Explaining the diffusion of innovation types amongst high and low innovative localities: a test of the Berry and Berry model

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ABSTRACT

Berry and Berry (1999, 2007) argue that diffusion of policy innovations is driven by learning, competition, user demands or vertical influence from higher levels of authority. In this article we examine this framework on management innovation, examining both total innovation and different types of management innovation (service, organizational, marketization, technology and ancillary). Analysis is undertaken on a panel of 676 English local governments over four years using random effects models. Given the variations in the degree to which innovations are adopted, we divide the sample into high and low adopters for different innovation types. Our findings reveal that a majority of the diffusion drivers are positively significant, providing strong support for the Berry and Berry model (1999, 2007) at the total innovation level of analysis and amongst the high innovation adopters in this sample. However, when we examine our data by innovation type the explanatory capacity of the Berry and Berry framework diminishes. Conclusions point towards the need for better theory to explain the diffusion on innovation types.

INTRODUCTION

A growing body of international literature points towards a range of innovative activity in public agencies—see for example Borins (1998) and Light (1998) on the USA and Osborne (1998), Newman, Raine and Skelcher (2000), and Walker (forthcoming) in the UK. These innovations are not based upon 'fadism' but in response to changes in technological and managerial knowledge, stakeholder expectations and changes in users' needs. Organizations are also responding to these challenges to maintain a balance between the organization and the environment and to achieve service improvements. The evidence base explaining the diffusion of public service innovation is growing, however the majority of it remains focused on policies or programmes, typically in US states (see Berry and Berry 2007), and has not considered the adoption of management innovations.

Organizations adopt a range of different types of innovations to achieve service improvements. New services are offered to new and existing users, internal changes are made to the operating system in an organization, to technical and administrative processes and to intra and interorganizational relationships (Damanpour 1987; Edquist, Hommen and McKelvey 2001). In focusing upon policy, prior studies offer inconsistent or non-applicable results because they do not distinguish between types of innovations. [1] Recent research shows how the adoption of different types of public management innovations are differently influenced by organizational and environmental characteristics (Walker forthcoming). Prior innovation research has differentiated product and process innovations (Damanpour and Gopalakrishnan 2001; Tornatzky and Fleischer 1990),

[1] A study showing that abortion policy when framed as morality or redistributive policies have different determinants by Roh and Berry (2008) is one exception in the policy literature.

technical and administrative innovations (Damanpour and Evan 1984; Kimberly and Evanisko 1981), and radical and incremental innovations (Ettlie, Bridge, and O'Keefe 1984; Dewar and Dutton 1986; Germain 1996). Therefore, in this article our first departure from much of the prior public management literature on innovation diffusion is to distinguish service, process (organizational, technological and marketization), and ancillary innovations.

Second, Berry and Berry (2007) posit a theoretical explanation of innovation diffusion. Their framework points towards the importance of competition, learning, public pressure, and vertical influence from oversight bodies as important variables influencing the diffusion of innovation. This framework has been empirically tested with state, national and international policy studies (Nicholson-Crotty 2004; Walker 1969; Berry and Berry 1990; Weyland 2004), but not on the diffusion of management innovations. Our final point of departure is to undertake statistical analysis that explores the effects of innovation diffusion on the full dataset we employ in this study and on sub-samples of high and low innovative organizations. We initially run a random effects model estimating the effects of the different diffusion variables on total innovation across all our cases of English local government. (We suspect that the Berry and Berry framework will have greater applicable at this level of analysis.) Such an approach, however, masks variations around the mean level of the adoption of total innovation and between types of innovations. If knowledge is to be generated on public service innovation it is important to isolate the diffusion effects amongst those organizations that adopt a larger number of innovations versus those adopting a lower number, therefore, we split the data into these two groups. Next we go on to examine ways in which the

variables contained within the Berry and Berry model influence the adoption of different innovation types, and again examine all our cases and then splitting the sample between high and low innovating organizations.

In the next section, innovation types are defined and the research literature is presented on the diffusion of innovation. Methods are then outlined and the data from English local governments discussed prior to the presentation of our research findings. The findings reveal that a majority of the diffusion drivers are positively significant, providing strong support for the Berry and Berry model (1999, 2007). However, these results are only applicable at the total innovation level. When we examine our data by innovation type the explanatory capacity of the Berry and Berry framework diminishes. Conclusions point towards the need for better theory to explain the diffusion on innovation types.

INNOVATION TYPE AND DIFFUSION

Innovation is a process through which new ideas, objects and practices are created, developed or reinvented, and which are new for the unit of adoption (Aiken and Hage 1971; Kimberly and Evanisko 1981; O'Toole 1997; Rogers 1995). Because public organizations may innovate in search of legitimacy and not fully adopt an innovation implementation has to occur (Boyne, Gould-Williams, Law and Walker 2004; Damanpour and Evan 1984) to ensure improvements can be forthcoming. While the policy literature generally has used innovation adoption as the dependent variable (Walker 1967; Berry and Berry 2007), some studies have made this distinction between adoption and use (e.g., de Lances Julnes and Holzer 2001).

Types of Innovation

Service innovations are defined as new services offered by public organizations to meet an external user or market need: they are concerned with *what* is produced. Service innovations occur in the operating component and affect the technical system of an organization and include the adoption of goods (which are material) and intangible services, which are often consumed at the point of production (Damanpour and Evan 1984; Kimberly and Evanisko 1981; Normann 1991). Given the focus on meeting needs in the public sector the nature of service innovation is best understood through the relationship with users. Three types of service innovation have been identified and tested (Osborne 1998; Walker, Jeanes and Rowlands 2002). Total innovations involve providing new services to new users. Existing services provided to a new user group describes expansionary innovations. The third type is evolutionary innovations, which involve delivering a new service to existing users. Osborne (1998) highlights a range of new services provided by voluntary organizations that include emergency accommodation for adolescents and sex therapy services.

Process innovations affect management and organization. They change relationships amongst organizational members and affect rules, roles, procedures and structures, communication and exchange among organizational members and between the environment and organizational members: they are concerned with *how* services are rendered (Abernathy and Utterback 1978; Damanpour and Gopalakrishnan 2001; Damanpour, Szabat and Evan 1989; Edquist, Hommen and McKelvey 2001). We focus

on three types of process innovations in this article (Edquist, Hommen and McKelvey 2001): organizational, marketization and technological.

Organization innovations are innovations in structure, strategy, and administrative processes (Damanpour 1987). In this study they include improvements in an organization's practices and the introduction of new organizational structures (Borins 1998; Light 1998; Walker, Jeanes and Rowlands 2002). Organization innovation are thus concerned with an organization's primary work activity and changes in the social system. Marketization innovations involve modifying the organization's operating processes and systems to increase the efficiency or effectiveness of producing and delivering its services to users (Schilling 2005). The drivers of marketization innovations are primarily reduction in delivery lead-time, increases in flexibility, and lowering of operational costs (Boer & During 2001). Marketization innovations are concerned with methods to purchase and deliver services and revenue generation, and reflect the core New Public Management themes of contracting, externalization and market pricing of public services. Technological innovations are associated with changes in physical equipment, techniques and organizational systems. Examples of technological innovations in public organizations would include information technology, hardware (physical equipment) and software (organizational systems).

Ancillary innovations are identified by Damanpour (1987) and are differentiated from other innovations because they are concerned with working across boundaries with other service providers, users or other public agencies. Thus their successful implementation is reliant upon others. Ancillary innovations are "organization-environment boundary innovations" (Damanpour 1987, 678). In Damanpour's study of

libraries these included community service programs and after school supplementary education programs. What distinguishes an ancillary innovation from service and organizational process innovations is that successful adoption is dependent on factors outside an organization's control. Ancillary innovations made up 39 percent of the Ford-KSG innovation award winners examined by Borins (1998) and included programs that housed people with AIDS in certified private homes with public funding.

Diffusion

Rogers (1983, 5) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". In this paper, we view the English local government authorities as part of a social system that includes English local authorities as well as governmental entities around the world, since management innovations are likely to diffuse beyond the borders of one country (Pollitt 2002; de Lancer Jules, Berry, Aristigueta and Yang 2007; Kettl 2000).

Berry and Berry (1991, 171-177; 2007, 225-226) posit that U.S. state and international policy diffusion studies generally assume that governments emulate each other for one of four reasons. First, governments compete to keep citizens happy and to develop their economy and quality of life. Public agencies might compete with one another in order not to be disadvantaged due to other governments' reforms so that, for example, when a nearby government adopts business incentives, it puts pressure on the non-adopting government to adopt that reform in order that businesses do not leave their jurisdiction (Gray 1994). The 'competition' argument has connections with the Tibout

model, which specifically asserts that local governments will adopt services and taxes equal to the preferences of their citizens or expect them to move to other locations with a better match. From this theory, we can expect local governments to be influenced by other local governments, although we might expect more immediate service competitors and user demands (see below) to exert a higher influence on innovation use as they are more easily measured and registered by managers in the local government. Shifts towards network forms of service provision and competition between public and other service providers in the private and not for profit sector have served to create a market-like environment where the pressures to improve services is strong in order to survive and be well-regarded in the market by users or citizens. It is likely that public organizations will also be influence by the activities and actions of private and voluntary sector organizations.

Second, government leaders and managers learn from each other, and emulate governments' innovations that have been successful elsewhere in achieving goals or are popular with the voting public. The 'learning' model incorporates a decision-making model based on incrementalism, whereby new policies are more readily adopted after potential adopters can learn from the experience of early adopters, and modify the policy based on their results. Public policy research on innovation and diffusion has assumed that managerial learning from professional associations and other sources is an important factor in promoting the diffusion of ideas, but few studies have been able to directly capture and test this hypothesis. Balla (2001) found that state managers most active in a national professional association were more likely than others to adopt a model law, thus implying active learning occurring through the informational networks. Knowledge

transfer and sharing good practice is shown to benefit from learning and collaborative approaches. While peer-to-peer learning may be used for many purposes, including the resolution of organizational failure, it plays a central role in the diffusion of innovation (Rashman, Downe and Hartley 2005; Rashman and Radnor 2005). Thus participation in professional meetings and networks should promotion innovativeness as these networks generally have a pro-innovation bias (Walker 1969).

Third, there is pressure on governments to conform to accepted management standards. This can be as a result of mandated governmental policy or incentive systems to adopt and use certain policy or management innovations, or as an influence from other sister jurisdictions through what DiMaggio and Powell (1983) label "normative" pressures, to adopt best practices to look legitimate to citizens and fellow professionals. When central governments promote or mandate a policy change it extends "beyond learning" (Berry and Berry 1999, 177). The action has been found to accelerate the innovation's adoption. Welch and Thompson (1980) determined than when the federal government offered incentives to states to adopt certain policies, those policies diffused faster than policies with no incentives attached. Allen, Pettus and Haider-Markel (2004) find that national financial incentives can impact the adoption of some policies but also found support for the reverse position, in that lack of action at the national level in the U.S. appears to spur the states to take action on other policies in response to hot topics and crises. Boyne, Gould-Williams, Law and Walker (2005) note a number of studies that find central authority decisions mandate use which is followed (Walker and Jeanes 2001; Fidler and Johnson 1984). Using a different viewpoint of a government's impacts, Moon and Bretschneider (1997) find that the degree of state government involvement in

innovation development is positively associated with diffusion, and that specific efforts to develop and diffuse new energy processes are related to industry's adoption decisions about those innovations. Thus we expect central mandates to be a source of pressure for innovation use. The most extreme form of 'vertical influence' is coercion. Coercion as a driver of innovation should be lower than mandate or incentives since this factor results from audited deficiencies found in local government organizations. However, we might expect coercion to be more associated with low-innovators than with high-innovators assuming that high innovators might be expected to be higher performers than low-innovators, overall.

Finally, "…public officials can experience public pressure from their own citizens to adopt policies…" (Berry and Berry 1999, 172). In this 'public pressure model' demands from citizens must be incorporated into governmental policy to keep the voting public satisfied or at least from being dissatisfied. External pressures, such as the media, may be more likely to promote adoption of innovations in response to scandals or other critical information provided to the public at large by the media (Berry and Flowers 1999). Thus we would expect external pressure to be a small factor associated with innovativeness overall, but more likely to be associated with low-innovating organizations than with the high innovating organizations. Organization innovations often involve changes associated with "reinventing" government (Osborne and Gabler 1992) such as internal process improvements that are often associated with customer demands and suggestions (Pollitt and Bouckaert 2004). The importance of user feedback and views have been stressed in a range of management reforms, therefore, we would expect local governments to be collecting user information and making changes to improve user

satisfaction and deal with their complaints. Thus we expect user demands to be positively related to innovation use.

Whereas these diffusion processes have been delineated and sometimes tested in policy studies, they have not been tested in relation to specific types of public management innovations. While, the research evidence may be too removed to permit specific hypotheses to be developed, we, nonetheless, offer some speculation on where we might find different diffusion mechanisms impacting the diffusion of types of management innovations. Organization innovations include agency decentralization or other structural changes to reduce hierarchical layers in decision-making. By attempting to make decision-making and communication more efficient and speedy, studies have shown flatter organizations to be more innovative (Kwon 2006), thus we expect that organization innovations may be especially sensitive to user demands. Marketization innovations involve changing the organization's operating processes to increase the efficiency or effectiveness of producing its services. As the name suggests, these changes are likely to be driven by external influences in a competitive market, and should be in response to outside influences, whether they be external pressures, user demands or competition from other service providers. Service innovations are a critical responsibility for governments, and may help citizens feel their government is responsive to user demands and needs. Service innovations are often adopted to achieve primary goals of public organizations (Boyne, Gould-Williams, Law and Walker 2005; Damanpour and Schneider 2006) and are likely to result from a mixture of external pressures and professional learning about best practices elsewhere to incorporate into organizational routines.

Ancillary innovations are heavily influenced by boundary-spanning actions across individual organizations. Such actions may result from new government budgets or requirements that provide either opportunities for cross-agency collaboration or require such actions. If these innovations are viewed as opportunistic and perhaps entrepreneurial, we would expect vertical influence to play a role in providing the resources and legal structure to allow such innovations to go forward. Technological innovations are innovations associated with technology and communication. While the use of technology is no longer limited to cutting edge organizations, still there is evidence that managers closely attuned to both user concerns and competition are more likely to integrate technology into their organizations (Kraemer, King, Dunkle and Lane 1989).

DATA AND METHODS

The unit of analysis in this article is English local authorities. Local authorities are politically elected bodies with a Westminster style cabinet system of political management. They are multipurpose authorities delivering education, social services, regulatory services (such as land use planning and environmental health), housing, libraries, leisure services and welfare benefits in specific geographical areas. In urban areas, authorities deliver all these services; in rural areas a two-tier system prevails with county councils providing environmental, housing, welfare and regulatory functions. Authorities are not all-purpose, for example health is provided by health authorities. They employ professional career staff, and receive around two-thirds of their income and guidance on the implementation of legislation from English central government.

Data

Data on innovation and diffusion were drawn from a panel of English local authorities (for data collection procedures and pilot information see Enticott 2003). Data for the controls we use were taken from documentary sources including the English Census and government departments.

The survey explored informants' perceptions of organization and management (culture, structure, strategy making and innovation), drivers of service improvement, background variables and a management reform regime called Best Value (Boyne, Martin and Walker 2004). [2] All questions were in the form of Likert-scales, ranging from 1 (disagree) to 7 (agree).

Multiple informant data were collected from staff at the corporate and service level in each organization. [3] This strategy was adopted to address the weakness of prior studies that have adopted elite surveys, which typically collect evidence on organizational leaders' aspirations rather than actual organizational innovations, and overlooks the range of different perceptions within organizations (Bowman and Ambrosini 1997; Walker and Enticott 2004). Two echelons were used to overcome the sample bias problem faced in surveying large numbers of informants from one organizational level. For this sample, a simple organizational mean would drown out the voices of the smaller numbers of

[2] A copy of the full questionnaire is available at www.clrgr.cf.ac.uk or on request from the author.

[3] Corporate officers include the chief executive officer, or head of paid service, and corporate policy directors with cross-organizational responsibilities for service delivery and improvement. Service officers include two sets of officers. First, chief officers who are the most senior officer with specific service delivery responsibility, they include the Director of Education or the Director of Planning. Second, service officers or front-line supervisory officers. They include Head of School Organization and Planning and Head of Business Efficiency.

corporate officers surveyed.[4] Corporate and service officers were selected for the two echelons because attitudes have been found to differ between these positions (Aiken and Hage 1968; Walker and Enticott 2004). By calculating an organizational mean from a mean of corporate officers and a mean of service officers, variations across organizations are maintained and categorical data is converted to continuous data.

Measures

Innovation. Innovations in public service agencies were identified from a literature review of new ways of managing, organizing and delivering services. The review focused upon key service, process, and ancillary innovations in the new public management, governance, and reinventing government literature together with previous work on public services innovation in the UK (Newman, Raine and Skelcker 2000; Osborne 1998; Walker, Jeanes and Rowlands 2001). Consultation with central government research staff and a pilot amongst 32 English local authorities confirmed the list of innovations.

Six dependent variables are used in this study, one for each type of innovation and an aggregate measure of all innovation types called 'total innovation'. To capture the degree to which the innovation was in use, respondents were asked to rate the degree to which the innovations were a major part of their approach to management, organization or service delivery which is related to actual results in outcomes. Seventeen measures in the survey were matched to the innovation types. In each case the dependent variable is a

[4] In each authority surveyed questionnaires were sent to up to three corporate officers, and up to twenty-eight service officers—four across seven core services: education, social care, land-use planning, waste management, housing, library and leisure and benefits services.

continuous variable created as an additive index. Table 1 reports descriptive data for all the variables used in this study and table 2 the reliability coefficients for the innovation measures.

Insert Tables 1 and 2 about here

Service innovations were drawn from Osborne's (1998) categories of total, evolutionary and expansionary innovations. The three measures explored the ways authorities develop 'new services to new users', 'new services to existing users' and 'existing services to new users'. *Organizational innovations* include three measures the explore management and organizational change: 'new management processes', 'decentralisation' and 'restructuring'. The *marketization innovation* type measure emphasizes operations and management systems for rendering services to users, lowering operational costs and enhancing efficiency through 'externalization', 'contracting out/outsourcing', and 'developing new methods of raising income'. *Technological innovation* has four measures reflecting the adoption of 'new information technology' and 'new management information systems' together with 'internal communication' and 'external communication'. The *ancillary innovation* type captures the boundary-spanning characteristic of the category. Four measures comprise structural network characteristics, including developing external partnerships with statutory and non-statutory bodies ('developing local strategic partnerships' and 'developing statutory partnerships'),

together with internal dynamics centered around intraorganizatinal working, 'enhancing co-ordination and joint working with other departments' and working beyond their own boundaries: 'working more closely with our users'. While these latter two measures include an internal process they are also concerned with working beyond one part of the organization or outside to groups of users.

Diffusion. To measure diffusion respondents were asked about how 'important in driving improvement in our service/authority' each of the below variables were. In this article we present two measures of competition, one of learning, two of vertical influence, and two of public pressure. The first measure of competition is directly related to Berry and Berry's notion of competition between public agencies and quizzed informants about 'the activities of other authorities'—*public competition*. The second measure—*service provider competition*— taps changes in the delivery of public services in the UK where for many sectors a market has been developed. This has resulted in a range of other service providers in the market place, be they voluntary or for profit organizations that can regularly be found delivering education, housing, planning and refuse services to the residents of local authorities. The question asked about the role of 'competition from other service providers'. The measure of *learning* examined informants' attitudes towards the role of 'professional associations and networks dissemination of good practice'. To operationalise Berry and Berry's concept of vertical influence we named the first variable *vertical influence*. Here informants were asked about the role of 'central government policies' in driving improvement. Secondly, given the growth of regulation (Ashworth, Boyne and Walker 2002; Power 1999) as a tool to increase central control over public agencies, informants were asked about the role of 'inspectors and auditors' in driving

forward improvements, this variable is labelled *coercion*. The first public pressure measure is *user and citizen demands*. In asking respondents about 'users' and citizens' demands' we sought to examine the degree to which informants believed that they were being responsive to the demands of users and citizen for improvements in their services. The second measure, *external pressure*, examined the extent to which local authorities were driven forward by external pressures (e.g. the media).

Controls

The environment of public service organizations is identified as an influence on their management and capacity to innovate (Pettigrew, Ferlie and McKee 1992; Meyer and Goes 1988; Thompson 1967). Controls are therefore included in our model for three variables that are argued to assist in the adoption of innovation—organizational size, urbanization and service need—and one that will inhibit it—diversity of service need. The evidence on *organizational size* is somewhat mixed, but on balance suggests that it is generally positively associated with early adoption of new ideas and products (Dewar and Dutton 1986; Walker 1969). Organizational size was operationalized by the size of the population of the local authority. This measure was selected because data on the number of employees, the commonly used measure of organizational size, vary with the level of contracting out of services and also because larger populations require larger organizations to deliver the requisite level of service.

The degree of urbanization is argued to influence the likelihood of innovation adoption. Urban areas are typically geographically constrained and give easier access to users, service providers and information in the environment than in more rural and

remote areas (Aiken and Alford 1970). We measured *urbanization* by the average population density within each local authority. This captures the differences between highly urban city authorities, from those with mixed urban and rural areas to those with predominately rural authorities.

Meeting social needs is one of the primary purposes of public organizations. Ensuring that the primary goals of public organizations are met is likely to motivate agencies to innovate to provide the appropriate quantity and quality of service (Boyne, Gould-Williams, Law and Walker 2005; Damanpour and Schneider 2006). *Service need* was measured by the Average Ward Score from the Index of Multiple Deprivation (Department of the Environment, Transport and the Regions 2000), which provides an overview of the different domains of deprivation (e.g., income, employment and health) and is the standard population-weighted measure of deprivation employed by the central government in England. More diverse areas are, by contrast, likely to place limits on the capacity of public organizations to innovate. As a geographic area becomes more heterogeneous it will become harder to establish needs and preferences and to develop a suite of innovations that suit the entire population. *Service diversity* was measured by a Herfindahl-Hirschman Index, squaring the proportion of each ethnic group (taken from the 2001 census, Office for National Statistics 2003) within a local authority and then subtracting the sum of the squares of these proportions from 10,000. This measure gives a proxy for 'fractionalisation' within a local authority area, with a high level of ethnic diversity reflected in a high score on the index. Higher levels of service need and service delivery make the task of achieving higher levels of organizational performance more demanding because opportunities for co-production of services are reduced. Moreover, as

the range of service users becomes more varied it becomes harder to determine the relative needs of different groups and to provide standardised services that meet their requirements (Andrews, Boyne, Law and Walker 2005).[5]

Analysis

Our data set consists of 335 cross-sectional units—the English local authorities. For 102 units, we cover a time span of four years (2001-2004), and for the remaining units, we cover a time span of one or two years, totalling 675 observations. This creates unbalanced panels. The use of cross-organizations pooled time series data holds the potential for three methodological problems (Beck and Katz 1995; Harrinvirta and Mattila 2001). First, the error terms may differ from organization to organization, generating panel heteroskedasticity. Second, the errors across panels might be time correlated; that is, an organization's errors at a year might be correlated with another organization's errors at the same year. Finally, there may be within panel autocorrelation, as there is in any time series. In considering them, we report random-effect estimations with Huber-White standard errors to correct for heteroskedasticity and include year dummies to count for autocorrelation. We included the years 2001-2003 (2004 is the baseline). Moreover, unlike the fixed-effects regression, the random-effects estimation allows us to include time invariant variables. Indeed, three of our control variables—organizational size, urbanization, and service need—do not vary across time.

[5] All the control variables were logged because of long tails.

RESULTS

We present six sets of results.[6] In each set we include three models. Model 1 includes all the observations, that is 675. Model 2 includes the authorities whose observed levels of total innovation exceed the estimated (or fitted) value as reported in model 1. Model 3 includes the authorities whose observed levels of total innovations are below the estimated (or fitted) values as reported in model 1. By splitting the data into these two groups, we are able to distinguish over-exceeding (high innovative) localities from the under exceeding (low innovative) localities in terms of their effort to diffuse innovation. In addition, we can compare the analysis from the two groups to identify what the good localities do differently (Meier and Gill 2000). Results are initially presented for total innovation before we go on to examine the diffusion determinants for different types of innovation.

Total innovation

Table 3 reports the random effect estimates for the influences of competition, learning, vertical influence, and public pressure on total innovation for three models. Results from Model 1 in table 3 show that five out of the seven driving mechanism of innovation diffusion are positive and statistically significant, covering each of the four areas in the Berry and Berry framework. Specifically, the greater the provider competition ($p < 0.001$), learning ($p < 0.05$), vertical influence ($p < 0.05$), external pressure ($p < 0.05$),

[6] For each model, we ran the influence and leverage diagnostics to ensure no single authority influenced the estimations. Whereas few observations were influential, they were isolated (not accumulated over years); therefore, we included all observations. The mean variance inflation factor (VIF) for each model shows no significant multicollinearity. No model reports the coefficients for year dummies; however, results suggest that in 2001 localities behaved statistically significantly different to year 2004.

and user demands ($p < 0.001$), the more organizational diffusion of innovation is promoted. In sum, these results provide strong support for the Berry and Berry model at the total innovation level.

Insert Table 3 about here

Model 2 in table 3 reports the analysis for the high innovative authorities, that is, those units whose observed levels of total innovation exceed the estimated (or fitted) value—as reported in Model 1. Results suggest that the high innovation levels of these authorities are positive and statistically related with user demands ($p < 0.001$), learning ($p < 0.001$), service provider competition, ($p < 0.05$; $p < 0.001$), and vertical influence ($p < 0.001$). The coefficient for one variable was, however, statistically significant and negative—public competition worked against the adoption of total innovations in this sample of English local governments. By contrast, Model 3 in table reveals that the innovation levels of the relatively lower innovative authorities are positively and statistically correlated with only three driving mechanisms: external pressure ($p < 0.001$); user demands ($p < 0.001$), and provider completion ($p < 0.001$). In other words, unlike the high innovative authorities, in the low innovative authorities, learning and vertical influence have no influence. It indicates that high innovative authorities learn good practices from professional associations and networks and at the same time respond to vertical influences from central government. These results further confirm applicability

of the Berry and Berry model to total innovation. We do, nonetheless, have a few words of caution. First, it is important to note that two of the variables are significant in all models, suggesting that they have a neutral effect on different levels of innovation adoption. Second, when high and low innovative localities are examined we find that external pressures are more likely to explain lower levels of adoption, perhaps because these organizations react more to local political demands, as expressed here through external pressures from the media. By way of contrast high innovative organizations differentiate themselves from lower innovative localities by listening to others, government and professional groups.

While we have three significant variables in the final model, two of which are statistically significant in all our analysis, the results for the low localities actually do not drive the results for the total model and the controls explain more in the low innovation cases than the high. Specifically, in low localities organizational size, urbanization, and service need positively contribute to the diffusion of total innovation.

Innovation types

We desegregate total innovation into its five innovation types and run the analysis independently for each one. Table 4 presents all the results. While there are some differences across the three models the results suggest that the capacity of the concepts in the Berry and Berry framework, as operationalised in the study, to explain diffusion by innovation type is curtailed. We present these findings in two parts, first we examine the results variable by variable before discussion the results by innovation type.

Insert Table 4 about here

First, there is a lack of variation in the results for one of the innovation diffusion mechanism measures, and limited variation for a second. Users demands is constant across all Models; it is positive and statistically significant at the $p < 0.001$ level in every case. This confirms the above finding at the total innovation level, and suggests that organizations are now sufficiently attuned to the voices of their users such that high and low innovation achievers listen to them in equal amounts. Another variable is significant in a large number of cases (11 out of 15 times): service provider competition. This variable is statistically significant for the three samples for the marketization, ancillary and technological innovation types. And this impact of competition from other providers is not unexpected in our model as both marketization and ancillary innovations deal heavily elements in the external environment, and technological innovation can also be viewed as a response to keeping up with "state of the art" applications based on the competitive environment. Public service competition also has weak effects ($p < 0.1$) on service innovations and stronger effects ($p < 0.05$) on authorities that are lower adopters of organizational innovation. Thus patterns of service provider competition are played out and used in somewhat different ways and differently influence the adoption of innovation types.

Public competition offers only limited explanatory power. The coefficient for this variable is statistically significant on one occasion, and then not in the hypothesized

direction. Authorities highly innovative in service innovations found that competition from other authorities was likely to reduce their likelihood of developing service innovations. Otherwise the coefficient was not statistically significant. Coercion similarly has weak explanatory powers, being statistically significant on only two occasions. However, in both cases the results were as anticipated; it better explained the behaviour of lower levels of activity for ancillary and marketization innovations. While vertical influence is significant on six occasions it is significant for all levels of innovative activity in relation to ancillary and technological innovations.

External pressures were more likely to be important for low innovative localities. This applied to service, marketization, organizational (at the lower level of $p < 0.1$) and ancillary innovation types. However, in the case of marketization and organizational innovations it was significant in all three models. The final variable to be discussed is learning. Learning was significant in relation to the adoption of service innovation by any type of locality and was associated with low innovative localities in relation to marketization innovations.

Turning away from the individual independent variables to interpreting the results from the innovation type perspective a similar pattern results to that noted above; for some innovation types there is a lack of variation in the explanation for innovativeness of high and low localities while for others a slightly more complex story emerges. For the technological innovation type the results indicate that three variables have constant effects across all cases, high and lower innovative localities: user demands (as in all models) together with service provider competition and vertical influence. Three variables are also statistically significant for all types of localities for the ancillary

innovation type: user demands, other service providers competition and vertical influence. Beyond these three variables a further two explained jurisdictions with lower levels of innovative activity: external pressures and coercion. For service, marketization and organizational innovation types two variables were important across all localities, of which one, as noted above was user demands. For service innovation the measure of learning was significant in each case, while it was service provider competition for marketization innovations and external pressure for organizational innovations. Three additional variables were significant in the service innovation model: service provider competition for all localities, public competition was negative for high innovative localities and external pressures for low localities. For marketization external pressures mattered for all localities and the low innovative localities, as did learning. Finally, for organizational innovations service provider competition influenced low innovative localities.

The control variables were frequently not significant in the innovation types models. There was a slight preponderance of significant variables in the low innovative localities, reflecting the findings for total innovation. Results of note include the likelihood of findings marketization innovations in less urban authorities with high levels of diversity—perhaps seeking to contract out in the face of complexity. In the organizational innovation model all the significant variables were in the anticipated direction, but were significant in all three models. Larger organizations facing high levels of need were likely to be associated with low innovative localities.

CONCLUSIONS

In this article we have examined the explanatory capacity of the Berry and Berry framework to explain public management innovation. The data, drawn from a four-year sample of English local governments, were separated by high and low innovative localities and by innovation type. The main findings from the study are thus: the Berry and Berry model is best able to explain total innovation, that is the overall innovative activity of English local governments. Amongst this sample of authorities it also has the ability to explain the behaviour of high and low innovators. The framework is, however, less able to the diffusion of innovation by innovation type, frequently variables from the Berry and Berry framework are significant across all three samples, offering little insight into the distinct drivers of specific types of management innovations. This would suggest, that when we are dealing with public management questions, that the Berry and Berry framework is more suited to a holistic measure of innovation rather than disaggregated measures.

This may be a product of the theory we use and nuances of English local governments. The theory was developed in the USA to be applied to state and policies. In this study we have applied it to English local governments and to management innovation. Different data and different contexts may offer alternative results, such work needs to be undertaken to confirm the validity of the conclusions reached here. Other limitations include some of our measures, such as those operationalising the Berry and Berry framework. We have used single item measures; future work should look to developing more robust index measures. It is also plausible that the theory is specific to the USA and more work needs to be undertaken on the model. The findings in this article would suggest that the public pressures model should be given less weight in the future as

user demands have a uniform effect and external pressures are more likely to be drivers in areas of low innovation adoption. It could also be that other factors not considered here drive innovation: perhaps it is not competition or learning that lead to innovation in today's internet connected world but the use of information accessible from within the organization.

On the other hand, Rogers' (1995) summary of thousands of studies on diffusion drivers across all types of innovation strongly suggests that innovation diffusion across individuals and organizations follows similar processes. This study's results demonstrate that different types of management innovation do not have uniquely different diffusion determinants. Further work on management innovations in different contexts and samples will be needed to see if this more uniform diffusion process continues to hold otherwise better explanations need to be developed by innovation types. We ask others to meet these challenges.

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Table 1. Summary of Statistics

Variables	Mean	Std. Dev.	Min	Max
Innovation Types				
Total Innovation	22.46	2.76	12.97	30.58
Service	4.27	0.82	1.5	7
Marketing	3.87	0.86	1	6.33
Organizational	3.98	0.92	1.16	6.66
Ancillary	5.20	0.63	2.5	6.66
Technological	5.13	0.65	2.25	6.91
Diffusion Mechanisms				
Public Competition	4.08	0.76	1	6
Service Provider Competition	3.31	0.85	1	6.5
Learning	4.25	0.71	1.5	6.09
Vertical influence	5.25	0.69	2	7
Coercion	4.69	0.80	1.5	7
External Pressure	3.47	0.90	1	7
User demands	5.13	0.64	2.83	7
Controls				
Organizational Size	243684	231879	24457	1329718
Service Need	24.08	11.46	4.89	61.34
Service Diversity	1947.43	1990.78	260.37	8452.81
Urbanisation	1741.27	2480.38	23.19	14916.67

Table 2. Innovation Types

Innovation Type	Average Inter-item Covariance	Number of Items in the Scale	Reliability Coefficient
Total			
Service	**0.58**	**3**	**0.86**
Marketing	**0.52**	**3**	**0.70**
Organizational	**0.56**	**3**	**0.64**
Ancillary	**0.32**	**4**	**0.80**
Technological	**0.32**	**4**	**0.77**
Total innovation	**0.22**	**5**	**0.74**

Table 3. Random-Effect Estimates with Huber-White Standard Errors for Total Local Innovation

	Model 1 All Local Authorities Beta/SE	Model 2 High Innovative Local Authorities	Model 3 Low Innovative Local Authorities
Diffusion Mechanisms			
Public Competition	-0.13	**-0.22***	-0.19
	(0.15)	(0.11)	(0.15)
Service Provider Competition	**0.43*****	**0.53*****	**0.36*****
	(0.12)	(0.11)	(0.11)
Learning	**0.26***	**0.39*****	0.10
	(0.13)	(0.11)	(0.12)
Vertical influence	**0.28***	**0.35*****	0.19
	(0.13)	(0.11)	(0.12)
Coercion	0.00	-0.05	0.03
	(0.13)	(0.12)	(0.13)
External Pressure	**0.27***	0.12	**0.37*****
	(0.12)	(0.09)	(0.11)
User demands	**1.48*****	**1.28*****	**1.69*****
	(0.17)	(0.13)	(0.17)
Controls			
Organizational Size	**0.53****	0.09	**0.75*****
	(0.18)	(0.11)	(0.12)
Urbanisation	0.08	0.00	**0.23****
	(0.13)	(0.08)	(0.09)
Service Need	0.42	0.28	**0.41***
	(0.11)	(0.18)	(0.20)
Service Diversity	0.14	0.23†	0.03
	(0.20)	(0.13)	(0.14)
Number of Groups	335	209	215
R^2 within	.31	.51	.46
R^2 between	.37	.56	.70
R^2 overall	.38	.55	.68
Number of Observations	675	346	329
Wald Chi2(14)	287.37	325.67	627.87
Prob. > Chi2	.00	.00	.00

Coefficients for year dummies are omitted

*** p. ≤ 0.001

** p. ≤ 0.01

* p. ≤ 0.05

† p. < 0.1

Table 4. Random-Effect Estimates with Huber-White Standard Errors for Types of Local Innovation

	Service Innovation			Marketization Innovation			Organizational Innovation		
	All Localities	High Innovative Localities	Low Innovative Localities	All Localities	High Innovative Localities	Low Innovative Localities	All Localities	High Innovative Localities	Low Innovative Localities
Diffusion Mechanisms									
Public Competition	-0.06	**-0.09***	-0.06	-0.04	-0.01	-0.06	-0.03	0.02	-0.01
Other Service Provider Competition	0.08†	0.06	0.05	**0.16*****	**0.17*****	**0.17*****	0.06	0.04	**0.07***
Learning	**0.13****	**0.16*****	**0.08***	0.03	-0.05	**0.10***	0.05	-0.01	0.04
Vertical influence	0.03	-0.01	0.02	0.05	0.01	-0.01	-0.01	0.06	-0.01
Coercion	-0.05	-0.07	-0.07	0.07	0.07†	**0.15****	0.01	-0.03	-0.01
External Pressure	0.4	0.04	**0.09***	**0.13****	0.05	**0.09****	0.73†	**0.07***	**0.10****
User demands	**0.35*****	**0.40*****	**0.32*****	**0.22*****	**0.23*****	**0.23*****	**0.20*****	**0.19*****	**0.18*****
Controls									
Organizational Size	0.05	-0.01	**0.18*****	0.13	0.04	**0.18*****	**0.19****	**0.11****	**0.24*****
Urbanisation	0.00	-0.03	0.03	-0.00	**-0.08****	0.02	0.08†	**0.07***	**0.10****
Service Need	0.03	0.09	0.06	-0.00	0.07	0.02	**0.25****	**0.18****	**0.31*****
Service Diversity	-0.00	0.01	-0.02	0.13†	**0.23*****	**0.12****	-0.02	0.00	-0.01
Number of Groups	336	336	202	335	199	217	335	212	214
R^2 within	.42	.42	.60	.17	.19	.21	.13	.24	.26
R^2 between	.27	.27	.62	.17	.35	.55	.20	.34	.61
R^2 overall	.33	.33	.62	.18	.30	.50	.20	.34	.53
Number of Obs.	676	676	317	676	346	330	675	336	339
Wald chi2 (14)	435.75	435.75	522.92	113.59	105.54	300.21	142.10	172.58	362.29
Prob. > chi2	.00	.00	.00	0.00	.00	.00	.00	.00	.00

***p.≤ .001; **p. ≤ .01; *p. ≤ .05; †p. < 0.1
Coefficients for year dummies are omitted

Table 4. Continuation

	Ancillary Innovation			Technological Innovation		
	All Localities	Excellent Innovative Localities	Low Innovative Localities	All Localities	Excellent Innovative Localities	Low Innovative Localities
Diffusion Mechanisms						
Public Competition	-0.01	0.02	-0.04	0.01	-0.02	0.04
Other Service Provider Competition	**0.06***	**0.04***	**0.12****	**0.08****	**0.08****	**0.11*****
Learning	-0.01	0.03	-0.03	0.04	0.03	0.03
Vertical influence	**0.15*****	**0.14*****	**0.11****	**0.09***	**0.08****	**0.11***
Coercion	0.00	-0.03	**0.03****	-0.01	-0.03	0.03
External Pressure	0.03	0.02	**0.07***	-0.02	-0.02	-0.03
User demands	**0.38*****	**0.29*****	**0.40*****	**0.32*****	**0.28*****	**0.38*****
Controls						
Organizational Size	0.05	0.01	**0.08***	0.12	0.04†	0.18
Urbanisation	0.01	0.00	0.03	-0.01	-0.00	-0.00
Service Need	0.11	0.04	**0.16****	0.01	-0.07	0.05
Service Diversity	-0.00	0.00	0.01	0.03	0.02	0.05
Number of Groups	336	224	202	336	232	217
R^2 within	.33	.55	.45	.24	.43	.48
R^2 between	.33	.52	.65	.18	.41	.46
R^2 overall	.34	.52	.63	.23	.44	.49
Number of Obs.	677	361	316	676	350	326
Wald chi2 (14)	142.10	172.58	362.29	142.10	172.58	362.29
Prob. > chi2	.00	.00	.00	.00	.00	.00

***p.≤ .001; **p. ≤ .01; *p. ≤ .05; †p. < .1
Coefficients for year dummies are omitted