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Institutions, Policy Innovation, and E-Government in the American States

New Perspectives on E-Government

Examining the rankings of American states in one fast-growing policy area, e-government, states with the most sophisticated and comprehensive policies varied over a five-year period. What factors account for change in digital government policy innovation over time? Using time-series analysis and 50-state data, the authors find that state institutional capacity is important for continued innovation. They also find an association between reinvention in state governments and the institutionalization of information technology, suggesting a more general orientation toward government reform and modernization. Although state wealth and education were not significant in previous studies, they emerge as predictors of later innovation. The theoretical contribution of this study is to better understand the dynamic character of innovation over time and the role of institutions. The link between reinvention and e-government raises the possibility that the modernization of state institutions generally facilitates innovation.

Do those who are early leaders in a field sustain a position of innovation over time? What role do institutions play in promoting continued innovation? Examining the rankings of states in one fast-growing policy area, e-government, we can easily see that the set of states with the most sophisticated and comprehensive policies has shifted over time.

This study examines the development of e-government in the 50 states over a period of five years and asks what factors contribute to sustained innovation. Drawing on cross-sectional time-series analysis (rather than event history analysis), this research conceptualizes and measures the relative degree of innovation over time. Researchers often measure policy innovation by the timing of adoption (Berry and Berry 1990; Gray 1973; Walker 1969), but early adoption is only one dimension of innovation. The quality of the policies that are developed—their scope, their sophistication, and whether adopters continue to keep pace with state-of-the art developments in the field—are surely important dimensions of innovation as well. We suggest that examining implementation and institutionalization over time may reveal a deeper understanding of innovation in the American states.

One possible aspect of change is the development of new institutions. One of the unique contributions of this study is to measure and test the importance of state institutional capacity in the form of new bureaucratic agencies, state legislative committees, and rules and procedures. We also examine the forces that lead to the creation of facilitating institutions in this policy area. Theoretically, our study builds on a long tradition of research that argues that formal and informal institutions matter and shape public policy (March and Olsen 1984; Peters 2005; Steinmo 1996; Steinmo, Thelen, and Longstreth 1992; Thelen and Steinmo 1992; Weaver and Rockman 1993). Thus, we seek not only to contribute to the literature on digital government and state policy innovations but also to provide a window into the role of institutions in policy innovation and change.

Building on earlier research on e-government in the American states (McNeal et al. 2003; West 2005), we observe the importance of new institutions (which were not examined before), as well as some traditional indicators of innovation such as state wealth and education, which were not significant in earlier research. We find that the creation of new institutions for e-government is associated with reinvention reforms, suggesting further motivation for innovation. This is consistent with the history of e-government at the federal level as a product of reinventing government reforms, but this is the first time that generalizable evidence for this association has been uncovered at the state level.

We begin by describing e-government and the relevance of the literature on innovation for understanding its development. Next, we conduct a statistical analysis using indices of e-government scope/implementation compiled by Darrell West of Brown University. As we find that institutions are important for

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explaining innovation over time, we also explore the factors that lead to more extensive institutionalization of an information technology infrastructure. Finally, we conclude with a discussion of the implications of this study for theories of institutions, innovation, and digital government.

E-Government, Innovation, and Institutions

Defined as "the delivery of [government] information and services online via the Internet or other digital means" (West 2000a, 2), e-government or digital government has the potential to improve connections with citizens, businesses, and other governments (Fountain 2001, 6; Seifert and Peterson 2002; Thomas and Streib 2003; West 2005). E-government is now one of the fastest-growing activities online, and more than half of all Americans (54 percent) report having used a government Web site (Pew Internet and American Life Project 2006). There is potential for even greater growth. The percentage of Americans who support the idea of looking up government information online exceeds the population of Internet users, as 78 percent of Americans say they favor e-government (Mossberger, Tolbert, and Stansbury 2003). Use of e-government may have implications for overall evaluations of American government and democracy. Recent research shows that the use of e-government can improve citizen confidence in government generally and, in some cases, can lead to more trust in government (Tolbert and Mossberger 2006; Welch, Hinnant, and Moon 2006).

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By 2000, the first year covered in this study, each of the 50 states had a presence on the Internet (Stowers 1999; West 2000b), but there was substantial variation in what states offered. Therefore, we focus on explaining variation in the comprehensiveness of implementation of digital government. Most policy innovation research examines the timing of adoption or explains why some states are leaders or laggards in adopting a policy (Berry and Berry 1990; Gray 1973; Savage 1978; Walker 1969). Yet Downs and Mohr define innovation as the "earliness *or extent of use*" of a new idea, and others have argued that there are two stages of knowledge utilization, consisting of adoption and implementation (1979, 385; see also Beyer and Trice 1982; De Lancer Julnes and Holzer 2001). Understanding the scope of implementation can offer a more accurate portrayal of innovation, taking into account that some states may have limited or even symbolic policies (Clark 1985; De Lancer Julnes and Holzer 2001) or that the extent of implementation may change over time (Boehmke and Witmer 2004).

The policy diffusion literature suggests factors that may also account for more extensive and innovative e-government implementation, including resources, need, politics, and demand (Mooney and Lee 1995). According to Walker (1969), general patterns of state policy innovation can be explained by wealth, urbanization, and (population) size (see also Savage 1978). For Walker, these factors represent a general environment that is conducive to innovation, as well as resources. Many scholars have concluded that the determinants of innovation vary across policy areas (Clark 1985; Gray 1973; Hwang and Gray 1991; Mooney and Lee 1995) and that state wealth is important for developmental policy, whereas political factors affect issues that are more politically salient. Research on innovation in organizations also points to the significance of slack resources, particularly for innovations with substantial start-up costs, such as e-government (Downs and Mohr 1979; Rogers 1995, 380). Clark (1985) concludes that resources are most important for complex policies that require new administrative infrastructures for implementation. E-government entails a substantial amount of equipment, professional expertise, coordination, and continued maintenance (Moon 2002; Norris, Fletcher, and Holden 2001), and so innovation in this particular area may require both slack resources and specialized administrative structures.

Two studies have used West's e-government index to measure the scope or extent of innovation in digital government, but neither considers the institutional structures included in this research. One study, based on 2000 data, found that more extensive use of e-government in the 50 states is associated with legislative professionalization and professional networks—factors that may indicate more general differences in state professionalization and administrative capacity (McNeal et al. 2003). Legislative professionalization is a common factor explaining early adoption in many policy areas (Derthick 1970; Downs 1976; Downs and Rocke 1980). In a later study using 2003 data, legislative professionalization was also found to be a significant predictor of the number of online services, but not overall rankings for the number and sophistication of features included in Web sites (West 2005, 75). Though the issue has not been a politically contested one, McNeal et al. (2003) found that Republican-controlled legislatures are more likely to embrace e-government, implying that efficiency concerns may promote broader implementation. The percentage of the state population online is not significant, so demand factors do not appear to be driving the development of digital government. In short, efficiency and

professionalism account for greater innovation in this administrative reform.

Variables traditionally associated with general state innovation, such as state wealth, urbanization, and education of the population, were not found to be important predictors of early e-government innovation in 2000, measured by online services and the overall scope of implementation (McNeal et al. 2003). Use of e-government has also been shown to be unrelated to more direct measures of organizational resources such as state budget deficits or privatization (West 2005, 80). But drawing on later data from 2003, West (2005) found that state per capita income is an important predictor for the percentage of agencies offering online services and for the overall scope of e-government implementation (West 2005, 75, 79).[1] State per capita income, used by West, is more a measure of the general state policy environment rather than a direct indicator of the resources available to state agencies. Given these conflicting findings, it is unclear from the literature how to understand the role of slack organizational resources or the state economic environment in digital government innovation. West's findings also rely on data from 2003, suggesting that either state or organizational resources may have become more important for sustained innovation than for the extent of early implementation.

This study will allow us to reexamine the role of resources over time and to explore the effects of new institutions and procedures. Theory and research on e-government suggest that there is a need for institutional change as well as new administrative bodies. Scholars have identified progressively more sophisticated stages for e-government, involving administrative restructuring at higher stages of development (Layne and Lee 2001; Moon 2002). Effective implementation may require agencies to collaborate across organizational boundaries in order to present information and service delivery in a way that it is seamless rather than fragmented across departments. (Fountain 2001; Peters 2001). Greater transparency of information may require rethinking the ways in which government communicates with its citizens (Tolbert and Mossberger 2006). Chadwick has observed that "there is much in the argument that the Internet has so far proved to be a major source of institutional innovation. Although what happens politically on the Internet maps onto existing non-Internet institutional forms, the net has created new types of rules, norms, procedures and social goals. In other words, the net is itself a source of institutional innovation; it creates some institutions of its own" (2006, 3).

> Technology may also facilitate organizational change through the flattening of hierarchies, decentralization, and the creation of new norms.

What are the factors that might facilitate the development of digital government? Proponents have depicted e-government as linked to other efforts to reform fundamental government processes in order to produce (1) greater efficiency and customer service or (2) enhanced opportunities for communication and participation (Norris 2001; Seifert and Peterson 2002). The entrepreneurial model of e-government emphasizes customer service and efficiency, emulating the use of e-commerce in the private sector (Fountain 2001; Ho 2002; Moon 2002). In the United States, e-government was promoted in the mid-1990s at the federal level by Vice President Al Gore as part of the National Performance Review (Fountain 2001, 19; West 2005, 22). Elsewhere, the idea has been associated with similar New Public Management reforms, although the Tony Blair government in the United Kingdom has portrayed digital government as a means of increasing political participation as well (Chadwick and May 2003; Clift 2000).

The potential for increasing civic engagement is clear, as the information capacity available on the Internet allows citizens to become more knowledgeable about government and political issues,[2] and the interactivity of the medium allows for new forms of communication with elected officials (Bimber 1999; Thomas and Streib 2003). Information and service delivery are currently much more prevalent than online participatory opportunities (Chadwick and May 2003; Musso, Weare, and Hale 2000; Norris and Moon 2003; West 2003a, West 2003b), and previous studies have indicated that potential efficiency gains are a primary motivation for e-government use (McNeal et al. 2003; West 2005). Though advocates vary in their visions of responsiveness, it is clear that e-government may be rooted in a more general orientation toward administrative reform. This suggests that the reform orientation of state governments should be examined in relation to the institutionalization of e-government.

Research Hypotheses

Based on the review of the literature, we develop a number of testable hypotheses for state implementation of e-government over time. The characteristics of more innovative states may be a combination of continuity with previous studies and change based on institutionalization of the policy area.

H_1—Institutional Capacity Hypothesis: Though not included in previous studies, we argue that state institutional capacity in information technology matters and should influence innovation in digital government. Building on Chadwick (2006) and Fountain (2001), we hypothesize that states that are sustained innovators (i.e., those that have high scores on the scope of e-government implementation across

years) are those that have the institutional infrastructure to develop e-government, such as dedicated state legislative committees, autonomous information technology executive departments, or more institutionalized information technology management and administration. Legislative professionalism is a measure of institutional capacity as well, although a more general one. We hypothesize that legislative professionalization will continue to be significant for digital government (McNeal et al. 2003).

H_2—Slack Resources Hypothesis: States with more slack resources, measured by total state revenues per capita, may have the ability to innovate more extensively in e-government, which requires investment in technical and administrative infrastructures (Clark 1985).

H_3—State Environment of Policy Innovation*:* Building on work by Walker (1969), we believe that wealthier, more urbanized states and larger states with more robust economies will be innovators in e-government, as they are in other policy areas.

H_4—Citizen Demand Hypothesis: States with higher need (evidenced by the percentage of the population online) are likely to be among the laggards catching up. Though citizen demand was not significant in earlier studies (McNeal et al. 2003), it may have become a predictor of innovation over time.

Data and Measurement

Outcome Variable

To explore the factors that influence state innovation in digital government, this study examines an index of state e-government use (or overall performance) during the period 2000–04. The primary dependent variable in our analysis is overall implementation of state digital government (or e-government Web sites), a variable developed by Darrell West and measured yearly as reported in a series of studies, *State and Federal E-Government in the United States* (West 2000b, 2001, 2002, 2003a, 2004a; see also West 2005). This measure is an annual, interval-level index based on a composite score using 12 criteria.[3] West's research team visited each state government site[4] and scored the site by the presence of the following 12 features: online publications, online databases, audio clips, video clips, foreign language or language translation, advertisements, premium fees, user payments or fees, disability access, several measures of privacy policy, multiple indicators of security policy, presence of online services, number of online services, digital signatures, credit card payments, e-mail addresses, comment forms, automatic e-mail updates, Web site personalization, PDA accessibility, and readability level. This overall index serves as the primary outcome (or dependent) variable in this study, measured over time.[5]

Table 1 Comparison of State Activities Online, 2000 and 2004

Activity	2000	2004
Online transactions*	22%	56%
Privacy policy	7%	63%
Security policy	5%	46%
Disability access	15%	37%
Foreign-language translation	4%	21%
Registration for updates	n.a.	24%

Note: Online transactions are those that can be completed entirely online. Forms that can be downloaded but must be faxed or mailed are not counted as online transactions.
Source: West (2000b, 2004).

Exploring the Data: Changes in Content and State Rankings

Comparing the findings from 2000 to 2004, it is apparent that e-government experienced rapid technical development over the five-year period. Table 1 shows dramatic growth in the technical capacity of state government online.

Privacy and security policies changed most over the five years, perhaps because of heightened awareness of these issues, as well as increased expertise. Online transactions more than doubled, and this aspect of e-government requires a more advanced technical and administrative infrastructure than does the simple posting of information online (Layne and Lee 2001; Moon 2002). Adaptive technology for individuals with disabilities and foreign-language translation features represent not only technical improvements but also greater efforts to reach a broader segment of the public. Registration for automatic updates shows that technical advances are making new services available over time.

A comparison of the top 10 states in 2000 and 2004 shows that states changed both in their rankings and in their innovation scores over the five years, so e-government may not be evolving for all of the states through the smooth progression from one stage to the next.

Table 2 indicates some overlap between the lists—primarily New York, Illinois, and Texas, but with Texas scoring much lower in 2004. Iowa, a relatively small rural state, provides a good example of the fluctuation in the rankings. In 2000, it ranked eleventh in terms of overall e-government innovation, along with other less populous states, but by 2004, it had fallen to thirty-seventh, with more populous, wealthier states leading in the rankings. It is clearly time to reexamine the factors that account for innovation in e-government given the dramatic growth of e-government and the sweeping changes in the states ranking most highly.

Table 2 Comparison of States E-Government Rankings, 2000 and 2004

State and Score, 2000		State and Score, 2004	
Texas (51%)	1	Tennessee (56.6%)	1
Minnesota (50%)	2	Maine (55.2%)	2
New York (50%)	3	Utah (54.6%)	3
Pennsylvania (50%)	4	New York (53.6%)	4
Illinois (49%)	5	Illinois (51.0%)	5
Kansas (48%)	6	Massachusetts (51.0%)	6
North Dakota (48%)	7	Indiana (46.0%)	7
Florida (47%)	8	Texas (44.5%)	8
Missouri (47%)	9	Delaware (44.2%)	9
Oregon (47%)	10	New Jersey (41.3%)	10
Iowa (45%)		California (41.2%)	
North Carolina (45%)		Connecticut (40.3%)	
Washington (45%)		Florida (39.9%)	
Idaho (44%)		Kansas (39.9%)	
Michigan (44%)		Pennsylvania (39.3%)	
Alaska (43%)		Arkansas (39.2%)	
Ohio (43%)		Kentucky (39.0%)	
California (42%)		Arizona (38.8%)	
Virginia (42%)		Oregon (38.6%)	
Wisconsin (42%)		Ohio (38.5%)	
Alabama (41%)		Louisiana (38.2%)	
Indiana (41%)		Michigan (38.0%)	
Massachusetts (41%)		Washington (37.8%)	
Mississippi (41%)		Virginia (37.7%)	
South Carolina (41%)		Georgia (36.9%)	
Utah (41%)		New Hampshire (36.0%)	
West Virginia (41%)		Colorado (35.5%)	
Arkansas (40%)		South Dakota (35.5%)	
Connecticut (40%)		Rhode Island (35.4%)	
Kentucky (40%)		North Dakota (35.3%)	
Louisiana (40%)		North Carolina (34.8%)	
Maryland (40%)		Maryland (34.4%)	
Maine (40%)		Montana (34.1%)	
New Jersey (40%)		Minnesota (34.0%)	
New Mexico (40%)		Nevada (33.7%)	
Tennessee (40%)		Idaho (33.7%)	
Wyoming (40%)		Iowa (33.3%)	
Oklahoma (39%)		Missouri (33.0%)	
Arizona (38%)		Alaska (32.8%)	
Georgia (36%)		Hawaii (32.3%)	
Montana (35%)		Vermont (31.3%)	
Colorado (35%)		South Carolina (30.6%)	
Hawaii (35%)		Wisconsin (30.0%)	
Nebraska (35%)		Alabama (29.9%)	
Vermont (35%)		Oklahoma (29.8%)	
Nevada (33%)		New Mexico (28.8%)	
South Dakota (33%)		Nebraska (28.5%)	
New Hampshire (32%)		Wyoming (28.4%)	
Delaware (31%)		Mississippi (26.8%)	
Rhode Island (29%)		West Virginia (26.0%)	

Source: West (2000b, 2004).

Predictor Variables

Extending the previous research on e-government, a primary explanatory variable is state institutional capacity in the area of information technology policy. Program complexity, obvious in the case of e-government, requires the building of a technical and administrative infrastructure (Clark 1985; Fountain 2001). We use the Progress and Freedom Foundation's measure of information technology (IT) management and administration (annual measures for each year in the time series), which calculates the "institutions and processes established by state governments to improve efficiency, coordination, decision making and information flow" (Lassman 2002, 15). This interval-level explanatory variable measures the presence of (1) an IT technology board responsible for oversight and coordination, (2) a state chief information officer authority, (3) statewide IT architecture, (4) intergovernmental projects, and (5) e-procurement systems, among other factors (Lassman 2002). These institutional or infrastructure support mechanisms are distinct from the features on the government Web sites themselves, which are used to measure the dependent variable—policy implementation. Two additional measures of infrastructure and leadership capacity included in the analysis are whether the state has a separate IT office that is a department unto itself (1 = yes, 0 = no) and whether there are IT committees in the state legislature (Council of State Governments 2002). The state legislative committee variable is a three-point ordinal scale coded 2 if both the state House and Senate have an IT committee, 1 if one of them has a committee, and 0 if neither has an IT committee. If institutions matter for sustained e-government development, it is expected that each of the infrastructure variables will be positively related to innovation in e-government.

Legislative professionalization serves as a final measure of state institutional capacity and a proxy for overall professionalization of state government. We expect support for digital government to be the strongest in states with more professional legislatures, measured by an index created by Squire (1992) that uses the U.S. Congress as a baseline against which to measure the salary, staff, and time in session of the 50 state legislatures.[6]

The literature on organizational innovation has identified slack resources as an important factor in innovation (Downs and Mohr 1979; Rogers 1995, 380). Though the use of computers and the Internet has the potential to save money in the long run, there are start-up and maintenance costs associated with Web sites. Government resources are measured by total revenues per capita for the 50 states for each year in the time series (2000–04) using data from the U.S. Census.[7]

A state economic environment or a more general environment of policy innovation may be more important than slack resources; it is measured by gross state product for each year in the time series (U.S. Census). Societal resources are measured by median household income, education, and urbanization for each state over time, consistent with the literature (Walker 1969). Urbanization is measured by the percentage of the population residing in urban areas, while educational attainment is measured by the percentage of the population over age 25 with a bachelor's degree over time, with data from the U.S. Census for each year in the time series.

Demand is another important factor in state policy innovation, according to Mooney and Lee (1995). Use of the Internet in state government could be conceived of as a response to demand from an increasingly computer-savvy populace (Norris, Fletcher, and Holden 2001), as measured by Internet use by state residents. We measure public demand for e-government services by the percentage of households with Internet access at the state level (U.S. Department of Commerce). An educated and wealthy population may also be important for demand. The variables measuring median household income and educational attainment of the state's population also measure demand for increased digital government services.

Another argument in favor of digital government articulated by participatory models of governing is to lower barriers for constituents and businesses in terms of accessing government information. We test this hypothesis directly by including voter age turnout in the state as a measure of participatory politics. This variable is available every two years from the U.S. Census and measures the votes cast for president or U.S. representative in midterm years, divided by the population older than age 18.

Given disparities in access to computers and the Internet based on race/ethnicity, a reality commonly referred to as the "digital divide" (Norris 2001; Mossberger, Tolbert, and Stansbury 2003; Warschauer 2003), we would expect states with higher racial diversity to be less likely to innovate in digital government than predominantly white, homogeneous states. State racial diversity is measured by a dissimilarity index of racial and ethnic percentages, created for the 50 states using demographic data from the 2000 U.S. Census on the size of the African American, Latino, Asian American, and non-Hispanic white populations (Hero and Tolbert 1996). States with more heterogeneous populations score higher on the index of racial diversity. Race has been shown to be associated with a range of policy outcomes in the states (Hero 1998), and thus it also serves as a control variable.

Urbanization represents more than a measure of economic development; it is also related to telecommunications infrastructure. Individuals who live in rural areas face unique challenges to online access compared to their urban and suburban counterparts. Stover (2001) examined the dial-up connectivity of four rural counties in the United States and found that Internet access was hampered by limited choices for service providers and considerably higher connection fees than in urban and suburban areas. More recent studies show continued disadvantages for rural residents (Nicholas 2003), including lower high-speed connectivity (Horrigan and Murray 2006).

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We measure party control of the government by the percentage of Democrats in the state legislature over time (Council of State Governments 2000, 2002, 2004). Party control of the state legislature measures the magnitude of partisan control of the state government and provides a better measure than a dichotomous variable for the political party of the governor or state legislative leadership. We also control for state party competition. This may create a more conducive environment for technology reforms, even if the issue is not highly charged politically. Party competitiveness is measured by an index of district-level electoral competition developed by Holbrook (1994). Legislative variables are relevant to e-government implementation, as legislators control budget authorization, and their support has been characterized by state administrative officials as helpful (West 2000a).

Finally, Erikson, Wright, and McIver (1993) have found that variation in some policy areas can be explained by the public opinion of the electorate, measured by an index of state ideology. Though this has not been a politically salient issue, given the earlier results that the partisanship of state legislatures was significant for innovation, we include public opinion as well. We use Berry et al.'s (2002) measure of citizen ideology for various years (higher values indicate greater policy liberalism).

Findings

Because the dependent variable is continuous, measured over time by pooling data from the 50 states, we use a common statistical method: cross-sectional time-series analysis. Specifically, we use ordinary least squares regression with panel-corrected standard errors.[8] Year dummy variables are also included to reduce possible bias in the standard errors from heteroskedasticity. Variation inflation factor tests indicate no problems of multicollinearity with the combination of variables included in the analysis. Summary statistics for the variables used in the analysis are presented in appendix table 1.

The results of the analysis are reported in table 3 in two forms: controlling for slack resources/total state revenues (columns 1 and 2) and overall wealth/gross state product (columns 3 and 4). There is a moderately high correlation between median income and the educational attainment of state populations (correlation = .72).

Columns 1 and 3 include a complete set of predictor variables, while columns 2 and 4 include a reduced number of coefficients addressing concerns about collinearity between the socioeconomic measures. The second and fourth models contain median income but drop educational attainment.

Summary of Findings: What Drives E-Government Innovation in the States?

	Institutional capacity	Slack resources	Traditional policy innovation environment	Demand
Hypotheses	Yes	No	Yes	Yes/No

Extending the research on e-government, we find support for our hypothesis about the importance of state infrastructure for sustained policy innovation—a factor not considered in earlier research on e-government adoption in the American states. The level of institutionalization for IT administration and management measured by the Freedom House is an important factor in determining which states will innovate in e-government over time across all model specifications. The presence of legislative committees in the House and Senate dedicated to e-government is also critical in explaining the extent of policy innovation (90 percent confidence interval). States with the necessary infrastructure and legislative policy making capacity have more extensive implementation of e-government over time. However, a dedicated department-level state office for information technology is not associated with e-government performance. In general, we find strong evidence that institutions and organizational capacity matters in explaining innovation in digital government in the states.

Demonstrating more general institutional capacity, table 3 also suggests that after controlling for other factors, legislative professionalism is an important factor in determining whether states will innovate in e-government. In three of the four models, legislative professionalization is a strong and statistically significant predictor of overall implementation of digital government. States with more professional governments are more likely to be leaders in offering state residents government services and information online, consistent with previous research (McNeal et al. 2003; West 2005).

We fail to find empirical support for our slack resources hypothesis for e-government innovation. In models 1 and 2, states with higher per capita total revenues (slack resources) are not more likely to develop e-government over time, controlling for other factors. The coefficients are negative but not statistically significant. Thus, it is not the availability of government dollars that drives lawmakers to invest in digital government.

However, consistent with previous research on the general innovativeness of states (Walker 1969), we find evidence that wealthier states are more innovative in this area, holding other factors constant. Across the board, states with higher educational attainment are also shown to be leaders in e-government, as are states with higher gross state product (columns 3 and 4). When educational attainment is not included in the models (columns 2 and 4), states with higher median incomes are more likely to demonstrate e-government innovation over time. Urbanization is not statistically significant. These results are consistent with West's (2005) analysis of 2003 data when the outcome variable is the overall index or percentage of state agencies with online services. West (2005) measures fiscal capacity by state per capita income. We measure fiscal capacity by gross state product, educational attainment of a state's population, and median income. The fact that the findings are consistent across the two studies despite the alternative measurement of state wealth provides further evidence that overall state wealth (if not government resources) is important in e-government performance in the states.

In contrast to previous research based on data from a single year (McNeal et al. 2003), when e-government innovation is measured over time and in terms of overall performance, we find that it approximates other policy areas in terms of factors traditionally associated with policy innovation, with wealthier and more educated states taking the lead.

From these results, we can conclude that participatory politics and constituent demand do not drive adoption of digital government. States with a smaller percentage of the population online are actually more likely to innovate over time, consistent with previous research. If demand is operationalized by a more educated population seeking improved communication with and information about government via digital means, we find partial support for the demand hypothesis. Participation in elections, measured by average state voter turnout, is not related to innovation.[9]

States with a smaller percentage of the population online are actually more likely to innovate over time, consistent with previous research.

However, it may be the *distribution* of technology access and use rather than the percentage of the population online that influences the use of e-government. States with higher racial diversity are significantly less likely to innovate in digital government over time, whereas more homogeneous white states are more likely to be policy innovators. Perhaps this reflects some constraints on e-government because of technology

Table 3 Predicting Sustained Innovation in E-Government, 2000–04 (Darrell West's Overall Indices of State Government Web Sites)

Covariates	Complete model with state general revenues per capita		Reduced model without educational attainment		Complete model with gross state product		Reduced model without educational attainment	
	1		2		3		4	
Model	*Coef.(s.e)*	*P>|z|*	*Coef.(s.e)*	*P>|z|*	*Coef.(s.e)*	*P>|z|*	*Coef.(s.e)*	*P>|z|*
Institutional capacity								
Legislative professionalization	10.45 (1.90)	.000	10.69 (2.06)	.000	5.50 (2.90)	.066	4.27 (3.14)	.313
Department-level IT office	.55 (.90)	.537	.16 (.91)	.860	.33 (.92)	.712	.02 (.90)	.979
IT management and administration	.10 (.02)	.000	.09 (.01)	.000	.08 (.02)	.000	.08 (.01)	.000
House and Senate IT committees	.30 (.17)	.066	.27 (.19)	.148	.35 (.19)	.071	.36 (.21)	.078
Slack resources								
Total state revenues per capita	–.0001 (.000)	.536	–.0004 (.0002)	.128				
Traditional policy innovator								
Gross state product					.005 (.001)	.000	.005 (.001)	.000
Median income	–.00002 (.00003)	.581	–.00009 (.00004)	.034	.00002 (.00004)	.550	.0001 (.00003)	.001
Percent with bachelor's degree	.29 (.03)	.001			.24 (.08)	.002		
Percent urban	.02 (.03)	398	.02 (.03)	.518	.02 (.03)	.473	.02 (.03)	.444
Citizen demand								
Percent of households with Internet access	–.20 (.09)	.021	–.13 (.09)	.155	–.21 (.07)	.003	–.17 (.08)	.019
Voter age population turnout	.01 (.04)	.250	.02 (.04)	.597	.04 (.05)	.335	.05 (.04)	.226
Political factors								
Liberal citizen ideology	–.02 (.03)	.250	–.02 (.02)	.404	–.02 (.03)	.321	–.01 (.03)	.526
Percent Democrats in state legislature	–4.11 (2.17)	.058	–3.56 (2.26)	.114	–4.34 (2.37)	.066	–4.22 (2.49)	.090
District-level party competitiveness	.03 (.05)	.542	.03 (.05)	.527	.02 (.05)	.545	.02 (.05)	.662
Controls								
Racial diversity	–6.41 (3.55)	.071	–5.19 (3.35)	.120	–8.24 (2.93)	.005	–8.04 (2.87)	.005
Year 2001	–.39 (.26)	.117	–.58 (.23)	.012	–.23 (.18)	.186	–.28 (.18)	.108
Year 2002	7.67 (1.70)	.000	6.79 (1.75)	.000	8.50 (1.46)	.000	8.30 (1.468)	.000
Year 2003	–1.84 (1.56)	.236	–2.53 (1.61)	.115	–1.13 (.89)	.421	–1.33 (1.42)	.347
Year 2004	–1.23 (.95)	.193	–1.76 (1.07)	.100	–1.23 (.89)	.164	–1.60 (.96)	.094
Constant	36.15 (3.25)	.000	35.82 (3.46)	.000	35.35 (3.99)	.000	34.66 (4.30)	.000
R^2	.523		.510		.544		.535	
Wald Chi^2	167150.03	.000	104965.14	.000	19774.56	.000	6810.31	.000
N	235		235		235		235	

Note: Time-series cross-sectional data for the 50 states. Unstandardized regression coefficients with panel-corrected standard errors in parentheses. Probabilities based on a two-tailed test. The number of panels is 47. The number of observations per panel is five. Variation inflation factor tests indicate no problems of multicollinearity.

disparities, or the "digital divide" (Mossberger, Tolbert, and Stansbury 2003; Warschauer 2003).

Consistent with earlier research (McNeal et al. 2003), we find that partisan politics matters. States with Republican-controlled legislatures are more likely to embrace e-government over time. This provides more evidence that the perceived efficiency gains and cost savings associated with e-government are a primary justification for its use and expansion from political elites. This stands in contrast to the lack of evidence for the other rationale for e-government, increased participation (measured by demand or voter turnout). Other variables measuring political factors, such as party competition or citizen ideology, are not related to innovation of e-government.

What Explains the Institutionalization of E-Government?

As a follow-up, we explore what state factors predict institutional capacity in the area of information technology. Our primary explanatory variable in table 3, IT management and administration, becomes the dependent or outcome variable in table 4. A similar set of control variables and statistical analysis is used in table 3, but we exclude all measures of state institutional capacity to avoid tautology concerns and include as an explanatory variable an index of reinventing government/state reform orientation developed by Brudney, Hebert, and Wright (1999, 24) and based on data from 1994. The reinvention index measures the implementation of 11 reforms that are consistent with the reinvention paradigm; a higher score indicates more extensive implementation. We would expect states with an orientation toward reform to be more likely to develop the structural and leadership capacity to support information technology. West has suggested that administrators with a New Public Management perspective are more amenable to e-government (West 2005, 22). The results presented in table 4 are illustrative and further refine the findings from the analysis of e-government innovation.

Table 4 indicates that a powerful predictor of information technology management and administration (state capacity in IT) is a state orientation toward public management reform, as measured by the reinventing government index for the 50 states. States that have reformed other rules, procedures, and institutions of state government are significantly more likely to develop the structures needed for IT development over time. So, institutional reform begets new institutions. Use of 1994 state scores on reinvention gives us strong leverage on causation and time order. Any institutional change associated with reinvention precedes the formation of new institutions necessary to support e-government by several years, creating sufficient lag time for reinvention reforms to have an effect.

Table 4 Predicting State Institutions/Information Technology Organizational Capacity, 2000–04

Covariates	IT management and administration/Freedom House scores	
	OLS	
	1	
Model	*Coef.(s.e)*	*P>|z|*
Reformed government		
Reinventing government index	1.34 (.06)	.000
Slack resources		
Total state revenues per capita	–.003 (.001)	.000
Traditional policy innovator		
Median income	.002 (.0001)	.000
Percent with bachelor's degree	1.43 (.28)	.000
Percent urban	–.08 (.02)	.000
Political factors		
Liberal citizen ideology	–.08 (.05)	.107
Percent Democrats in state legislature	–11.37 (5.37)	.034
Controls		
Racial diversity	19.43 (3.75)	.000
Percent Internet access	.03 (.31)	.911
Year 2001	–1.02 (.44)	.021
Year 2002	–1.06 (4.43)	.810
Year 2003	.44 (3.97)	.911
Year 2004	3.44 (3.47)	.323
Constant	27.62 (6.67)	.000
R^2	.21	
Wald chi^2	8.89	.000
N	240	

Note: Time-series cross-sectional data for the 50 states. Unstandardized regression coefficients with panel-corrected standard errors in parentheses. Probabilities based on a two-tailed test. The number of panels is 48. The number of observations per panel is five. Variation inflation factor tests indicate no problems of multicollinearity.

As we found earlier, wealthy states with a more educated population are significantly more likely to develop institutional and management capacity for IT, as shown by the positive and statistically significant coefficients for state median income and educational attainment. However, once again, slack resources are not important. States with higher total revenues per capita are actually less likely to develop infrastructure and management in the area of information technology. While traditional policy innovators tend to be urban states, we find the opposite is the case with the development of information technology institutions (if not e-government). Rural states tend to be significantly more likely to develop institutional capacity regarding technology. Despite lower rates of connectivity for rural populations, states may recognize the potential of information technology for improving service delivery in sparsely populated areas. Ideology and partisan politics matter even more for the development of institutions than for innovation in digital government. States with more conservative public opinion or ideology and Republican-controlled legislatures are more likely to develop infrastructure in the area of information technology. It should be noted that e-government is but one small section of state

information technology policy, so the overlap in the factors that predict both phenomena (e-government and IT management and administration) is important. To our knowledge, this is the first empirical analysis to explore the factors predicting the creation of new institutions resulting from technology use in state government.

As in the analysis of e-government innovation, we find a combination of overall state wealth, partisanship or ideology, and reform orientation drives institutional capacity in the American states in information technology policy. The aggregate state data analysis has some limitations; although we have used a longitudinal design, only five years can be examined given the early stage of development of this policy area. Further research is necessary to confirm the findings reported here—especially whether the factors we have identified will continue to be important predictors of e-government innovation in the future.

Conclusion: Institutions and Innovation over Time

A broader conceptualization of innovation as implementation (rather than as a single act of adoption alone) leads us to ask what factors sustain and support innovation and whether these change over time. This study has aimed to better understand the development of e-government in particular, but also to contribute an institutional dimension to the study of innovations.

Although some variables for e-government innovation are consistent across years, we find that the states that emerge later as innovators are those that have created facilitating institutions and are more affluent and educated states. In turn, those states more committed to reinventing government reforms are the ones that have established new institutions for e-government.[10] Together, these findings paint a picture of greater e-government innovation as part of a more general effort to modernize government and as a result of institutional capacity. This fits the genesis of e-government at the federal level but offers new evidence of the connection with the reinvention paradigm at the state level as well.

The continued significance of legislative professionalization indicates more wide-ranging capacity across state government (Rosenthal 1997), as well as the new institutions in these states specifically addressing information technology. Both innovation in e-government and the institutionalization of information technology are associated with Republican state legislatures, demonstrating that e-government has been consistently viewed as a vehicle for producing efficiency and trimming budgets. As in earlier research, demand is not significant, and neither are participatory variables such as voter turnout, lending little support to the idea of digital democracy as an inspiration for e-government innovation in the states. Indeed, discussion and deliberation are not at this time prominent features of state Web sites, whereas online service delivery has been increasing. The values of efficiency and improved communication with citizens are not necessarily opposed, of course, and the relative significance of these goals for public administration depends on what citizens want from government (Goodsell 2004; Hyneman 1950). Some authors have also suggested that more participatory opportunities, as well as better service delivery, may develop with more experience (Moon 2002).

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Because scholars have contended that higher levels of e-government implementation demand considerable restructuring of existing organizations, this raises interesting questions for further research (Layne and Lee 2001; Moon 2002). To what extent do these new structures in state government (state-level agencies, for example) represent other, deeper changes within organizations, including norms of collaboration and the informal interactions across agencies that are needed for the full development of information technology's potential (Fountain 2001)? Examining Lassman's (2002) index, it is clear that states with higher scores have administrative structures that span departmental boundaries (such as technology boards, the position of chief information officer, and government-wide systems for procurement). More research is needed to understand the specific role of institutional creation and change in e-government, in qualitative terms, and over a longer period of time.

How generalizable are the main findings about institutionalization and state policy environment to other policies? Baumgartner and Jones (1993) describe the creation of institutions within a policy area as necessary for maintaining activity around an issue once it has dropped from visible public agendas. The incremental change that occurs under such conditions may be sufficient to promote continued experimentation and expansion. Institutional theories, then, suggest that the creation of supportive institutions may have broad implications for the capacity to innovate over time in other policy areas as well. As political scientist E. E. Schattschneider (1960) made clear nearly a half-century ago, rules and institutions matter.

Our results also build on more general theories of policy innovation. States that have moved ahead with e-government are those that tend to be first adopters when many policies are examined over time—wealthier and more educated states (Savage 1978; Walker 1969). While this differs from the factors associated with more comprehensive e-government innovation in 2000, an examination of other policies may show that states with a general climate of innovation (supported by a more affluent and educated population) have some advantages in sustaining innovation as well as being first adopters. Legislative professionalization, a measure of state institutional capacity, has been shown to be a significant predictor in numerous studies of innovation in policy adoption (Derthick 1970; Downs 1976; Downs and Rocke 1980). Because this may be a more general indicator of state institutional capacity, it is also associated with more comprehensive and innovative implementation in earlier studies and over time (McNeal et al. 2003; West 2005).

Finally, the affinity between reinvention and e-government raises the possibility that the modernization of state institutions more generally facilitates innovation. In an earlier wave of state institutional reform, Bowman and Kearney (1986) described the resulting policy innovation as the resurgence of the states, which was evident on issues as diverse as health, education, welfare, and economic development. More recently, they concluded that these institutional reforms have sustained innovation across a number of policy areas in recent years (Kearney and Bowman 2003). By updating institutions, states may promote the conditions for further innovation. Given the extensive changes in governance experienced over the past few decades (Osborne and Gaebler 1992; Peters 2001; Rosenthal 1997; Tolbert 2003), there is compelling reason to further explore the relationship between broad institutional reforms and policy innovation.

Notes

1. West (2005, 74–75) measures the number of online services by the average number of services online across sites/agencies (i.e., total online services divided by the number of agencies in a state). He also measures the percentage of state agencies offering online services. The depth (number) and breadth (percentage of agencies) for online services has a modest correlation of $r = .47$, indicating an incomplete overlap between the two measures. McNeal et al. (2003) employ the percentage of a state's government Web sites that offer at least one service, using West's (2000) data.
2. For example, a number of studies have connected the use of online news with civic engagement (Jennings and Zeitner 2003; Nisbet and Scheufele 2004; Shah, Kwak, and Holbert 2001) and with voter participation (Bimber 2003; Krueger 2002, 2005; Tolbert and McNeal 2003). Information provided by governments online may plausibly increase civic engagement or participation offline as well, although this is an empirical question.
3. The Web site components listed here are from West (2004). The list for West (2003) is largely the same. Some additional items in the 2000 study are now ubiquitous, such as office phone number, office address, and external links. New items in 2004 reflect changes in technology, such as PDA accessibility.
4. The 2000 study is based on 1,716 state government Web sites, whereas the 2004 study is based on 1,569 state sites.
5. We analyze overall e-government performance (index) rather than the percentage of online services on a Web site available to citizens as a more complete measure of policy innovation in this area.
6. Because the Squire index does not change over the time series, this variable represents a fixed effect.
7. See http://ftp2.census.gov/govs/state/04statess.xls.
8. The command in STATA is "xtpcse," which produces panel-corrected standard error estimates for linear cross-sectional time-series models in which the parameters are estimated by ordinary least squares. When computing the standard errors and the variance-covariance estimates, the disturbances are, by default, assumed to be heteroskedastic and contemporaneously correlated across panels. Beck and Katz (1995) make a strong case for using panel-corrected standard errors over random-effects models for pooled data when the number of time periods is relatively small compared to the number of panels ($T < N$). They argue that the coverage probabilities based on the ordinary least squares point estimates with panel-corrected standard errors are closer to nominal levels than the coverage probabilities of the general least square estimators with associated model-based general least square standard errors. Our models have five time periods (T) and 47 panels (N), with each state as a panel. The use of panel-corrected standard errors corrects for serial correlation in calculating the standard errors of the regression coefficients. Because these data are panel dominated with a small number of time periods, some scholars have suggested that the use of panel-corrected standard errors may introduce bias. The models in this paper were also estimated with a general least square random-effects model in STATA, and the results were not substantively different from those using panel-corrected standard error procedure.
9. West (2005) found citizen demand (measured by the percentage of Internet users in a state) to be most central with regard to Web site readability.

10. One reason earlier innovators appear to fall behind from 2000 to 2004 may have to do with the natural cycle of expenditures. A state that invested in "state of the art" e-government technology just prior to 2000 would have unlikely to make another heavy investment before 2004. So by 2004, their Web sites are no longer scoring high on the e-government rankings and have lagged behind. However, it may be the original innovators will not necessarily remain behind indefinitely. A reevaluation of this study in five years would help determine whether the pattern of innovation we find will remain. Newer indices for measuring reinvention reforms and legislative professionalization in the states (Squire 2007) would facilitate such research.

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Appendix Summary Statistics for Variables Used in the Analysis

State variables (average 2000–04)	Mean	Median	Maximum	Minimum	Range	Inter-quartile range	Standard deviation
Legislative professionalization	.22	.19	.66	.04	.62	0.12	.14
Department-level IT office	.30	.00	1.00	.00	1.00	1.00	.46
IT management and administration	72.17	72.86	95.01	.00	95.01	11.72	17.57
House and Senate IT committees	1.12	1.50	2.00	.00	2.00	2.00	.93
Total state revenues per capita	4716.08	4420.78	13691.30	2774.13	10917.17	1424.35	1489.58
Gross state product	204.75	120.30	1873.80	17.00	1856.80	225.90	259.52
Median income	48957.58	47375.00	65182.00	34465.00	30717.00	10433.00	7255.21
Percent with bachelor's degree	25.57	25.35	37.60	15.30	22.30	5.73	4.43
Percent urban	65.40	67.04	93.80	29.60	64.20	23.50	14.96
Percent of households with Internet access	49.58	51.05	68.80	26.30	42.50	14.50	9.08
Voter age population turnout	47.94	48.00	73.00	29.60	46.10	15.30	10.16
Liberal citizen ideology	47.33	47.43	95.85	8.45	87.40	18.58	15.81
Percent Democrats in state legislature	.50	.49	.86	.11	.75	.18	.15
District-level state party competitiveness	39.03	40.18	56.58	9.25	47.32	18.71	11.31
State racial diversity	.37	.36	.77	.07	.70	.27	.16
State reinvention score	22.76	23.06	28.32	17.82	10.50	4.76	2.71