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Twitter and the Diffusion of Technology Innovation in the United States Congress

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Abstract

This paper affords an opportunity to study the early adoption, implementation and performance of an emerging technology by analyzing which members of Congress have been early adopters and extensive users of Twitter, and which have attracted the most followers. Our research questions and measures draw from the diffusion of innovation literature and early studies of online politics. Three multivariate analyses reveal that two motivators of adoption, party (Republican) and campaign resources are also drivers leading to extensive usage, but the other two, an urban constituency and the member's own age do not. Instead, a large vote share in the last election joins party and funding in explaining high usage. The latter two plus high influential power differentiate between members with large and small numbers of followers. Collectively, these findings suggest that at this early developmental stage, Twitter is not a game changer, but an additional communications medium. They also underscore the contribution of diffusion of innovation literature to understanding how these interrelationships change depending upon whether we are examining adoption, implementation or performance.

Introduction

The Role of Twitter. Social networking sites emerged as campaign tools in 2006. The site most prominently used by the candidates that year was Facebook. Although YouTube made its debut February 2005, its notoriety that election cycle derived not from its use by candidates, but from user generated videos that compromised candidates and in a few cases drove them from the race. Twitter first became available to those online in August 2006. Celebrities like Oprah and large businesses that include JetBlue, Dell and Starbucks have hundreds of thousands of followers on Twitter.[1] Members of Congress, in contrast, only began tweeting in April 2007, and only President Obama and Senator McCain have followings that match and indeed exceed those numbers (3,649,295 and 1,736,979 respectively, as of April 14, 2010).

Twitter attracted major attention during the June 2009 demonstrations and unrest following the Iranian election to the point that the State Department asked the site to delay scheduled maintenance to avoid disrupting communications among the Iranian protesters. Political tweets have generated their share of controversy in the U.S. as well. For example, on May 27, 2009, former House Speaker Newt Gingrich tweeted that Supreme Court Nominee Sonya Sotomayor was racist. "White man racist nominee would be forced to withdraw. Latina woman racist should also withdraw." Days later Gringrich issued a mea culpa, tweeting that his "initial reaction was...too strong and too direct."[2] The White House elevated the status of Twitter in its April 13th public call for tweets on the best and brightest ideas for the Grand Challenges of the 2st Century program sponsored by the Office of Science and Technology Policy and National Economic Council.[3]

The advent of Twitter challenges existing policies and rules of the game. Just before his interview with the president, Terry Moran, ABC Nightline co-anchor tweeted "Pres. Obama just called Kayne West a 'jackass' for his outburst at VMAs when Taylor Swift won. Now THAT'S presidential,"[4] raising questions about whether the understanding that discussions between the correspondents and the president are kept off the record by mutual consent applies to tweets. Tweets may violate House rules that "have been interpreted to prohibit (House) members from posting official content outside of the House.gov domain," according to Rep. Michael Capuana, D-MA, chairman of the Congressional Commission on Mailing Standards (franking). Recommendations he sent to House Administration Capitol Security Subcommittee Chairman Robert Brady advise that some rules are necessary so as not to mix House official messages with commercial or political campaign material. 'Official content' — like video — that is posted outside the House.gov domain should be clearly marked, should not appear alongside commercial or campaign content and should contain an exit notice for people linking out from the House.gov domain. Republicans like John Culberson argue that this interpretation limits their communications. Speaker Nancy Pelosi supports Capuano's recommendations as loosening, not restricting the rules, whereas House Minority Leader John Boehner warns of possible Democratic-led censorship of the Internet.[5]

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[1] See http://www.time.com/time/specials/packages/article/0,28804,1901188_1901207,00.html.

[2] See http://www.associatedcontent.com/article/2595475/the_influence_of_twitter_on_american_pg2.html?cat=15.

[2] See http://www.associatedcontent.com/article/2595475/the_influence_of_twitter_on_american_pg2.html?cat=15.

[3] See http://techpresident.com/blog-entry/white-house-turns-twitter-tap-next-big-thing.

[4] See (http://www.associatedcontent.com/article/2595475/the_influence_of_twitter_on_american_pg2.html?cat=15)

[5] See http://www.foxnews.com/story/0,2933,383444,00.html

Description of Twitter. Twitter is a free Web site that blends social networking with the ability to post short messages, or micro-blogs, commonly known by users as "tweets." CEO Evan Williams, Jack Dorsey, and Biz Stone co-founded Twitter to answer one question: What are you doing? The response, which is limited to 140 characters or less, is posted to a personal Web page that can be restricted to select viewers or viewed by anyone. Twitter boasts that its open platform supports 50,000 applications, for example, photo- and video-sharing. Unlike instant messaging, viewers do not reply to Twitter postings. Tweets are designed to be accessed through the Internet and on mobile devices.[6] Indeed, 76% of Twitter users are interacting wirelessly via a laptop, pda or cell phone. Moreover, Twitter usage is highly correlated with the use of other social networks and blogging.[7] In seeking new revenue sources, Twitter announced on April 13 an advertising program of 'promoted tweets' that will deliver sponsored ads at the top of contextually relevant Twitter search results. Only those that receive re-tweets, replies or get bookmarked will reappear.

According to the comScore Digital Year in Review, Facebook and Twitter both experienced triple-digit growth in 2009. Facebook surged to the number one position among social networks for the first time in May 2009 and finished with 112 million visitors in December 2009, up 105% from about 55 million visitors during 2008. Twitter finished the year with nearly 20 million visitors to its Website, up 900% from just 2 million visitors in 2008. By the end of February 2010, Twitter's estimated reach in the U.S. was over 27 million people per month.[8]

The site attracts a fairly wealthy, slightly more female than male, more youthful following.[9] Twitter users are also slightly more diverse in their racial and ethnic background than the U.S. population as a whole, and they are more likely to live in urban areas than Internet users more generally.[10] At the end of 2009, more than 30% of Twitter's visitors were under 25, up from about 20% of its visitors at the end of 2008. This represents a shift in its demographic composition. The initial success of Twitter was largely driven by users in the 25-54 year old age segment, which made up 65% of all visitors to the site in December 2008, with 18-24 year olds accounting for just 9% of visitors. As recent data from the Pew Internet & American Life Project show, Twitter and other status-updating sites are more popular with younger adults than older adults. Thirty-seven percent of online adults 18-29 use Twitter or another status-updating site, compared to 9% of 50- to 64-year-olds and only 4% of online adults 65 and older; the average usage rate among all adults is 19%. The median age of a Twitter user, however, is 31 in contrast to MySpace at 27 and Facebook at 26 years.[11]

Predicting Early Adopters

The diffusion of innovation literature offers insights into our research questions about who decides to use a new technology, to what extent, and with what impact on job performance or the organization itself. The characteristics of early adopters and also the timing and extent of the adoptions have been studied for both individuals and organizations (Fichman, 1992; Frambach & Schillewaert, 2002).[12] In most formulations, adoption decisions depend not only

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[6] See http://twitter.com/about

[7] See http://www.pewinternet.org/Reports/2009/Twitter-and-status-updating.aspx?r=1

[8] See http://www.quantcast.com/twitter.com

[9] See http://www.quantcast.com/twitter.com

[10] See See http://www.pewinternet.org/Reports/2009/Twitter-and-status-updating.aspx?r=1

[11] See http://www.pewinternet.org/Reports/2009/Twitter-and-status-updating.aspx?r=1

[12] A parallel, earlier literature exists in political science. See for example Hage and Aiken, 1967; Mohr, 1969; Walker, 1969; Gray, 1973.

on the characteristics of the adopter, but also on characteristics of the innovation or technology (e.g., ease of use, cost, etc.) and of the environment. For example, Kwon & Zmud (1987) identify five categories of these contextual factors: characteristics of the adopting organization, the user community, the innovation or technology, the task and the environment. Robertson and Gatignon (1986) describe a large set of factors related to what they call the competitive supply-side and adopter environments that affect diffusion of new technologies. The former include factors such as the degree of competition, standardization of the technology, research and development resources. The competitive adopter environment includes both structural attributes of the adopter industry such as its homogeneity and uncertainty of demand (customer needs) and communication attributes such as the professionalism and cosmopolitanism (external orientation) of the adopter industry.

Political science studies of the diffusion of campaign Web sites have examined fewer categories and a more limited number of contextual factors. Most draw upon the same finite set, which is divided into constituency factors (the user community) and political system factors (the environment). Constituencies are described demographically by median income, and percent urban, white, college educated, young, and sometimes rate of Internet penetration (Foot and Schneider, 2006). The political environment is described by characteristics of the electoral contest and candidate or public official: level of office, competitiveness of the race, party identification (of the constituency or candidate), party status (major or minor party), status of the seat (incumbent, challenger, open seat), and amount of campaign funds raised.

The diffusion of innovation literature suggests that the reason constituency factors should lead candidates to adopt new technologies is that organizations are mindful of the degree to which an innovation is compatible and incompatible with expectations (existing norms and values), as well as the needs and capacities of its users or customers (Tornatzky & Klein, 1982). The constituency attributes that have been selected to explain campaign Web site adoption are those that have been shown to correlate with citizen access to and use of the Internet: education, income, ethnicity, age, and urbanization (Chadwick, 2006; Klotz, 2004; Mossberger et al., 2003). Higher levels of education make people more comfortable with and skilled in the use of technology, while higher levels of income make computers easier to afford. Although whites use the Internet at higher rates than do African Americans, racial and ethnic differences have diminished over time and seem to be a reflection of disparities in education and income (Marriott, 2006). The age gap persists, however: Internet use declines with each advancing age group. Urban areas have greater Internet use than rural areas, but the difference has declined substantially. These constituency demographics in turn influence candidates' Internet use (Hernnson et al., 2007).

Although some studies confine their analysis of campaign Web site adoption to a single office (e.g., Puopolo, 2001), those that compare across levels find more adopters at higher levels of office (e.g., Kamarck, 2002; Greer & LaPointe, 2004). Major party candidates outpace those from minor parties, although the gap is shrinking (Gibson, et al., 2003; Greer & LaPointe, 2004; Klotz, 2004; Panagopoulos, 2005; Williams & Gulati, 2006; Howard, 2006). In the early days, incumbents were less likely than challengers to campaign on the Web, but a competitive race increased its use by incumbents and challengers alike (Kamarck, 2002; Xenos & Foot, 2005; Foot & Schneider, 2006; Hernnson et al., 2007). Financially disadvantaged candidates were less likely to have a campaign Web site in the early days of Internet campaigning (Gibson et al. 2003), although this has proved less of a barrier subsequently. Financial resources and major party status still differentiate which campaigns incorporate the latest technology and features, however (Foot and Schneider 2006). Electoral

attributes are less important today in differentiating which campaigns have a Web site, but remain important determinants of the degree to which they provide more sophisticated content and use their Web site to engage and mobilize supporters (Gulati & Williams, 2007).

Technologies diffuse at different rates, from more than fifty years for half the U.S. population to acquire telephones to just a few years for a majority to own personal computers (West, 2005). DiMaggio and Cohen (2005) posit that the rate depends on network externalities such as the need for a large number of participants or particular kinds of participants and new expertise and products to realize its value. They demonstrate this for Internet technologies, which consequently had a slower take-off relative to television. Thereafter, Internet diffusion has followed a very steep upward trajectory, which can be attributed to characteristics such as the technology's relative advantage, compatibility, versatility, "trialability" and visibility (see also Rogers, 2003). Social networks evidence many of these same externalities and characteristics. They benefit from a large number of members or serving a specific niche. And they require technical expertise and specialized knowledge to be designed and leveraged effectively.

The diffusion of innovation literature and previous studies of online politics, lead us to expect that the explanatory variables predicting which elected officials will be early adopters of Twitter will mirror those that predicted Web presence in the early days of Internet campaigning. Our models include three sets of factors, which represent indicators tied to attributes of constituencies (demographic attributes correlated with citizen access to and use of the Internet: education, ethnicity, age, and urbanization); a second set of attributes specific to the electoral environment: political party, vote share, and amount of funding; and a third set that capture personal characteristics: age and visibility.

Research Questions

This is a baseline, exploratory study of how members of Congress decide whether and how extensively to use Twitter in their communications with others, and the degree to which that audience is attending to them by becoming followers. The data reported herein address three research questions.

R1: What differentiates early adopters from their peers? We consider three sets of factors, constituency attributes, electoral environment, and personal characteristics. Each factor is represented by multiple indicators.

R2: What differentiates avid tweeters from infrequent ones? We employ the same three sets of factors and their indicators to explain the variation in the number of tweets members have sent since registering for a Twitter account.

R3: What differentiates those with a large Twitter following from those with only a few followers? Using the same three sets of factors and indicators, we view Twitter popularity as a measure of performance, i.e., evidence of a successful implementation of a technology innovation. Given that the number of tweets members have sent is only weakly correlated (+.315) with their number of followers (see also Huberman, et al., 2009), we need to look further to explain these performance results. This is important for two reasons. First, later adopters will base their decisions on whether an innovation has proven itself, i.e., their assessment of a technology's destiny rather than just management fashion (Fichman, 2004). Second, assuming a technology does take root, we need to understand its impact, on how

many and which individuals and groups. Number of followers is an initial measure of performance that will shed light on the role and importance of this new communications medium.

Data and Methods

To address our research questions, we first viewed account data for sitting House members in two aggregator sites during the last week of January 2010.[13] To explain why some incumbents were more likely than others to establish a Twitter account, we estimated a logistic regression model of Twitter account initiation for all House incumbents as of January 2010. The dependent variable—*Twitter Activation*—was coded as a "1" if the member had registered for a Twitter account and coded a "0" if s/he had not. This model is based on all 435 members of the House of Representatives.

Our independent variables in the model predicting which members opened Twitter accounts included four electoral characteristics and four indicators of constituency-demand, all of which have been linked both theoretically and empirically to the presence of campaign Web sites in previous studies (Hernnson et al., 2007; Gulati & Williams, 2007). Party is represented by a dummy variable where 0= Republican and 1= Democrat. Our indicator for the financial resources these incumbents had during their campaigns is the natural log of the total net receipts collected during the 2008 election cycle or, in six cases,[14] special elections held thereafter.[15] Our fourth electoral variable captures how competitive these races were, and hence the security of the seat, using the percentage of votes the incumbent received in his or her election. The indicators that we used to account for constituency-demand were: (1) the percentage of residents over 24 with a college degree, (2) the percentage of residents classified as white, (3) the percentage residents between 18 and 64 years of age, and (4) the percentage of residents living in rural areas.[16] We also include two measures for the incumbents' personal attributes: their age in years and their 2008 score on the Knowlegis Power Index "Indirect Influence," which measures how much power the legislator has demonstrated or may be capable of demonstrating to influence the congressional agenda or outcome of votes through the media or congressional caucuses.[17] It ranges from -4.25 for Representative Jerry Lewis (R,CA, 41st) to 45.5 for Speaker Nancy Pelosi.

In addition to identifying which House members had opened Twitter accounts, we also noted the number of tweets that they had sent. This number gauges activity on Twitter, which represents both a higher level of effort and greater use of the technology than a simple

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[13] We monitored House members Twitter counts on < http://www.congressional140.com/tweeting.php > as the primary source and cross-checked them on < http://tweetcongress.org/list >.

[14] The six special elections were California, 10th and 32nd districts, Colorado, 7th district, Illinois, 5th district, and New York, 20th and 23rd districts.

[15] Data on campaign contributions were obtained from the Federal Election Commission: <http://www.fec.gov/finance/disclosure/ftpsum.shtml>. We used the natural log transformation of net receipts to be consistent with most past studies of the effects of money on congressional campaign outcomes that assume diminishing returns or each additional dollar spent (Jacobson 2005; Jacobson 2008).

[16] These data are from the 2000 Census and were obtained from the U.S Bureau of the Census. We also measured age in terms of the percentage of residents under 18 and over 64. In our multivariate models, the effects of the measures of constituency age produced near zero, non-significant coefficients.

[17] <https://ssl.capwiz.com/congressorg/power_rankings/backgrounder.tt> This index was calculated for 2008 and does not include 95 members who were newly elected to Congress in that or a subsequent special election, yielding 340 cases for the logistic regression analysisl. For the subset who tweet (N=145), 40 of them do not have power rankings reducing the regression models to 105 cases.

dichotomous classification of the presence or absence of an account. Representatives with accounts sent a combined total of 42,005 tweets through January 2010. The median number of tweets was 175, and the average number per member was 289.69 (359.65 for the 97 Republican tweeters and 148.31 for the 48 Democratic tweeters). Congressman Ron Paul (R-TX, 14th) was the most active House member on Twitter, with 5,133 tweets. Figure 1 is a screen capture of his twitter page and data. As shown in Table 1, all but three of the top 25 most active users were Republicans, the three Democrats being Chellie Pingree (ME, 1st), Neil Abercrombie (H, 1st) and Frank Pallone (NJ, 6th).

[Figure 1 about here]

To answer our third research question, we recorded the total number of followers each of the tweeting members of Congress had through the end of January 2010. Representatives had a combined total of 380,327 followers. The median number of followers was 1,626, and the average number per member was 2,622.94 (3,056.07 for the 97 Republican tweeters and 1,747.67 for the 48 Democratic tweeters). Half of the top 25 tweeters also appear in the top 25 list of followers (r = +.315). Congressman John Boehner (R-O, 8th) has the most followers on Twitter, with 21,264 whereas Congressman Ron Paul, the top tweeter, has only 2,146 followers, which is below his party's average.

[Table 1 about here]

Analysis and Findings

Research Question 1: Who Tweets. Overall, 33% of House members have a Twitter account. While over half (54.5%) of the Republicans in Congress tweet, just under one fifth (18.7%) of the majority party Democratic members do so. Table 2 reports the results of the binary logistic regression model for having a twitter account (1=yes; 0=no). Among the constituency characteristics, only percent rural has a significant (negative) impact on adoption. This is consistent with Straus, et al., 2010, who also found that urban districts are significantly related to Twitter adoption in the two month period of their study, August through September 2009. While % college graduates is not significant in their model, they included % high school graduates, which was significant and positive. Turning to the electoral environment, two of our three variables are significant: party (Republican) and campaign receipts for the last election; the vote share the incumbent received in that election is not significant. Although Straus, et al. (2010) did not include campaign receipts in their model, their model generates the same results for party and vote share. Finally, of our two indicators for personal characteristics, only age is significant and negative, consistent with the Straus study. Other models that included gender and race/ethnicity did not produce significant coefficients for those variables, nor did the measure we included to capture members' seniority, the power to influence, replicating Straus, et al. While our model improves upon the percentage correct by guessing the modal category (68.8 vs. 73.8%) it is not a great deal better and the pseudo R square is only .264.

Constituency characteristics. In our earlier studies of Facebook and YouTube (Williams & Gulati, 2009; Gulati & Williams, 2010), the % college educated was the one constituency characteristic that had a significant, positive impact. The diffusion of innovation literature suggests a new way of conceptualizing these conflicting results. In this formulation, college education would be viewed as an attribute of the technology innovation Facebook in the sense that this is the domain in which Facebook originated and the demographic group that

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constitutes its most significant user base. Twitter, on the other hand, had its roots in the corporate sector whose base was an older demographic. Because our accumulated results for constituency characteristics differ across relatively contemporaneous media, we cannot conclude that non-significant coefficients are the result of a diminishing digital divide from the era of campaign website innovation to that of social media. Diffusion of innovation literature also suggests an alternative, developmental explanation, however, if we view Facebook usage in 2008 has having progressed to a more a mature stage (late majority) than Twitter in 2010 (49.8% Facebook adoption rates for all House candidates and 48.0% for incumbent candidates in 2008 vs. a 33.3% adoption rate for Congressional tweeters in 2010).[18]

Yet, % rural (or % urban) was not significant in our 2008 data for either Facebook or YouTube, but is in this Twitter analysis. This suggests the technology artifact explanation is a better fit with both sets of constituency findings taken together. An urban lifestyle or the culture of city dwellers is somehow more conducive to tweeting than that which typifies rural settings, while the use of Facebook and YouTube for social networking or video-sharing are not place-sensitive. At 140 characters, tweeting can be conducted while engaged in other activities—subway commuting, attending business meetings, waiting in lines or at a restaurant—whereas updating a profile or sharing/viewing videos might be considered leisure activities and are more time consuming. Indeed, recent studies show that peak tweet-times are mid-week and during business hours.[19]

Despite expectations that new, social media are a vehicle for reaching youthful constituencies, the (positive) relationship does not quite achieve significance (.09) in our model, which measures age as the proportion between 18 and 64 years at the time of the 2000 Census. This is consistent with Lassen and Brown (2010) who found a non-significant, but positive relationship with median age of the district. We think it likely that age of the relevant user community (congressional district in this case) is becoming less relevant as a motivator for adopting new technologies in recent years. We also note that although candidates and elected officials could be making sophisticated, strategic decisions about adopting social media, anecdotal evidence from staffers suggest it is based more on general perceptions and desire to augment existing media or extend their reach.[20] "The people on Twitter seem to be more tech savvy, so it seems to open a new demographic and it is just a different way to communicate… it's just a different way to get out the message."[21] "It attracts more of a younger generation… and it is great we can have the venue to reach a broader spectrum."[22] This anecdotal evidence fits with formulations in the diffusion of technology literature that characterizes innovators and early adopters as primarily interested in the technology, which they perceive as a window of opportunity, in contrast to early and late majority adopters who are looking for solutions that are reasonably priced and have proven reliable and efficient (Moore, 1991).

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[18] According to Rogers (2003), when a new technology is introduced, innovators are the first to embrace it (2.5%), followed by early adopters (13.5%), early majority (34%), late majority (34%), and finally laggards (16%).

[19] <http://www.pearanalytics.com/wp-content/uploads/2009/08/Twitter_Study_August_2009.pdf >; <http://blog.hubspot.com/Portals/249/sotwitter09.pdf>; Strauss, et al., 2010.

[20] Interviews with congressional staff on why and how members are using Twitter are ongoing.

[21] Personal communication April 15, 2010, with Creighton Welch, Press Secretary to Representative John Carter (R-TX, 31st).

[22] Personal communication April 15, 2010, with Alisia Essig, Communication Director for Representative Jason Chaffetz (R-UT, 3rd).

The electoral environment. The findings for political party are noteworthy because they too differ from our earlier studies of Facebook and YouTube adoption (Williams & Gulati, 2009; Gulati & Williams, 2010). Although Democratic candidates were more likely to have profiles on Facebook than Republicans, there was no significant party difference in opening a channel on YouTube. Here we find that Republicans have outpaced Democrats by a margin of 3 to 1 in adopting Twitter, and party is the most important predictor in our model. Although Republicans were the minority party in Congress during all the years covered by our respective studies, the differences cannot not be explained simply in terms of out-party strategy. We have argued elsewhere (Williams & Gulati, 2009; Gulati & Williams, 2010) that Facebook usage reflects a mobilization strategy rooted in the Democratic party's constituency base and grassroots centered mode of organizing. YouTube, however, is merely another communication dissemination channel for implementing the parties' traditional campaign strategies, and equally useful to both. These tweeters are sitting members of Congress, not candidates, which is evident from the content analyses conducted for both our study and the Straus study. The status or informational content of legislative activity represents the highest proportion of tweets, followed by advocacy or position taking. Thus diffusion of innovation literature would attribute the disparate findings for the impact of party to the difference in competitive environments candidates and office-holders face in deciding whether to adopt a new technology. Republicans and Democrats today face a highly charged legislative environment where policy is decided by close votes. In the 2008 House elections, less than one quarter of the races were competitive; in more than 85% the incumbent was running for reelection.

Although a competitive race mattered to Facebook and YouTube adoption (Williams & Gulati, 2009; Gulati & Williams, 2010), these incumbent House members' vote share is non-significant and near zero. Neither a close race (low margin of victory) nor a safe seat (high margin of victory) constitutes an incentive (or disincentive) in deciding whether to expand constituency outreach through communications media such as Twitter. Our finding is consistent with both Straus, et al. (2010) and Lassen and Brown (2010). In a close election, candidates have an incentive to adopt any and all tools that stand to increase their margin of votes, even by a small amount. Once elected, however, the memory of a razor thin margin of victory does not goad members into adopting new and unproven communications technologies. "You are communicating with an audience who has decided proactively that they wanted to be aware of what the congressman is doing and have taken an interest."[23] As we move closer to the 2010 elections we would expect this to change as recruiting and mobilizing the electorate assumes higher priority than discussing and disseminating information about legislative business at hand.

In contrast to our findings on party and the competitive environment, the significant impact of funding on adoption is consistent across technologies, Twitter, YouTube and Facebook. Well- funded candidates have greater access to professional consultants and more sophisticated tools for promoting their candidacies. Since well-funded candidates tend to win election, these members of Congress bring the benefits of those advantages and experiences with them. Almost one quarter of the membership has adopted all three technologies and almost half have adopted two of the three. Just over 1% are laggards who have resisted all three innovations, and about one quarter have adopted only one of them.

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[23] Personal communication April 15, 2010, with Kurt Bardela, Press Secretary for Representative Darrell Issa (R-CA, 49th)-

Innovator profile: personal attributes. Although the percentage of constituents in the middle age demographic was not a significant predictor of Twitter adoption in our model, the representatives' own age does matter. The finding is corroborated by both Straus, et al. (2010) and Lassen and Brown (2010). Our previous studies (Williams & Gulati, 2009; Gulati & Williams,2010) also provided evidence that early adoption decisions by campaigns often depend on idiosyncratic, personal circumstances of the candidate, particularly his or her own, relative's, or staff member's keen interest in technology. There is also extensive documentation in the diffusion of innovation literature of early adopters' characteristics or profile, which, besides age, includes education, risk taking, opinion or social leadership (see Fichman, 1992 for a review). As the above Pew data demonstrate, social media are preferred and dominated by younger adults; older groups follow later and are disproportionately represented in the laggard category.

Members' power to influence the congressional agenda through legislative networks (committee caucuses) and the media does not differentiate adopters from non-adopters in our model. While we saw that the external competitive environment was relevant to candidates but not to office holders, the internal competitive environment as depicted by a member or incumbent candidate's influence is not a significant predictor of adoption, although the sign is positive for Twitter and negative for both YouTube and Facebook (whose coefficient approaches significance at the .10 level). Members of Congress do tend to use Twitter for communications related to their job and the congressional policy agenda (Straus, et al., 2010), whereas YouTube and Facebook focused on communications aimed at mobilizing support for their 2008 campaigns. Greater media attention and activity and higher levels of caucus participation seem to generate more need for or see higher utility in a Twitter account, and Twitter in turn enhances member visibility and effectiveness in those venues. "A lot of the followers are from everywhere, it is not just our district, and many of them are reporters. A lot of the time when he [the congressman] does tweet something interesting or funny, it does get picked up and run in a story."[24] As the 2010 midterm elections draw closer, Twitter adoption is likely to increase as less influential incumbents begin to seek out additional communication channels that hold promise of electoral reward. Diffusion of innovation helps explain these findings by drawing attention to differences in the purposes of technologies as well as those who adopt them and those who are affected by or use them, and it considers how these elements interact. "Depending on who you want to reach, you have to communicate through different venues."[25]

[Table 2 about here]

Research Question 2: Who is an active tweeter. Diffusion of innovation literature differentiates among adoption, implementation or usage, and performance. In this study we also counted the number of tweets members have sent since registering for a Twitter account. The same independent variables reveal different patterns of relationships when considering who more actively employs Twitter as a communication tool.

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[24] Personal communication April 15, 2010, with Alisia Essig, Communication Director for Representative Jason Chaffetz (R-UT, 3rd). Examples of media coverage of Congressional tweets include McClatchy Tribune News Service < http://www.jsonline.com/news/statepolitics/42644607.html>; *The Economist* < http://www.economist.com/world/united-states/displaystory.cfm?story_id=13109717>; Gannet News Service < http://www.tucsoncitizen.com/ss/nationworld/112795.php>.

[25] Personal communication April 15, 2010, with Jordan Haverly, Communications Assistant for Representative John Shimkus (R-Il, 19th).

While party and funding continue to have a large and significant impact, vote share in the last election now shows a significant positive coefficient as well (see Table 3, model 1). Members who enter or remain in Congress with secure margins of victory tweet more often than those with slim ones. A safe seat may be indicative of greater resources and experience that provide fodder for tweet content. In 2008, those facing a competitive electoral environment were more likely to update their Facebook profiles than those in non-competitive races (Williams & Gulati, 2009).

No constituency attribute has an impact on Twitter usage, only on the decision to adopt. This is consistent with the diffusion of innovation argument that implementation depends more heavily on the resources and capacity of organization and less so on demands from the external user community. Personal characteristics of adopters also take on less importance as an innovation is incorporated into business practice. Our model finds that while age is no longer an important differentiator with respect to usage, a member's influence now achieves a .10 level of significance, but carries a negative coefficient. This could signify that members are using Twitter as an alternative communications channel when they lack sufficient or prestigious internal networks in their caucuses or do not receive media attention through other venues.

[Table 2 about here]

Research Question 3: Who attracts a following on Twitter. To find a measure analogous to performance in the political context of Congress, we examined the number of followers members attracted (see Table 3). As in each of the other models, party and funding matter here as well. Just as Facebook took hold in Democratic Party circles and strategies, Twitter appears to have become part of the Republican Party's culture. Funding is a useful currency in every circumstance, albeit for different reasons: an entrée to professional consulting services that includes the newest technologies among their repertoire (adoption) the depth of experience and content at hand to use them extensively and well (implementation), and here, the visibility that is conferred on well funded, prominent members as well as incumbents more generally (performance).

As with usage, no constituency attribute remains in the factors that differentiate tweeters who are sought out from those who are largely ignored. Age is no longer significant and indeed the sign switches back to negative. Younger members were significantly more likely to have a Twitter account, but older ones sent more tweets, albeit not significantly more. Here we see that younger members have more appeal than their older peers, lending credence to members' belief that the medium reaches a different age demographic than traditional communications media.

It is also notable that in this model (2), a member's influence is significant at the .06 level and with a much larger, and this time positive, coefficient compared to model 1, for members' tweets. As the staff member put it, Twitter followers are political influentials who have taken an active interest and want to be aware of what particular members of Congress are doing.

[Table 3 about here]

Discussion

The diffusion of innovation literature informs our research hypotheses, model specification, analysis and interpretation of our data on who adopts new technologies and to what extent. Our findings demonstrate the importance of differentiating among the decision to become an early adopter, the extensive implementation and use of the technology once it has been adopted, and how well the technology subsequently performs, i.e., the quality and or degree of its success. In addition to the point that the selection of independent variables should be made in relation to the dependent variable under investigation, diffusion of innovation literature and our findings underscore that the interrelationships between these will change depending on whether we are examining adoption, usage or performance.

Taking the example of financial resources, we may be capturing one kind of motivator in the adoption decision, (e.g., an external one like norms, expectations and practice surrounding high visibility, high level offices) or practice that is historically associated with particular states or districts. In the innovation's implementation, however, that same measure of financial resources may be capturing quite a different driver, namely an internal, organization specific facilitator or constraint in ways analogous to the findings and reasons that large firms (Rogers 2003)—or states (Mohr 1969; Walker 1969)—innovate more and better than smaller ones in the same industry. Our results also demonstrate that the same independent variable may be a significant influence on one decision (adoption) and not the other (implementation), or work in the opposite direction. This was clearly evident in our findings with respect to the degree of influence members hold, which was negligible in the adoption decision, negative for number of tweets, and positive for number of followers.

The low percentage of variance explained in this (26.4%, 15.2% and 13.6%, respectively) and similar studies of campaign Web sites and other social media underscores the point that we have a long way to go in identifying variables that appropriately and fully specify our models. Geographic proximity contagion and propensity to adopt innovation technologies are two promising directions. Having a campaign website was a positive predictor of Facebook profile activation or creation in 2006 and 2008, but was not related to the extent that candidates used Facebook features in 2008 (Williams & Gulati, 2009). A more sophisticated measure of propensity for innovation would include other new technologies or take into account how early the technology was adopted, rather than merely whether or not it had been. The average value across members of the same state delegation shows that same pattern of relationships. A refined physical proximity distance measure may yield even stronger results. Alternatively, it may be that a member's social interaction networks (e.g. via professional membership groups and contacts) are more important than geographic affinity.

The 2010 election cycle promises another opportunity to increase our understanding of the adoption, dissemination, use and impact of new technologies on campaign organizations. The current study of incumbent members of Congress takes this in an additional direction by examining these same technologies in the context of their potential to improve office holders' communications with constituents and in the service of government transparency more generally. Both applications presage large scale changes in our democratic processes and the relationships between politicians and voters, government and the governed.

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Figure 1: Rep. Ron Paul's (R-TX)Twitter page, April 13, 2010

RepRonPaul

1. scheduled to be on Happy Hour today, Fox Business about 1 hour ago via web
2. new column posted today http://www.house.gov/paul/index.shtml 1:52 PM Apr 12th via web
3. @TDMielke I don't think so - its just on MSNBC 9:05 AM Apr 9th via web in reply to TDMielke
4. Going to try the Skype thing for a couple of MSNBC interviews today - one coming up at noon and another at 4est with Dylan Ratigan. 9:00 AM Apr 9th via web
5. New column posted http://www.house.gov/paul/index.shtml 10:45 AM Apr 5th via web
6. From the medals presentation yesterday http://www.victoriaadvocate.com/news/2010/mar/31/sl_soldier_honored_040110_90962/?news&local-news 9:24 AM Apr 1st via web
7. RT @minnesotachris: @RepRonPaul had a great interview with Russia Today on the disastrous #healthcare bill: http://youtu.be/J2MHw3BfELU ... 10:49 AM Mar 29th via web
8. New column posted today on Healthcare and Economic Realities http://www.house.gov/paul/index.shtml 10:36 AM Mar 29th via web
9. New video from Financial Services hearing, questioning Bernanke http://www.youtube.com/watch?v=6jUEDsPCoYA 8:30 AM Mar 25th via web
10. RT @megynkelly: Is the Stupak Deal unconstitutional? @RepRonPaul joins us to share his views on health care reform. You don't want to mi ... 9:48 AM Mar 24th via web
11. Planning to be on Fox News tomorrow at 2pm est with Megyn Kelly discussing healthcare reform 1:20 PM Mar 23rd via web
12. Video from a hearing this morning, questioning Geithner http://www.youtube.com/watch?v=ghs5KBXofSQ 10:08 AM Mar 23rd via web
13. scheduled to be on Fox Business tonight at 7p EST 11:09 AM Mar 22nd via web
14. New column on the healthcare bill passing http://www.house.gov/paul/index.shtml 7:49 AM Mar 22nd via web
15. Video from today on Fox Business on Healthcare http://www.youtube.com/watch?v=r2_SsLut1Bk 2:20 PM Mar 21st via web
16. The bill includes $569.2 billion in job-killing tax hikes during the worst recession in a generation http://bit.ly/bOtfdx 11:03 AM Mar 20th via web
17. In 1965, Congress said Medicare would cost $9 billion by 1990. In reality it cost $67 billion—seven times more than the prediction 9:04 AM Mar 20th via web
18. The health care takeover contains $52 billion in new taxes on employers who already cannot afford to pay their employees health care 8:19 AM Mar 20th via web

more

- *Verified Account*
- *Name Ron Paul*
- *Location Lake Jackson, TX*
- *Web http://www.house....*
- *Bio Congressman Ron Paul*

| 63 Following | 5,727 Followers | 561 Listed |

- 138Tweets
- Favorites

Following

View all…

RSS feed of RepRonPaul's tweets
RSS feed of RepRonPaul's favorites

17

Table 1

The Top 25 House Tweeters in the 111th Congress

Ranking	Candidate		State	District	Party	Tweets*	Followers
1	Ron	Paul	Texas	14	R	5133	2146
2	John	Culberson	Texas	7	R	2638	13044
3	Mike	Pence	Indiana	6	R	1435	8122
4	Jason	Chaffetz	Utah	3	R	1277	9033
5	Darrell	Issa	California	49	R	1144	8614
6	Rob	Wittman	Virginia	1	R	1039	3082
7	Michael	Burgess	Texas	26	R	1038	3927
8	Ileana	Ros-Lehtinen	Florida	18	R	1010	2872
9	John	Carter	Texas	31	R	981	3051
10	Bob	Latta	Ohio	5	R	865	4764
11	John	Shimkus	Illinois	19	R	821	2459
12	John	Boehner	Ohio	8	R	669	21264
13	Tom	Price**	Georgia	6	R	590	4691
14	Pete	Hoesktra	Michigan	2	R	558	8991
15	Bob	Inglis	South Carolina	4	R	497	2720
16	Chellie	Pingree	Maine	1	D	496	1986
17	Dave	Camp	Michigan	4	R	480	4139
18	Roy	Blunt	Missouri	7	R	475	5071
19	Neil	Abercrombie	Hawaii	1	D	474	5595
20	A.G.	Wilson	South Carolina	2	R	448	13712
21	Thad	McCotter	Michigan	11	R	412	7081
22	Frank	Pallone	New Jersey	6	D	407	1078
23	Steve	King	Iowa	5	R	398	1444
24	Vern	Buchanan	Florida	13	R	377	2053
25	J. Gresham	Barrett	South Carolina	3	R	373	2496

* through January 2010. Source: http://www.congressional140.com/

**third longest (since 6/4/2007)Representative after Eric Cantor- R,VA and John Boozman- R,AR (both since 4/27/2007) in using Twitter source: tweetcongress.org

Table 2

Logistic Regression Analysis of Twitter Adoption by U.S. House Members of the 111th Congress

Independent Variables	B	S.E.	p
Party (Democrats=1)	-1.982	0.314	0.000
Contributions received (natural log)	0.756	0.295	0.010
Electoral security (% vote, last election)	0.009	0.010	0.378
Percent white in district	0.007	0.009	0.470
Percent w/college degrees in district	-0.030	0.025	0.223
Percent ages 18-64 in district	0.110	0.064	0.088
Percent rural residents in district	-0.026	0.012	0.024
Power influence index	0.026	0.026	0.312
Member's age	-0.036	0.014	0.012
Intercept	-15.007	6.381	0.019
N	340		
Percent correctly predicted	73.8		
Mode	68.8		
Pseudo R^2	0.264		

Table 3

OLS Multiple Regression Analysis of Twitter Updates by U.S. House Members in the 111th Congress

Independent Variables	Model 1: Member Tweets		Model 2: Twitter Followers	
Party (Democrats=1)	**-433.673**	***	**-1803.223**	**
	139.830		*824.987*	
Contributions received (natural log)	**453.490**	***	**1483.413**	**
	126.154		*744.301*	
Electoral security (% vote, last election)	**9.542**	**	**0.828**	
	4.855		*28.646*	
Percent white in district	**-4.524**		**21.774**	
	3.785		*22.334*	
Percent w/college degrees in district	**-6.333**		**-72.920**	
	10.190		*60.118*	
Percent ages 18-64 in district	**35.060**		**254.172**	*
	25.994		*153.361*	
Percent rural residents in district	**3.111**		**-16.719**	
	4.902		*28.923*	
Power influence index	**-15.558**	*	**103.664**	*
	9.373		*55.301*	
Member's age	**8.794**		**-45.680**	
	6.103		*36.009*	
Intercept	**-8781.254**	***	**-30602.387**	*
	2831.167		*16703.675*	
N	105		105	
R^2	0.152		0.136	
Standard Error of the Estimate	544.705		3213.721	

Note: Bold entries are unstandardized regression coefficients; standard errors are in italics.   * *p* < .10, ** p < .05, *** p < .01.