Original Article

Mandatory innovation in a decentralised system: The adoption of an e-government innovation in Dutch municipalities

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Abstract Local governments, especially in decentralised states, are increasingly performing tasks previously the responsibility of national government as well as new tasks. This research studies the conditions affecting the adoption of a mandated e-government innovation – 'Basic Registration Addresses and Buildings' (BAG), in Dutch municipalities ($N = 429$) between 2008 and 2011. In contradiction to what theory suggested, a great deal of variation in the timing of adoption was found. The results of Event History Analysis (EHA) show that early adoption of BAG was primarily the result of a municipality's command over resources. More resourceful municipalities, that is, with better past e-government performance, that are better informed, and included in more extensive policy networks were more likely to adopt this innovation relatively early. Of the motivational factors included in our study, the degree of political alignment between the municipal council and national government proved an important factor in the timing of a municipality's adoption. This is a surprising finding, as it is an uncontroversial and technical governance innovation. This research also shows that classical diffusion explanations play a role, even in the case of a mandated innovation for which the time frame, and thus the time to learn from other governments, was relatively short.
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Introduction

Local government in a decentralised polity potentially provides an ideal *test bed or laboratory* (Volden, 2006; Karch, 2007a; Füglister, 2011a) for innovations in governance. In the context of decentralisation, municipalities may come up with

different responses to more or less similar policy challenges. It is possible that, on the basis of a careful evaluation of various programmes, 'best practice' may be identified and more widely adopted. However, the extent to which the adoption of innovations in local government follows an innovation pattern based on the search for best solutions remains to be seen. It has, for example, been observed that often local governments' responses to new challenges are characterised by a considerable degree of uniformity (Sugiyama, 2008). In particular, in the case of national regulations demanding the implementation of certain policies by municipalities, high degrees of uniformity are to be expected. Against this background, this article aims to deepen our understanding of the process of adoption of innovations in local government. In our research, we define innovations simply as a programme that is new to the political actor adopting it (compare, Mohr, 1969). This means that an innovation can be new to one municipality and labelled an innovation there even though other municipalities may already have adopted that innovation (Gray, 1994).

Most research into the diffusion of policy innovations has examined *voluntary* adoptions. The cumulative number of innovations over time is normally characterised by an *s*-shaped learning curve (Rogers, 2003). Such a learning curve illustrates a pattern of adoption in which there are a few early adopters, followed by what has been called an early majority and a late majority. Finally, there are the laggards. Collectively, these groups form an *s*-shape. In this type of research, political actors are assumed to be autonomous: free to decide whether or not to implement any particular innovation. Here diffusion refers to both the population level phenomenon of cumulative individual level decisions, and to explanations for individual level decisions based on interdependency between different adopters.

It has been argued that when simply mandating local governments to adopt a certain policy innovation, national governments create a 'highly uninteresting form of diffusion, as nearly all state discretion is eliminated by national-level fiat' (Berry and Berry, 2007, p. 231). However, we cannot assume that municipalities act precisely as they are instructed to; generally they will have some discretion in performing their mandatory tasks (Goldsmith, 2005; Goldsmith and Page, 2010). National mandates requiring local action do not usually suggest that all local governments should react in the same way, nor that they should all react at the same time. This, for example, was observed in the United States where state governments chose different paths of action under a common federal mandate (Soss *et al*, 2001). Even if there is no discretion regarding the substance of the innovation, which is the case in our study, there may be freedom in terms of the timing of the adoption. Given the increased tendency to decentralise policy responsibilities from national to local governments in the Netherlands and other decentralised European countries (Pollitt and Bouckaert, 2004; Denters, 2005), investigating both vertical (top-down) influence and local autonomy is very important. We emphasise the importance of how innovations in local government are adopted, and to what extent the pattern of mandated innovations also follows the *s*-shaped learning curve.

We argue that it is an empirical question to what extent there are differences in the timing of policy adoptions after a national government mandate. We address this question in a study of the adoption of the Basic Registration Addresses and Buildings (in Dutch: Basisregistratie Adressen en Gebouwen (BAG)) in the Netherlands. We examine the timing of the adoption of BAG for all 429 Dutch municipalities, addressing two research questions: (i) *What differences exist among Dutch municipalities in the timing of the adoption of BAG? and* (ii)*How can we explain differences in the timing of the adoption of BAG among Dutch municipalities?*

The scientific progress we aim for is twofold. First, our questions supplement earlier questions asking *why* a certain policy is or is not adopted by a certain polity (for example, Walker, 1969; Gray, 1973; Berry and Berry, 1990; Volden, 2006). Owing to the mandated nature of the innovation of BAG, the main question is no longer *whether* a municipality will adopt the innovation, but rather *when*. By focusing on the adoption of BAG as a mandated innovation, we are able to retest theoretical explanations that were originally designed to explain voluntary processes of policy adoption. From existing theories about uncoordinated innovations, we derive and test predictions for mandated innovations.

Second, local governments are often considered to be seedbeds for public sector innovations (Beetham, 1996; Denters and Mossberger, 2006). In many instances municipalities have taken up new challenges, and experimented with innovative policies, modes of governance or institutional arrangements. Little is known, however, about whether and how municipalities adopt mandated innovations. So far diffusion research at the local level has mainly concentrated on voluntary adoption of innovations (for example, Sugiyama, 2008; Hansen, 2011; Krause, 2011; Walker *et al*, 2011). A considerable amount of research focusing on e-government (related) innovations has also been carried out at the local level (for example, Weare *et al*, 1999; Moon, 2002; Norris and Moon, 2005; Ahn, 2011; Homburg *et al*, 2013). In this article we aim to contribute to a better understanding of innovation in local government in a decentralised system by examining patterns of adoption of a *mandated* e-government innovation in Dutch municipalities.

Differences in Timing of Adoption Among Dutch Municipalities

In this section we answer our first question on variation in the timing of the adoption of BAG among municipalities. In 2006 in the Netherlands, the national government, the provinces, the municipalities and the water boards agreed to improve public services by setting a goal to improve electronic government (Kamerstukken II, 2005–2006). Since 2006, Dutch e-government has concentrated on the establishment of 13 so-called basic registrations that involve the storage and supply of important information about people, businesses and buildings (Kamerstukken II, 2005–2006). The main purpose of this nationwide system of basic registrations, of which BAG is

one, is collecting and sharing relevant unambiguous data held in one central database. Data are collected and kept up-to-date, to provide accurate information to all administrative bodies and public services in the Netherlands. For example, since February 2012 ambulances have navigated using data provided by the BAG (E-overheid.nl, 2012).

Responsibility for the law, the realisation and the financing of the nationwide BAG facility (In Dutch: Landelijke Voorziening BAG (LV BAG)) lay with the Ministry of Housing, Spatial Planning and the Environment (in Dutch: Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer – hereafter referred to as VROM); VROM was also responsible for the overhead costs, such as support for municipalities, and the costs for the connecting audits. Municipalities were (financially) responsible for their local database containing address and building information from within their own territorial borders. If local systems complied with the national standards they were connected to the nationwide BAG facility managed by the Land Registry. In 2008, the Dutch States-General mandated that from 1 July 2009 all municipalities were required to be connected to the nationwide BAG facility (VROM, 2009).

Figures 1–4 show, at four different moments in time, the municipalities that had not yet adopted BAG (in white), and the municipalities that had adopted BAG (in grey). VROM initially set 1 July 2009 as the deadline for all municipalities. Figure 1 shows that only 4 out of 429 municipalities (1 per cent) had adopted BAG before the first deadline. VROM then, in consultation with the Association of Dutch Municipalities (in Dutch: Vereniging van Nederlandse Gemeenten – hereafter referred to as VNG), set 1 January 2011 as a new deadline. Figures 2–4 show developments after the first deadline. Figure 2 shows that 63 municipalities (15 per cent) had adopted BAG by 1 July 2010, a year after the first deadline. Figure 3 shows that on 1 December 2011, a month before the second deadline, 248 municipalities (58 per cent) had adopted BAG. Figure 4 shows 415 municipalities (97 per cent) had adopted BAG by the second deadline. On 8 April 2011, the final municipality adopted BAG.

Figure 5 describes the pattern of innovation by representing the cumulative distribution of BAG-adoptions (the solid line) between August 2008 and May 2011. The first deadline (month 17), and the second deadline (month 35) are represented by two vertical dotted lines. The cumulative distribution of BAG-adoptions (solid line) shows that it took over 18 months for the adoption rate to increase. The increase in BAG-adoptions was strongest between 32 months and 34 months. This increase was probably because of the strongly upheld second deadline set by VROM and VNG.[1] Towards the end of the time period the line flattens, which means the *rate* of adoption decreased after the second deadline expired. By that time all Dutch municipalities had adopted BAG. Appendix A shows the major events and timelines of the adoption process.

In summary, Figures 1–5 show clear differences among municipalities. From these figures we conclude two things. First, there is considerable variation in the timing of the adoption of BAG. This implies that the adoption of a mandated innovation is by no

Figure 1: 1 July 2009; first BAG deadline.
Source: Maps (shape-file): © 2011, Statistics Netherlands/ Land Registry Office, Zwolle, 2011; Data: authors' own calculations based on VROM (2011).

Figure 2: 1 July 2010; A year after the 1st BAG deadline.
Source: Maps (shape-file): © 2011, Statistics Netherlands/ Land Registry Office, Zwolle, 2011; Data: authors' own calculations based on VROM (2011).

Figure 3: 1 December 2010; A month before the second BAG deadline.
Source: Maps (shape-file): © 2011, Statistics Netherlands/ Land Registry Office, Zwolle, 2011; Data: authors' own calculations based on VROM (2011).

Figure 4: 1 January 2011; second BAG deadline.
Source: Maps (shape-file): © 2011, Statistics Netherlands/Land Registry Office, Zwolle, 2011. Data: authors' own calculations based on VROM (2011).

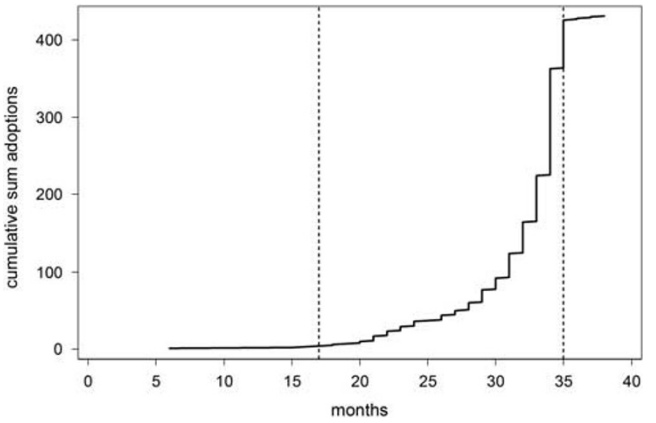

Figure 5: The cumulative distribution of BAG-adoptions for 429 municipalities in the Netherlands between the introduction of BAG legislation in 2008 and the last adoption in 2011.

means a mechanical process of central orders and local obedience. Local governments' discretion is clearly not eliminated by a national government mandate. The marked differences in timing demonstrate that the study of mandatory innovations is substantially more interesting than Berry and Berry (2007) suggested. Second, Figure 5 somewhat resembles an *s*-curve that is often found for voluntary governance innovations. We will therefore examine to what extent theories that were developed for voluntary governance innovations can help to understand the processes of mandated innovations.

Theory and Hypotheses

To explain variation among municipalities in the timing of BAG-adoptions, we derive predictions from basic assumptions underlying rational choice theory. These assumptions concern utility maximisation, existing preferences and decision making under conditions of uncertainty. When local governments face problems, they tend to confront these problems in a more or less rational manner, by looking around for various possible solutions. By assuming that municipalities make rational choices in response to a mandate, we do not assume that all municipalities 'act in an entirely rational manner: *only* that the tendency to act rationally, in the circumstances that prevail, is the common factor at work' (Goldthorpe, 1996, p. 115). Municipalities, based on the information available, and after – to some extent – weighing the costs and benefits, select their preferred solution from a wide range of alternatives. Of course, in our case municipalities cannot *choose* the innovation to adopt, but they can choose when to adopt it. To explain differences in timing, we use an assumption postulated by Mohr (1969, p. 114) (see also, Berry and Berry, 1990, 2007): 'Innovation

is directly related to the motivation to innovate, inversely related to the strength of obstacles against innovation, and directly related to the resources for overcoming such obstacles'. In our case this means that when the willingness to innovate is high, obstacles that can delay innovation are small and resources to overcome obstacles are large, the probability of municipalities adopting BAG will generally be high.[2]

In explaining the timing of the adoption of BAG, we look for factors reflecting municipalities' motivations, obstacles and resources. In further developing our theoretical argument we refer to factors that are internal and external to municipalities. Simultaneously considering internal and external factors originates from Berry and Berry (1990), and has been widely, and convincingly, applied (Boehmke and Witmer, 2004; Walker, 2006). In the context of mandated innovations the relevance of external intergovernmental factors in addition to internal local factors is even more pertinent, as national governments might provide facilities to create favourable conditions for successful implementation. We therefore accommodate both internal and external factors under Mohr's denominators, which we discuss below.[3]

Motivation

Motivation to innovate in government may stem from various sources. Governments are expected to provide adequate solutions for local problems, and they may want to act to meet these expectations. However, there is often ideological disagreement on the definition of such local problems, which may lower the motivation to innovate (Traut and Emmert, 2003; Daley and Garand, 2005; Makse and Volden, 2011). We assume more highly motivated municipalities will introduce an innovation sooner than less motivated municipalities. Hereby, we come to our most general hypothesis about municipalities' motivation. *General Motivation Hypothesis:* Municipalities that are more motivated to adopt BAG will do this sooner than municipalities that are less motivated to adopt BAG. We derive two specific hypotheses from this general motivation hypothesis.

Problem severity is the first motivational factor that has been hypothesised to be one of the possible reasons for political decision makers adopting a certain policy or not (Sapat, 2004; Daley and Garand, 2005; Karch, 2006). *Problem Severity Motivation Hypothesis*: Municipalities are more likely to adopt BAG earlier if they perceive their recent address registration system as already being high quality.

The second factor we assume to be an indicator of the motivation to innovate relates to the highly interdependent character of the Dutch governmental system. It has been hypothesised that the composition of government may influence policy innovation (Berry and Berry, 1990; Boehmke and Witmer, 2004). Bearing in mind the local level discretion mentioned earlier, it may be expected that the degree of local level obedience to a central mandate will reflect central-local political differences. *Political Alignment Motivation Hypothesis*: Municipalities are more likely to adopt BAG earlier if their party preferences are more aligned to those of the national government.

Obstacles

In addition to motivation, obstacles may also affect the timing of adoption. Our most general hypothesis regarding the influence of obstacles is that municipalities experiencing fewer obstacles will implement innovations sooner than municipalities experiencing more obstacles. *General Obstacles Hypothesis:* Municipalities that have more obstacles will adopt BAG later than municipalities that have fewer obstacles. We derive two specific predictions from this general hypothesis.

First, the political fragmentation of a municipality is assumed to reduce the adoption speed. As other have hypothesised, it is difficult to take decisions in a politically fragmented setting, even if the issue itself is not politically highly charged (McNeal *et al*, 2003). Numerous scholars have emphasised the importance of party fragmentation; for example, Brooks (2005) posits that party fragmentation is inversely related to the likelihood of successful innovation, and others have hypothesised that the probability of a state adopting a law is greater when a single party controls the governorship and both houses of the legislature, than when the state government is under divided control (Berry and Berry, 1990; Boehmke and Witmer, 2004). *Political Fragmentation Obstacles Hypothesis*: Municipalities are more likely to adopt BAG earlier if their level of party fragmentation is lower.

The relationship between the complexity of the innovation and the rate of adoption has also been hypothesised (Fliegel and Kivlin, 1966; Rogers, 2003). In this context the complexity of the innovation is likely to increase with the number of buildings and addresses in a municipality. Each municipality is responsible for adding information about all buildings and addresses within its own boundaries; this is a very time-consuming job. *Buildings Obstacles Hypothesis:* Municipalities are more likely to adopt BAG later if they have more buildings.

Resources

The timing of adoption might also be affected by municipalities' command over financial, human and social resources. Financial resources refer to the amount of revenue, human resources refer to the quantity and quality of the municipal administrative staff, and social resources pertain to the degree to which a municipality has access to relevant vertical and horizontal networks. Our most general hypothesis regarding the influence of resources is that municipalities with more resources will implement innovations sooner than municipalities with fewer resources. *General Resources Hypothesis:* Municipalities with more resources will adopt BAG sooner than municipalities with fewer resources. We derive four specific hypotheses from this general hypothesis.

The first municipal resource is organisational size (Walker, 1969; Weare *et al*, 1999; Ahn, 2011). Larger organisations are generally more inclined to adopt

innovations than smaller organisations, because they have greater financial resources and more human resources. *Size Resource Hypothesis:* Municipalities are more likely to adopt BAG earlier if they have more personnel and greater financial resources.

More specifically, we expect that technical capacity may be an important form of human resource in the development of e-government (Moon, 2002; Ahn, 2011). The technical expertise available in a municipality will, to a large extent, determine a municipality's ability to implement new forms of e-government. We assume that the better the prior performance of a municipality within the e-government domain, the more likely it is to be an early adopter of any new e-government innovation. *Past Performance Resource Hypothesis*: Municipalities are more likely to adopt BAG earlier if their past performance in e-government is better.

The third resource relates directly to the multi-level government setting in which innovations are implemented. Karch (2007a, p. 143) found that national forces are very important in the information distribution process, particularly in the early stages of political decision making. We assume that municipalities adopt earlier if they have access to information provided by VROM. *Information Resource Hypothesis*: Municipalities are more likely to adopt BAG earlier if they have more access to information.

Finally, there may be relevant horizontal inter-municipal-networks that can be considered as a resource. Walker (1969) was one of the first scholars to investigate the geographic spread and temporal patterns of newly adopted programmes, concluding that states adopted new programmes more often when other similar states had already adopted them. This tendency to adopt innovations in similar sub-national governments refers to a process of *learning*: if a policy was successful in a similar setting it might work 'with us'. Much support has been found for the claim that policies diffuse across neighbouring polities (for example, Berry and Berry, 1990; Volden, 2006). A well-known problem for geographic proximity as a driver for the spread of a policy is the difficulty in determining exactly *why* proximity should lead a policy to diffuse (Beck *et al*, 2006; Karch, 2007b). In trying to achieve real understanding of where inter-governmental learning takes place, it is important to take into account the places where policymakers exchange or acquire their information (Füglister, 2011b). In line with other scholars, we therefore address intergovernmental organisations as a driver of policy diffusion (Sugiyama, 2008; Füglister, 2011b). *Policy Network Resource Hypothesis*: Municipalities are more likely to adopt BAG earlier if there are more municipalities in the same policy network that already have adopted BAG.

Method and Data

To test our hypotheses, we apply an EHA, which estimates the probability that a municipality with certain characteristics that has not yet adopted BAG will adopt BAG at a particular point in time (see also, Berry and Berry, 1990; Singer and Willett, 2003).

To do so, we constructed a *municipality-month* dataset that contains a record for each municipality in each month between the adoption of the BAG law in January 2008 and the moment of BAG adoption. Once a municipality adopts BAG, it is no longer 'at risk' of adopting and it is excluded from our dataset for the following month. This means the number of observations for each municipality varies. For example, Vlaardingen, the first municipality to adopt BAG, is only 'at risk' for 5 months, whereas Apeldoorn, the last municipality to adopt, is 'at risk' for 37 months. In each month we examine each municipality, for a total of 13 644 observations (429 municipalities × number of months from law up until the adoption).[4] Appendix B presents the frequency distribution by month of adoption for the municipalities in our analysis.

Our research questions are about the *timing* of the adoption of BAG. We have therefore gathered information on the exact dates of BAG-adoptions by municipalities (VROM, 2011). This allows us to follow all municipalities through time starting from the adoption of the law in January 2008 until the final BAG adoption in April 2011. The units of analysis are therefore municipalities (referred to with subscript *i*) in certain months (referred to with subscript *t*). Our dependent variable, $ADOPTION_{it}$, is a binary variable referring to whether or not municipalities adopted BAG in a certain month. Each month, the municipalities are assigned a score of 1 if they adopted BAG in that month, and a score of 0 in all other months.

Motivational Variables

The variable *PROBLEM SEVERITY* is measured by the question of how highly the responsible official would rate the current standard of address registration (measured at the beginning of 2006) in their own municipality (scale ranges from 0 (lowest) to 9 (highest)). Data are time-invariant and come from the report entitled 'Baseline measurement BAG', written by BMC Consultancy and Management (2006) at the request of VROM.[5]

We measure *POLITICAL ALIGNMENT* between municipal government and national government by the proportion of political parties in a municipal council that are represented in the national government's coalition. This variable ranges between 0 and 87 per cent. The higher the percentage, the greater the local-national party alignment is. Data are time varying and were measured using data from local and national elections in 2006 and 2010.[6] Data were obtained from Kiesraad (2011).

Obstacles variables

PARTY FRAGMENTATION is measured by the Laakso-Taagepera index (1979) that reflects the effective number of political parties in a municipal council, by taking into account their relative size. The higher the score, the more fragmented a municipal council is. This variable ranges between 1.53 and 10.07. Data are time varying

because local elections were held in 2006 and 2010.[7] They were obtained from Kiesraad (2011).

The number of *BUILDINGS* in a municipality is measured (at the end of 2011) as the absolute number of buildings imported into BAG by each municipality. Data are time-invariant and come from VROM.[8]

Resources variables

PAST PERFORMANCE with e-government is measured by making use of the E-Government Ranking (in Dutch: Overheid.nl Monitor) (ICTU, 2007–2010).[9] For each year during the period between 1999 and 2011, this monitor gives a relative score and compares the Websites of all municipalities in the Netherlands, looking at their ability to provide various e-government services and e-government content to citizens. The measurements used to calculate the scores changed every year because of new priorities and new forms of e-government. Measurements took place in the final 3 months of each year. Because we want to measure a municipality's prior experience with e-government, we use the scores from the previous year. For each year, a relative interval score, lying between 0 and 91.4 was calculated.

Access to *INFORMATION* is measured (at the beginning of 2006) in two ways. The first one is familiarity with the BAG *Website* (1 = yes, 0 = no) administered by VROM. The second one is subscription to the BAG *newsletter* (1 = yes, 0 = no) provided by VROM. We summed up the answers to both of these questions into one interval score (0 = none, 1 = one of the two, 2 = both). Data are not time varying and are also taken from the report entitled 'Baseline measurement BAG' (BMC Consultancy and Management, 2006).[10]

SIZE is a somewhat problematic measurement because larger populations self-evidently require larger organisations for service delivery (Walker *et al*, 2011). We therefore included *z*-scores of the fulltime-equivalent (FTE) employees per 1000 inhabitants (BZK, 2008b) (data comes from the Ministry of the Interior and Kingdom Relations; in Dutch: Ministerie van Binnenlandse Zaken (BZK)), the amount of money municipalities received from the municipal fund (BZK, 2008a) and the population size (Statistics Netherlands, 2011) into one reliable scale for the years 2008–2011.[11]

VROM divided municipalities into regional contact groups that, between 2006 and 2009 and approximately every 6–8 weeks, worked towards connecting to the nationwide BAG-database, under the guidance of an assigned BAG-account manager and BAG-expert. The four major municipalities Amsterdam, Rotterdam, The Hague and Utrecht had their own contact group. There were also pilot project participants, who jointly formed a separate contact group.[12] To measure whether or not it matters if municipalities in the same policy network ($ADOPTION_{jt}$ *POLICY NETWORK)* have already adopted BAG, a variable was constructed that measures the cumulative

number of municipalities in the same policy network that had previously adopted BAG. Data are time-variant and come from VROM.

Each municipality contributes multiple records (one for each month under study) to our data set. As these repeated measures may contain temporal dependence, we account for that by including t, t^2 and t^3 (Carter and Signorino, 2010).[13] However, we have found multicollinearity to be a problem, and therefore demeaned t, and used t/100, and its square and cube. Table 1 presents the means, standard deviations and range of all variables used in our analysis.

Findings

As described above, our dependent variable is a dummy indicating whether or not a municipality$_i$ adopts BAG in a particular month. To test our hypotheses, and because of the dichotomous nature of our dependent variable, we employ logistic regression analysis.[14] The model parameters are estimated using Stata/IC 12.1. In Table 2 we present the estimation coefficients, robust standard errors and the Akaike Information Criterion (AIC)-value as measurement for the model fit. In model 1 all motivational factors are included, in model 2 only obstacles are included and model 3 tests only for the influence of resources. Finally, model 4 shows the coefficients for motivation, obstacles and resources side by side, along with the point estimate of the percentage

Table 1: Descriptive statistics ($N = 429$)

Information for:	*Time varying*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Dependent variable					
ADOPTION$_{it}$	yes	0.03	0.17	0.00	1.00
Motivation					
POLITICAL ALIGNMENT	yes	43.56	14.12	0.00	86.67
PROBLEM SEVERITY	no	6.15	1.06	0.00	9.00
Obstacles					
POLITICAL FRAGMENTATION	yes	4.83	1.28	1.53	10.07
BUILDINGS	no	9.79	0.75	7.15	13.79
Resources					
SIZE	yes	0.00	1.00	−4.22	5.05
PAST PERFORMANCE	yes	38.14	11.88	10.70	91.40
INFORMATION	no	1.34	0.68	0.00	2.00
ADOPTION$_{jt}$ POLICY NETWORK	yes	1.53	3.45	0.00	28.00
Duration					
MONTHS	yes	16.66	9.52	1.00	38.00

Table 2: Logistic regression coefficients explaining the timing of the adoption of BAG (*N* observations = 13 644, *N* events = 429)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Percentage change in odds*
	β (*σ*)	*β* (*σ*)	*β* (*σ*)	*β* (*σ*)	
Motivation					
POLITICAL ALIGNMENT	0.011**	—	—	0.018**	+1.8
	(0.004)			(0.006)	
PROBLEM SEVERITY[a]	0.034	—	—	0.042	+4.3
	(0.047)			(0.059)	
Obstacles					
POLITICAL FRAGMENTATION	—	−0.026	—	0.030	+3.0
		(0.051)		(0.071)	
BUILDINGS[a]	—	0.055	—	0.123	+13.1
		(0.091)		(0.128)	
Resources					
PAST PERFORMANCE	—	—	0.016*	0.017*	+1.7
			(0.008)	(0.007)	
INFORMATION[a]	—	—	0.180*	0.167*	+18.1
			(0.095)	(0.095)	
SIZE	—	—	−0.020	−0.092	−8.8
			(0.088)	(0.119)	
$ADOPTION_{jt}$ POLICY NETWORK	—	—	0.198**	0.204**	+22.6
			(0.025)	(0.025)	
Duration					
time/100	26.539	26.293	21.165*	21.852*	—
	(22.609)	(22.741)	(10.776)	(10.028)	
$time/100^2$	−392.612	−403.020	−172.660	−150.147	—
	(299.801)	(301.444)	(162.225)	(151.820)	
$time/100^3$	2485.839*	2529.415*	850.979	730.419	—
	(1042.467)	(1048.331)	(636.544)	(599.369)	
Constant	−5.358**	−5.311**	−5.311***	−5.417**	—
	(0.301)	(0.300)	(0.226)	(0.228)	
Number of municipality-months	13 644	13 644	13 644	13 644	—
Number of municipalities	429	429	429	429	—
Degrees of freedom	6	5	7	12	—
Log-likelihood	−1002.2	−1004.1	−952.3	−947.6	—
AIC	2016.4	2020.1	1920.5	1919.1	—

[a]Time-invariant variable.

** $P<0.01$, * $P<0.05$: one-tailed except for the variables for which we have stated a directional hypothesis, and two-tailed for the constant and duration indicators.

Notes: To account for repeated measures, all models are estimated with robust standard errors clustered on municipality. Estimated coefficients with standard errors in parentheses beneath; calculations for the percentage change in the odds represent a one-unit change around the mean, holding other variables constant at their mean.

change in the odds ratio that accompanies a one-unit change in each independent variable.

Model 1 in Table 2 shows the results of the variables capturing municipalities' motivation to innovate. We expected that municipalities that were more highly motivated would have a larger likelihood of BAG-adoption. Of the motivational factors, only the coefficient of the political alignment variable shows up as positive and statistically different from zero. Its positive sign indicates that, in each month, municipalities that are politically more aligned with national government have a greater likelihood of adopting BAG. Holding all other variables constant at their mean, a one-point increase in political alignment is associated with an approximate 1.1 per cent (100*((*e*^0.01061)−1) = 1.0666 per cent) increase in the odds of BAG-adoption. Given that this independent variable is measured on a scale between 0 and 86.67, it is difficult to give substantial meaning to a one-unit change. Interpretation of a one standard deviation increase that is associated with an approximate 15 per cent (100*(14.1185*0.01061)) increase in the odds of BAG-adoption, may be more informative. The coefficient of problem severity does not attain conventional levels of statistical significance, and appears to be unrelated to the adoption of BAG. The implication of our findings in model 1 is that our motivational hypothesis, stating that more highly motivated municipalities adopt BAG sooner is only partly confirmed.

Model 2 in Table 2 shows the results for the variables reflecting obstacles to the adoption of BAG. We assumed that municipalities with fewer obstacles would adopt BAG earlier. On the basis of the political fragmentation coefficient, and the buildings-coefficient, which do not appear to be statistically different from zero, we conclude that our obstacles hypothesis cannot be confirmed.

The coefficients for the factors reflecting resources for BAG-adoption are shown in model 3, Table 2. We hypothesised that more resourceful municipalities would adopt BAG earlier. Three of the four resource specific factors included in the model have a positive and significant impact on the likelihood that a municipality will adopt BAG. The past performance variable shows that in each month municipalities that previously performed better with different forms of e-government have a greater likelihood of adopting BAG. When holding all other variables constant at their mean values, a one-unit increase in past performance is associated with a 1.6 per cent change in odds, and a one standard deviation increase is associated with an approximate 19 per cent increase in the odds of BAG-adoption. The positive coefficient of the information variable indicates that, in every month, municipalities that are better informed are more likely to adopt BAG. When holding other independent variables fixed at their central values, an additional unit yields an approximate 19 per cent higher odds ratio. We are cautious about placing too much confidence in this result, because of the possible imprecision of this particular time-invariant variable. The coefficient of the policy network variable is also positive and statistically different from zero. This we interpret as follows: in each month, municipalities that have more municipalities in the same policy network that have

already adopted BAG are more likely to adopt BAG themselves. Substantively, within a municipality's network each additional municipality that has adopted BAG is associated with a rise of 21.9 per cent in the odds of BAG-adoption. Finally, the size-coefficient does not attain conventional levels of statistical significance, and shows that human resources and financial resources are not related to the likelihood of BAG-adoption. This means our resources hypothesis is partially confirmed.

Finally, the results of model 4 in Table 2, where we tested for the effects of motivation, obstacles and resources in one model, did not substantially alter the results and outcomes described earlier. For the motivational variables the outcomes did not change, except that a one-unit increase in the party alignment variable is now associated with a 1.8 per cent increase in the odds ratio of BAG-adoption, compared with a 1.1 per cent increase in model 1. Again, the obstacles variables failed to attain conventional levels of statistical significance. The coefficients of the resources variables changed only slightly from the results in model 3. In model 4, the odds of BAG-adoption increase by 1.7 per cent for every additional unit on the past performance scale, compared with 1.6 per cent in the previous model. The percentage change in odds for the information variable decreased to 18.1 per cent, compared with 19.7 per cent in model 3. The effect of every additional municipality in the same policy network that had already adopted BAG also changed slightly. In model 4 the odds of adopting BAG is 22.6 per cent, compared with 21.9 per cent in model 3.

Discussion and Conclusion

In the multilevel governance setting of a decentralised unitary state like the Netherlands, municipalities are quite often mandated to adopt innovations. We have shown, by considering the adoption of BAG, that the implementation process in the event of a mandated innovation is not 'just' a matter of following a time schedule imposed by central government. We have therefore challenged Berry and Berry's (2007) assertion that national governments' mandated innovations create an uninteresting form of diffusion because local level discretion is supposedly very limited. We show that, even with a limited time frame for municipalities to complete the implementation of this mandated technical and uncontroversial innovation, classical diffusion explanations are important. Indeed, we have shown that there is local independence as well as horizontal interdependence among municipalities, and thus a lot of insight can be gained by studying mandated innovation from a general innovation perspective. Future research should focus on mandated policies in which adopters have more freedom for differentiation in the design and implementation of the policy. It would be interesting to see what local characteristics can explain differences in decisions, because we know from the implementation literature that strategic delay among later adopters in some cases meant more responsive or fuller implementation (Goggin *et al*, 1990).

We found that more resourceful municipalities, that is the ones that are better informed, have better past performance, and are included in more extensive policy networks, were more likely to adopt this innovation relatively early. In addition to the internal resources factors, we proved that it was also worth investigating resources external to the municipalities (compare, Berry and Berry, 1990; Boehmke and Witmer, 2004; Walker, 2006). The finding that municipalities adopt earlier when there are more municipalities in the same policy network that have already adopted BAG is important for understanding how policies are adopted. We found support for the idea put forward by others that what really matters is the actual place or social network where policymakers exchange or acquire their information (Sugiyama, 2008; Füglister, 2011b). It is important to take into account the role of real existing and functional policy networks, especially in a setting where these learning networks are encouraged, as was the case in our mandated setting.

Motivation matters as well, as we have seen from the findings of our hypothesis that the composition of both local and national governments matter (compare, Berry and Berry, 1990; Boehmke and Witmer, 2004). Thus, even for this not politically charged and highly technical innovation, differences in the timing of adoption become visible through political expression. In relation to the degree to which municipalities are motivated, and given their amount of obstacles and resources, we conclude that in the absence of obstacles it is primarily a matter of having sufficient resources available to innovate. It might not be very surprising that motivational factors are less important than resources in making municipalities adopt a top-down innovation. Nevertheless, we think that the degree of political alignment is a relatively underexposed factor when it comes to determining differences in the speed of performing innovative tasks imposed by national government. Furthermore, given our findings, we are convinced that the distinction made by Mohr (1969) (see also: Berry and Berry, 1990; Berry and Berry, 2007), between motivation, obstacles and resources will be very useful for future research. We expect that for innovations that are politically more pertinent, such as for innovations in social or moral policies, motivation may play a more important role than obstacles and resources when explaining the timing of adoption. Future research should shed light on how such politically sensitive innovations are adopted and whether motivation is indeed more important than for highly technical policies.

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Notes

1 There were neither incentives nor disincentives for fast or slow municipalities, except that municipalities connecting to the nationwide BAG facility in 2011 had to pay for the audit themselves. However, by the end of the year 2010, the Ministry of VROM intensified the guidance and support for possible late adopters.

2 Because we define the adoption of a policy new to the respective municipality as innovation, we are aware that the adoption of a mandated policy might be less of an innovation than the voluntary adoption of a new policy. Nevertheless, we argue that they both represent a certain level of readiness to engage in policy change.

3 In line with rational choice theory, and in line with Mohr (1969), we assume methodological individualism which means that we consider municipalities as unified decision makers. We abstract from the individual actors within a municipality to the organisation as a whole that allows for ascribing the concepts of motivation, obstacles and resources to municipalities.

4 In the final overview of VROM 'Adoption dates of all municipalities' *[In Dutch: Plandata BAG van alle Gemeenten]* there were 429 municipalities that had adopted BAG. In the period of our study there was a reduction in the number of municipalities, because of municipal amalgamation. There were 443 municipalities in 2008, 441 municipalities in 2009, 431 municipalities in 2010 and 418 municipalities in 2011. We consider this not to be a problem because our statistical method (EHA) only requires information about municipalities up to the moment of adoption. For example, Abcoude adopted BAG in 2010 (month 33) and amalgamated in January 2011; this means that the amalgamation does not influence our data collection because Abcoude is 'at risk' until month 33, and from the next month is removed from our dataset.

5 In October 2005 all Dutch municipalities ($N = 467$) were phoned by BMC Consultancy and Management and introduced to the survey 'Baseline measurement Basic Registration Addresses and Buildings' [In Dutch: Nulmeting BAG]. Hereafter municipalities were asked which official could be approached as a contact person. All theses contacts were asked, by e-mail, to complete the online questionnaire. The exact question asked for this variable was: 'What rating would you give to the current quality of the addresses registration in your municipality (scale of 1 to 10; 1 = lowest, 10 is highest rating)'. We are aware the question asked is a subjective measurement of problem severity, but we assume that someone designated as a contact person by the municipality itself could make a good estimate when answering this question. Because we wanted to keep as many municipalities as possible in the analysis, for 148 municipalities we replaced the missing value with the average score of all other municipalities. This adjustment did not alter the outcomes of our results. Furthermore, although this variable was measured at the beginning of 2006, and BAG legislation came into effect in 2008, in our view it is a good baseline measurement that is able to distinguish between municiaplities.

6 National elections were held in November 2006 and June 2010. Local elections were held in March 2006 and March 2010. From January 2008 (month 1) to June 2010 (month 24) we compare the results of the local elections in 2006 with the results of the national elections in 2006. From July 2010 (month 25) to April 2011 (month 38) we compare results from the local elections in 2010 with the results of the national elections in 2010. For some municipalities values were missing ($N = 29$ in 2006 and $N = 34$ in 2010). Because most missing values were because of amalgamation, we were able to find election results (from other dates, but valid in the same periods) on municipalities' Websites.

7 Local elections were held in March 2006 and March 2010. From January 2008 (month 1) to June 2010 (month 24) we use the results of the local elections in 2006, and from July 2010 (month 25) to April 2011 (month 38) we use results from the local elections in 2010. For some municipalities values were missing ($N = 29$ in 2006 and $N = 34$ in 2010). Because most missing values were because of amalgamation we were able to find election results (from other dates, but valid in the same period) on municipalities' Websites.

8 Although the number of buildings is measured at the end of 2011, and BAG-adoptions took place between the end of 2008 and the beginning of 2011, we consider it to be a good estimate because it is not a variable that is substantially subject to change. Also, the fact is that the number of buildings per municipality only became known *after* entering the buildings in the database (put differently, it does not measure progress for the filling of the database, it measures only the final amount). To decrease the influence of municipalities with many buildings we use a log-transformation.

9 The E-Government Monitors of 2007 and 2009 are examined by Daadkracht in cooperation with TNS NIPO, and is commissioned by ICTU (program Overheid heeft Antwoord© / BZK). The E-Government Monitor of 2008 is examined by Panteia and commissioned by ICTU (program Overheid heeft Antwoord© / BZK). The E-Government Monitor of 2010 is examined by Daadkracht in cooperation with TNS NIPO, and is commissioned by ICTU (program RENOIR / BZK). In the last months of every year researchers examined the Websites of all Dutch municipalities using a standard questionnaire. In 2007 the standard questionnaire consisted of five main themes that were reviewed on the basis of 78 aspects (i) Standards (N of questions = 9, relative importance = 15 per cent); (ii) Public access to government information, and citizen involvement (N of questions = 29, relative importance = 15 per cent); (iii) Service provision (N of questions = 8, relative importance = 25 per cent); (iv) Personalised service provision (N of questions = 8, relative importance = 20 per cent); (v) Participation (N of questions = 5, relative importance = 10 per cent); (vi) Accessibility (N of questions = 1, relative importance = 15 per cent). In 2008 the standard questionnaire consisted of five main themes that were reviewed on the basis of 89 aspects (i) Standards (N of questions = 12, relative importance = 15 per cent); (ii) Transparency: public access to government information (N of questions = 19, relative importance = 15 per cent); (iii) Service provision (N of questions = 34, relative importance = 20 per cent); (iv) Personalised service provision (N of questions = 9, relative

importance = 15 per cent); (v) Citizen involvement and participation (N of questions = 13, relative importance = 20 per cent); (vi) Accessibility (N of questions = 2, relative importance = 15 per cent). In 2009 and 2010 the standard questionnaire consisted of five main themes that were reviewed on the basis of 101 aspects (i) Standards (N of questions = 13, relative importance = 17 per cent); (ii) Transparency: public access to government information (N of questions = 12, relative importance = 15 per cent); (iii) Service provision (N of questions = 33, relative importance = 25 per cent); (iv) The citizen centred (N of questions = 29, relative importance = 25 per cent); (v) Interactive references (N of questions = 7, relative importance = 3 per cent); (vi) Accessibility (N of questions = 7, relative importance = 15 per cent). Missing values were replaced with scores from later years ($N = 4$ in 2007 and $N = 4$ in 2008).

10 For this variable, the same background knowledge applies as for the variable problem severity discussed in footnote 3. We are aware the question asked is a subjective measurement of information, but we assume that the person designated as a contact person by the municipality itself is the most important person for the ingestion of information provided by VROM. The exact questions asked were: 'Do you know the Website bag.vrom.nl?', and 'Are you subscribed to the newsletter about the basic registrations addresses and buildings?' To keep as many municipalities as possible in the analysis, for 108 municipalities we replaced the missing value with the average score of all other municipalities. This adjustment did not alter the outcomes of our results. Furthermore, as BAG legislation came into effect in 2008, and this variable was measured at the beginning of 2006, it is possible that municipalities began to familiarise themselves with the BAG Website and the BAG newsletter after legislation was passed. As we have not been able to solve any such misspecification (that is, the timing of when municipalities took steps to acquire more information could have affected the timing of BAG-adoptions) it is possible that this variable might not adequately measures what it wants to.

11 For size we used three measures; total population, fulltime-equivalent and municipal fund. Total population was log transformed to decrease the influence of larger municipalities, and after that transferred into z-scores. Missing values were replaced with values from later years ($N = 5$ in 2008 and $N = 3$ in 2009). FTE was log transformed to decrease the influence of larger municipalities, and after that transferred into z-scores. Missing values were replaced with values from later years ($N = 1$ in 2008 and $N = 1$ in 2009). Municipal fund was log transformed to decrease the influence of larger municipalities. Missing values were replaced with values from later years ($N = 5$ in 2008 and $N = 3$ in 2009). A factor analysis and a subsequent reliability test indicated that one size scale could be constructed (for all years: $\alpha > 0.786$ and eigenvalue > 2.174).

12 The Ministry of VROM developed, together with a few pilot municipalities, a guidebook for other municipalities to help prevent common pitfalls. Municipalities that participated in the BAG pilot project were; Amstelveen, Apeldoorn, Arnhem, Barneveld, Borne, Boxmeer, Doetinchem, Eindhoven, Haarlemmermeer, Helmond, Horst aan de Maas, Lelystad, Nieuwegein, Reiderland, Scheemda, Tilburg, Vlaardingen, Waalre and Winschoten. These municipalities had already begun work on their implementation of BAG in 2006. The ministry of VROM did not select the municipalities randomly to act as a pilot; it was the state of progress of BAG implementation that formed the basis for selection.

13 The table in Appendix C shows a comparison of alternative specifications for time (based on calculations proposed by Singer and Willett (2003, Chapter 12)) on which basis (the x^2 value for the deviance statistic is way above the critical value for the 0.01 significance level for both the model for the cubic polynomial compared with the quadratic polynomial, and for the cubic polynomial model compared with the model with time dummies (general)) we conclude that the model with the cubic polynomial (cubic) for time functions best, as it performs almost as well as the model with time dummies (general), and that given its lowest values for AIC and Bayesian Information Criterion (BIC) it outperforms the quadratic polynomial (quadratic) for time. The figure in Appendix C shows us that the cubic polynomial of time is quite capable of recovering the baseline hazard. This is in line with recent methodological advice by Carter and Signorino (2010).

14 Results are robust to the alternatives of probit and complementary log-log (cloglog) models (Buckley and Westerland, 2004).

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Appendix A

Table A1: Major events and timelines of the adoption of BAG

Event	*Timeline*	*Months*	*number of municipalities.*	*BAG-adoption*	
				Percentage of municipalities	*Percentage change*
Legislation	24 January 2008	0	0	0	0
1st deadline	1 July 2009	17	4	1	1
	1 July 2010	29	63	15	14
	1 December 2010	34	248	58	43
2nd deadline	1 January 2011	35	415	97	39
	8 April 2011	38	429	100	3

Appendix B

Table B1: BAG-adoption by month

Time month	*Number of Adopters*	*At risk of adoption*	*Hazard probability*
1	0	429	0.0000
2	0	429	0.0000
3	0	429	0.0000
4	0	429	0.0000
5	0	429	0.0000
6	1	428	0.0001
7	0	428	0.0000
8	0	428	0.0000
9	0	428	0.0000
10	0	428	0.0000
11	0	428	0.0000
12	0	428	0.0000
13	0	428	0.0000
14	0	428	0.0000
15	1	427	0.0001
16	1	426	0.0001
17	1	425	0.0001
18	2	423	0.0003
19	1	422	0.0002
20	3	419	0.0005
21	7	412	0.0014
22	6	406	0.0013
23	6	400	0.0014
24	7	393	0.0018
25	1	392	0.0003
26	7	385	0.0023
27	6	379	0.0022
28	10	369	0.0044
29	17	352	0.0089
30	15	337	0.0097
31	31	306	0.0261
32	41	265	0.0482
33	59	206	0.1083
34	139	67	0.4964
35	63	4	0.8514
36	2	2	0.2857
37	1	1	0.3333
38	1	0	1.0000

Appendix C

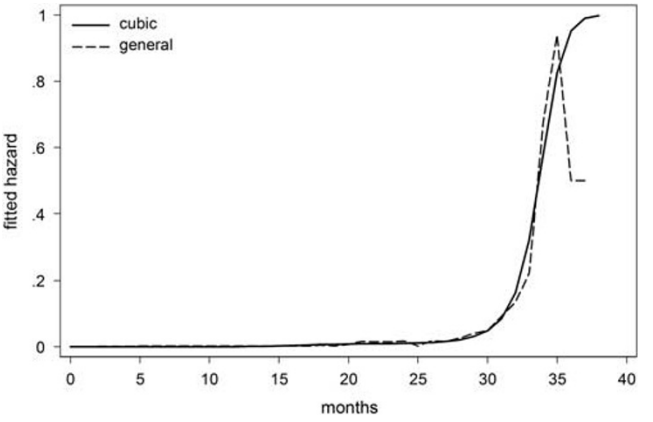

Figure C1: Fitted hazard function for number of months until BAG adoption, with cubic polynomial for the main effect of time (*Months).*

Table C1: Justification for the specification of the control variable time

Representation for time		*Difference in deviance in comparison to …*				
	n parameters	*Deviance*	*Previous model*	*General model*	*AIC*	*BIC*
Constant	1	3812.70	—	1886.35	3814.70	3818.74
Linear	2	2178.30	1634.39	251.95	2182.30	2190.43
Quadratic	3	2098.21	80.09	171.86	2104.21	2116.39
Cubic	4	2008.68	89.53	82.33	2016.68	2032.92
General	24	1926.35	—	—	1974.35	2071.83

Comparison of alternative smooth polynomial representations for the main effect of time (*Months*) in a baseline discrete-time hazard model (*N* observations = 13 644, *N* events = 429)