise, legislative approval of a state CIO nomination positively influences returns to IT expenditures (Figure 13). When the state senate confirms a CIO nominee (e.g. Minnesota, Arkansas), the expected return on \$1 IT spending is \$7.86. In other states (e.g. Rhode Island, Nevada), the average amount of estimated cost reduction is \$2.13.

# CIO CONFIRMED BY LEGISLATORS

Legislative approval of a state CIO nomination positively influences returns to IT expenditures (Figure 13). When the state senate confirms a CIO nominee (e.g. Minnesota, Arkansas), the expected return on \$1 IT spending is \$7.86. In other states (e.g. Rhode Island, Nevada), the average amount of estimated cost reduction is \$2.13.

This finding recommends that for a state CIO's IT investments to be valuable to the state, they be given sufficient formal authority and power over statewide IT management [9].

To perform their duties effectively, a state CIO needs to be recognized as an authoritative, legitimate figure in statewide IT management by state executive agencies. State legislatures can provide such authority .



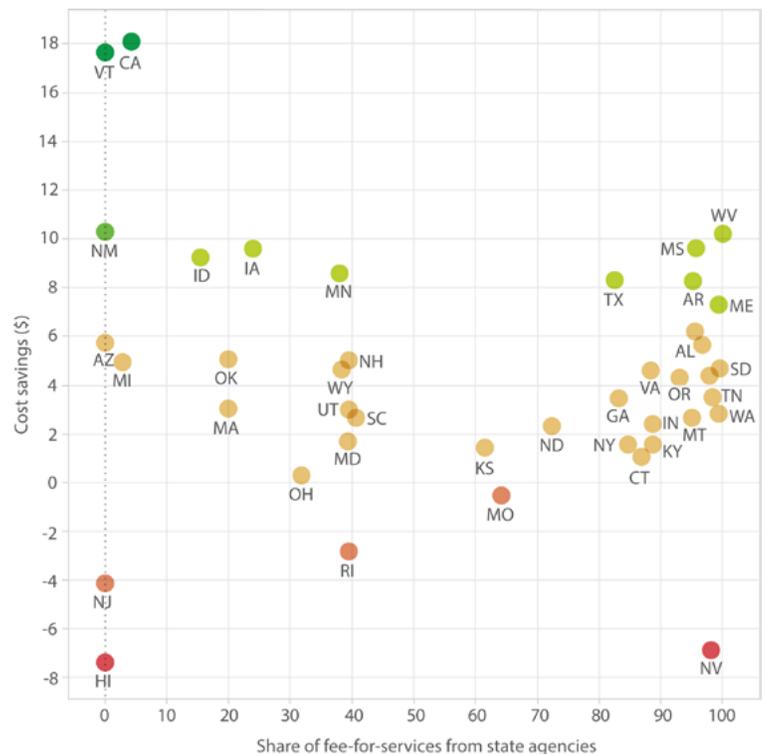
Without legislative support, state executive agencies would not be cooperative in initiatives proposed by a state CIO such as enforcement of technology standards, integration of fragmented application systems, sharing of information resources across the state, and alignment of IT and state strategic goals. State IT management would have a hard time in achieving economies of scales from technology standards enforced across the state, and state executive agencies are more likely to continue maintaining siloed, fractured information systems. A state CIO empowered by a higher authority (i.e. state legislatures) would be better able to lead statewide IT operations toward achieving greater economies of scales and cost savings.

# HOW THE CIO'S IT BUDGET IS FUNDED

The source of IT funding plays an influential role in IT returns. When less than 50% of the state CIO's IT budget relies on chargeback fees from state executive agencies (e.g. Idaho, Vermont), expected cost reduction is estimated to be \$5.17. However, when more than 50% of their budget comes from peer state agencies (e.g. Wisconsin, Indiana), the estimated return is only \$3.47.

When a state CIO oversees budgets that rely primarily on fee-for-services from state executive agencies the implication is that they do not have sufficient authority in statewide IT management. If the majority of their IT budgets originate from payment by state executive agencies, they would have to serve the interests of the agencies, rather than that of the entire state, making it hard for the CIO to perform the duties of statewide IT management.

The CIO's responsibilities to align IT and statewide strategic goals, enforce technology standards, or integrate information systems and data assets would be undermined by the interests of individual state agencies, which would prefer to preserve the status quo - siloed, uncoordinated IT management. Therefore, in order to effectively carry out the responsibility in enterprising IT management, the state CIO should be given funding directly by the state legislatures or by the governor.



# What it Takes to Maximize Returns on IT Investments

This report clearly demonstrates substantial returns on IT investments made by state CIOs. However, cost savings from IT investments are not uniform. A state can expect greater cost reduction if

- ➔ The state population is larger more state citizens reside in rural areas,
- ➔ The state has larger private-sector IT industries,
- ➔ A state CIO position is established by legislation and confirmed by the state senate
- ➔ Less of the budget given to the CIO is funded by other state agencies.

## KEY TAKEAWAYS FOR STATE GOVERNMENT SENIOR MANAGEMENT AND CIOs

- ➔ States with larger or more geographically dispersed operations can expect greater cost savings from IT investments by interconnecting state offices and digitizing state services for rural residents.
- ➔ State IT management can utilize local private-sector IT industries for access to more advanced IT products/services and more qualified, professional IT talent.
- ➔ For IT investments to generate more value, a state CIO needs strong legal and budgetary authority and legitimacy for their role as a senior leader in strategic IT management to be recognized by peer state executives.

# References

1. <https://myit-2015.itdashboard.gov/portfolios>, accessed on Feb. 26, 2015.
2. Pang, M.-S., Tafti, A., and Krishnan, M.S. (2014) "Information Technology and Administrative Efficiency in U.S. State Governments - A Stochastic Frontier Approach," *MIS Quarterly* (38:4) pp. 1079-1101.
3. <http://www.nascio.org/publications/compendium.cfm>, accessed on Feb. 26, 2015.
4. [http://www.nascio.org/publications/documents/NASCIO\\_2014BestPracticesBook\\_FinalDraft.pdf](http://www.nascio.org/publications/documents/NASCIO_2014BestPracticesBook_FinalDraft.pdf), accessed on Feb. 26, 2015.
5. <http://www.nccourts.org/Support/FAQs/FAQs.asp?Type=23&language=2>, accessed on Feb. 26, 2015.
6. <http://www.nascio.org/publications/documents/NASCIO-2009Awards.pdf>, accessed on Feb. 26, 2015.
7. Pang, M.-S., Lee, G., and DeLone, W. (2014) "IT Resources, Organizational Capabilities, and Value Creation in the Public Sector Organizations - Public Value Management Perspective," *Journal of Information Technology* (29:3), pp. 187-205
8. [http://www.dhs.state.mn.us/main/groups/county\\_access/documents/pub/dhs16\\_145244.pdf](http://www.dhs.state.mn.us/main/groups/county_access/documents/pub/dhs16_145244.pdf), accessed on Feb. 26, 2015.
9. Pang, M.-S. (2014) "IT Governance and Business Value in the Public Sector Organizations - The Role of Elected Representatives in IT Governance and Its Impact on IT Value in U.S. State Governments," *Decision Support Systems* (59:1), pp. 274-285.

# About the Author



## Min-Seok Pang

Min-Seok Pang is an assistant professor of Management Information Systems at Fox School of Business, Temple University. Before joining Fox MIS in 2014, he was a faculty member at the School of Business, George Mason University. He received a Ph.D. in Business Administration from the Stephen M. Ross School of Business at the University of Michigan in 2011 and holds an M.S. in Management and a B.S. in Industrial Engineering from Korea Advanced Institute of Science and Technology (KAIST). His research has

been published in several premier academic journals including Management Science, Information Systems Research, MIS Quarterly, Decision Support Systems, and Journal of Information Technology. His work has also been featured in such news outlets as Computerworld. His research interests include IT business value, IT governance, and electronic governments. He currently teaches Strategic Management of Information Technology and Data Science at Temple's Fox School of Business.

# The IBIT Report

The Fox School's Institute for Business and Information Technology (IBIT) regularly publishes The IBIT Report for its members. IBIT reports are based on rigorous vendor neutral academic research and are written to provide actionable knowledge to industry. Each report focuses on an important cutting edge topic that is of interest to our members.

**For additional information, contact:**

Institute for Business and Information Technology  
Fox School of Business  
Temple University  
210 Speakman Hall (006-00)  
1810 N. 13th Street  
Philadelphia, PA 19122  
ibit@temple.edu  
ibit.temple.edu  
215.204.5642

