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RESEARCH ARTICLE

Multilevel policy implementation and the *where* of learning: the case of the information system for school buildings in Italy

Marco Di Giulio[1] · **Giancarlo Vecchi**[1]

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Abstract
The paper builds on the case of the design and implementation of the National Information System for School Buildings in Italy. The project is one of digitalisation of the public sector and involves several layers of territorial governments (the State Department for Education, regional and local governments) and ICT experts, and is becoming a tool for policy making in the field. Nonetheless, the programme was initially designed with a top-down approach immediately stuck. Its effective implementation only took place some years later by downsizing policy design and allowing regions to implement those digital solutions which, in the meanwhile, had been designed and implemented from the bottom-up. The paper draws from the case study theoretical considerations about the importance of where policy learning happens and the strategies that policy makers may adopt in case of policy failure in order to re-establish the conditions for effectiveness.

Keywords Policy learning · Change management · Public administration · E-government · Multilevel governance

Introduction

This paper addresses the current debate on the different types, mechanisms and consequences of policy learning. While it is generally accepted that learning can take place based on both experience and lessons drawn from others (Greve 2003; Bardach 2004; Barzelay 2007), the more recent academic debate has shed light on the fact that policy actors may learn in different ways (Dunlop and Radaelli 2013). The impact of learning on policy-making has also been critically discussed, as learning processes may not only be paths to policy success but might also pave the way for future failures (Dunlop 2017a, b).

✉ Marco Di Giulio
marco.digiulio@polimi.it

Giancarlo Vecchi
giancarlo.vecchi@polimi.it

[1] Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Building 26 - Room 1.36, Via Lambruschini 4/B (Campus Bovisa), 20166 Milan, Italy

This paper introduces a feature that has been undermined by the literature: the *loci* of learning, or the places where learning processes could be improved. In other words, the question is whether there are, in the process of multilevel policy implementation, specific venues that facilitate learning dynamics among policy actors. We argue that such a dimension exists and that it is particularly important for the analysis of complex and multilayer policy programmes, as it represents a key element for their success or failure.

Empirically, the paper builds on an original case study about the design and implementation of an e-government programme in Italy. The *National Register for School Buildings (Anagrafe Nazionale dell'Edilizia Scolastica)* (hereafter referred to as NR) is an information system that connects bureaucracies in the policy field of primary and secondary education in Italy. The case is particularly revealing because it covers a considerable span of time—from the register's inception in the late 1990s to the present—and because the register was developed in a multilevel policy setting involving the national Ministry of Education, twenty regional governments, local governments and school administrators. Over the last 20 years, the adoption of the NR passed through several *stop-and-go* stages in which the original top-down design, which proved to be ineffective, was gradually replaced by the diffusion of some local good practices. The analysis of this case allows us to specify some of the contextual conditions contributing to the activation of learning mechanisms that account for the eventual effective implementation of a programme.

The remainder of this paper is organised as follows. "Multilevel policy programmes and the 'where' of learning" section discusses the importance of localising policy learning for the study of multilevel, complex policy programmes. "E-government as an implementation game" section provides a brief review of the literature on the implementation of e-government policy programmes; it underlines the difficulties that arise with regard to both the complexity of the relations between information and communication technology (ICT) experts and policymakers and the general expectations of automatic effectiveness associated with the introduction of ICT. "The case and the research design" section provides a descriptive narrative of the case study, while "The national programme 2001–2009: no learning from the top-down", "Down-scaling the certification mechanisms: the rise of two local solutions" and "The diffusion of the Tuscany system: a case of 'intelligence of democracy'" sections will analyse actors' interactions in the main policy venues and will account for the policy outcomes. "Discussion and conclusion" section presents our final comments.

Multilevel policy programmes and the 'where' of learning

Broadly defined as 'the updating of beliefs based on lived or witnessed experiences, analysis or social interaction' (Dunlop and Radaelli 2013, p. 599; Radaelli 2009), policy learning has always been linked to policy change as a mechanism (or a set of mechanisms) capable of accounting for certain outcomes (Bennett and Howlett 1992; Hall 1993; May 1992). Nonetheless, the notion of learning had been initially (and vaguely) associated with policy success, since the positive impact of experience—even considered in the long term, as suggested by Weiss (1998) through the concept of the 'enlightenment use' of knowledge—has attracted the interests of scholars (Gilardi and Radaelli 2012). More recently, such a relation has been problematised. First, due to the flawed nature of policy success and failure (Bovens and 't Hart 1996, 2016); second, because some contributions suggest that the impact of negative feedback does not automatically trigger *positive* learning but

can instead bring about pathologies to the policy process with detrimental effects on outputs and outcomes (Dunlop 2017a; Newman and Bird 2017; Kay 2017). Little attention has been instead paid on the reverse path: the mechanisms by which the perverse effect of negative feedback (potential or actual) could be countervailed (Lanzara 1998). In particular, Dunlop (2017a) links policy learning outcomes to the idea of 'organisational capacity', understood as the stock of powers, financial resources and analytical skills that policy actors—particularly public administrations—might possess in varying amounts. Although the characteristics of a single organisation could be sufficient to explain the outcomes of simple policy programmes, such could hardly account for the dynamics taking place in multilevel settings.

Indeed, the multilevel nature of policy programmes has several implications for the literature on learning. The first, and most obvious, is that such programmes usually involve many actors, belonging to both the public sector and civil society, whose behaviour usually takes place in policy venues collocated at different layers of a given polity (Hill and Hupe 2003). This, in turn, has recently led scholars to focus on the impact of policy networks' shapes on outcomes (Howlett et al. 2017) and, from a more epistemological standpoint, on the search for causal mechanisms as a key to drawing lessons from the experiences of others, which is helpful in designing multiactor policy implementation (Barzelay 2007; Busetti and Dente 2018).

The second implication that multilevel settings bring to the analysis of policy programmes concerns the places where policy learning happens and their impact on outcomes. The literature on policy learning has thoroughly focused on the actors of learning (*who*), on what they are likely to learn (*what*), and on the ways (intended or not, depth, extension, etc.) through which the process is carried out (*how*) (Moyson et al. 2017, p. 166). Little or no attention has been paid to *where* learning takes place in multilevel policy processes, meaning *in which venues* learning happens. Such a theme is implicitly discussed in recent works which emphasised the modes of governance (Gilardi and Radaelli 2012) and the role of proximity between implementers and users on policy outcomes (Nohrstedt and Weible 2010; Busetti and Dente 2016; see also the concept of 'trading zones' in Galison 1997).

In this paper, we argue that in multilevel policy programmes, actors' learning is not a sufficient condition for policy success, since *ceteris paribus* a given learning process may or may not have a positive impact depending on which policy venues are involved and with which characteristics. This implies that the place where actors' relations take place shapes—or, constitutes the essential contextual condition to trigger specific interactions that influence—the two dimensions affecting the learning mechanisms singled out by Dunlop and Radaelli (2013): *actor certification* and *problem tractability*. Both in fact do not exist in a vacuum and both, in a multilevel setting, could be declined in very different ways by policy designers depending on their causal theories about the programme to be implemented.

More specifically, this reasoning applies to the procedural dimension of policy learning, initially conceptualised by Etheredge as 'government learning', by which the author emphasised the learning processes occurring within a given public administration (1981) and more recently reframed with the notion of 'governance learning'. Whereas policy learning 'is usually focused on learning about instruments and the content and substance of policy, governance learning is distinctly concerned with the procedural dimensions of decision-making and governance processes' (Challies et al. 2017, p. 291; see also Gilardi and Radaelli 2012).

We suggest that the failure of public programmes, and especially innovative programmes based on e-government solutions, can be explained not by the lack of learning

but by the fact that learning happens in the wrong places. In fact, in multilayer policy programmes, the fact that certain actors are learning about how to effectively implement a policy could have no impact if this occurs away from contexts where incentives and preferences allow actors to deliver the programme.

E-government as an implementation game

In public debate, the use of ICT solutions in government and public administration is often welcomed as a revolutionary process that can eliminate most of the limits normally and often rightly attributed to bureaucracies, such as inefficiency, ineffectiveness, lack of adaptability and myopia (Dunleavy and Margetts 2010, 2015; Dunleavy 2016). However, technology does not automatically apply to operational contexts. Empirical investigations have revealed how these transformations are often far from being smooth and successful (Heintze and Bretschneider 2000), especially as *actors* play a crucial role in these processes. Indeed, according to Heeks (Heeks 2006; Heeks and Bailur 2007), the simple fact that a considerable number of the case studies analysed in the literature ended up being total or partial failures might be interpreted as an indicator of the socio-technical nature of such contexts. Unfortunately, little empirical work on successful cases has been attempted (Cordella and Tempini 2015).

The implementation of e-government innovations has been more likely to encounter severe pitfalls and negative side effects that were not entirely envisaged in the formulation and design phases. Possible threats occur at different stages of the innovation process and range from purely technological aspects to wider organisational and policy aspects (Pardo et al. 2012). A literature survey by Ebrahim and Irani (2005) identified five types of barriers to the implementation of e-government solutions. One barrier is *infrastructure*, which encompasses all the possible issues related to technical feasibility. Another barrier is the *cost* of the solutions. From the institutional standpoint, the barrier of *security and privacy* regulations might negatively affect the optimality of e-government systems. In terms of more policy-related issues, policymakers may lack ICT *skills and expertise*, and eventually other *organisational deficits* can emerge, such as difficulties in coordinating different units or different institutional levels. In these last cases, collaboration between experts and policymakers is essential to foster learning and to guide decisions for successful solutions.

This paper specifically addresses the last two barriers, which constitute the political and organisational dimension of change within the public sector and thus directly relate with governance learning. This dimension can be broken down into two sub-dimensions. The first concerns the relationship between the public sector and the sources of knowledge and expertise, which are often located outside public sector boundaries. Considering the pace at which ICT knowledge evolves, internalising skills is almost impossible for the public sector. Conversely, a more viable strategy could rely on building the capacity to absorb the necessary knowledge and thus on structuring the organisation and recruiting the staff required to establish a dialogue with experts and the markets (Breznitz 2007; Dunlop and Radaelli 2017, 2018).

The second sub-dimension relates to the fact that technochange often depends on intergovernmental processes involving the interaction of several layers of government that are not necessarily willing to cooperate. More importantly, the implementation of ICT solutions within the public sector not only represents a way to develop its relationship with citizens and business more effectively but also is a tool to manage (and possibly improve)

intergovernmental relations (Ebrahim and Irani 2005, p. 590), a point that has been almost totally neglected by the literature. A notable exception is the work of Dunleavy and Margetts (2010, 2015), which focuses on the potential positive impact that ICT solutions could have in integrating structures and processes that new public management (NPM) reforms have progressively fragmented, sometimes with negative effects in terms of effectiveness and control (Ling 2002; Bogdanor 2005). Such a perspective aims at (a) fostering a better coordination setting, overcoming the traditional organisation based on specialised silos; (b) reducing the costs of ICT development; and (c) developing platforms useful for many different services and institutional units (Dunleavy 2016). In fact, the complexity of the policy fields might represent a severe challenge for the implementation of top-down programmes, as in multilevel governance settings where actors are often loosely coupled, resulting in unexpected fiascos. Although such a recentralising perspective represents a possible outcome in many cases, it is also possible that the design and implementation of technological change in the public sector assume a different meaning (Kuipers et al. 2014) as not (or not only) a tool to streamline and centralise the decisional system but as an instrument and a strategy to make governments and bureaucracies, which will continue to be located at different layers of the state structure, cooperate better.

As suggested by Margetts and Naumann (2017), the implementation of e-government systems cannot be analytically captured by separate categories such as 'centralisation' or 'decentralisation' since to be effective, ICT innovations in the public sphere are necessarily a combination of both: The central level of a policy sub-system should ideally provide coordination capacity and a flexible technological standard which, together, allow an innovative solution scaled from the bottom-up. This finding gives strength to the argument concerning the loci where governance learning processes take place. Our claim is that the strong diffusion of expertise regarding ICTs allows the local development of innovations (Sørensen 2012), especially where universities or research centres are operating and producing technicians for the market. This opportunity supports the hypothesis that the design of successful ICT solutions can find favourable arenas in local settings where more fruitful relationships among experts, users and policymakers can arise and where implementation of those solutions is more a matter of how to incentivise the development of innovation rather than the top-down execution of a programme. In this sense, proximity (along the centralised-decentralised continuum) should be interpreted as an enabling condition to foster actor certification and problem tractability, which have been identified as key dimensions of learning mechanisms (Dunlop and Radaelli 2013). In fact, because proximity facilitates the exchange of knowledge among networks of experts, brokers, translators and policymakers, the adaptation of technical solutions to policy needs might be more feasible at the local level.

Another hypothesis regards the capacity of local successful solutions to scale up and achieve national diffusion. Even using the policy learning framework, our claim is that the change of venue from a local setting to a national one will be improved by mechanisms fostering the involvement of higher-level actors whose role would be that of the implementation of coordinating activities through which a local solution will be legitimated and diffused to the whole national territory.

The considerable time span and multilayered nature of the policy programme that will be analysed in the following sections and that involved several actors and different policy venues make the case suitable to empirically trace the learning processes that might reverse a central policy failure and end with a success characterised by an effective ICT solution and (currently in-progress) national diffusion (Sabatier and Jenkins-Smith 1993). The research strategy followed a qualitative approach based on semi-structured interviews

with policymakers and on document analysis. The paper therefore describes micro-dynamics and mechanisms but aims at shedding light on meso-level learning (Dunlop 2017b, pp. 7, 8) by reconstructing specific organisational configurations associated with the outcomes.

The case and the research design

In the summer of 2015, Italian Minister of Education Stefania Giannini launched the NR, a database management system that stores information about publicly owned school buildings to be used for planning and investment allocation at both the national and regional levels. To date, the NR is a collection of 20 regional databases that have surveyed more than 42,000 buildings across the country. The data concern structural features such as planimetry, room capacity, type of furniture, safety and energy standards and certificates, the existence of evacuation plans and the existence of transport connections for students. The total entries number approximately 180 fields and are updated annually. Upcoming improvements to the system include the implementation of a unified national data warehouse that will be updated in real time as schools' owners, mostly municipalities and provinces, log in and provide the latest available information on their properties (Presidency of the Council 2017, pp. 29, 30).

The development of such an e-government solution that significantly restructures the G–2–G relationship in the policy field of school management had been far from smooth, and the system faced a troublesome implementation that was punctuated by negative feedback and the fiascos of a flawed original programme. The original programme was launched in 1996 when a national law framework regulating investment in schools envisaged the construction of a unified information system to collect and analyse data that until that moment were exclusively on paper and in the hands of local governments. In cooperation with the different regional governments, the Ministry of Education, which had been empowered to oversee planning functions in the field by the same law, started to implement the system in the early 2000s. However, after some years, the rate of compliance dropped, and the system was declared a failure in 2009 by the Ministry itself. In the meanwhile, the regional governments of Tuscany and Piedmont had independently developed local solutions that proved to be more effective than the national one.[1] Once the national programme was declared a failure, the Ministry gave all regional governments the opportunity to choose among those two solutions (some had already independently made the decision to do exactly that). Currently, only one of the two solutions, that of Tuscany, has been adopted by other regional governments and by the Ministry itself, and thus, it has become the operating standard for the new edition of the system, which will be launched in 2018 and will allow an immediate data flow from the regional platforms to the new national one (Interview 6).

In this study, the NR programme is analysed as a single longitudinal case study that will explain three distinct outcomes which correspond with three different phases of the implementation process. The first is the failure of the original national programme. The second concerns the success of the local solutions (the Piedmont and Tuscany interventions); here, success (or effectiveness) is measured as the ability to realise an informative system able

[1] A third locally developed system was developed by the Region of Friuli Venezia-Giulia, but it was a mere adaptation of a pre-existing database management system used for a completely different purpose and has recently been dropped by the same regional government.

Table 1 Timeline. *Source*: Author compilation

1996	Law 23/1996 gives planning powers to regions in the area of education infrastructures. Scheduled the construction of a National Register for School Buildings
1997–1998	The task force for the NR consisting of representatives of the Ministry, three regions and local government associations takes office
1999–2001	Education directors from the region of Toscana start a dialogue with the Schools' Observatory of the province of Pisa to develop a regional register
2001	The Ministry selected Engineering SpA. as the hardware and software provider and operational manager of the system Funds are transferred to regions to create the regional hubs and collect data
2002	Earthquake in Molise
2002, fall	Pisa's task force trains local regional governments
2003, fall	The first survey of the Toscana region is completed
2004	The NR is officially launched
2005	The region of Piedmont developed its own register in partnership with CSI, its own ICT company
2008	The region of Liguria entered into an agreement with Toscana and the province of Pisa to adopt their solution
2009	Earthquake in Abruzzo The Ministry officially declared the NR project expired and invited regions to adopt the existing local solutions
2009–2011	Eight regions reached a deal with the region of Toscana and the province of Pisa
2011	The Ministry set incentives for regions to build and update their own registers
2011–2015	Most of the regions adopted the Toscana solution and outsourced regional register management to Soluxioni S.r.l
2016	An agreement was reached to use the system developed by the Toscana region for the national data warehouse Hewlett Packard, the general contractor of the Ministry for Information Systems, subcontracted the new NR project to Soluxioni S.r.l

to guarantee school directors that the solutions offered by such a system are useful, thus fostering their compliance with data collection protocols and data entry duties. The last is the revision of the national implementation strategy, which underpinned the nationwide diffusion of one of the two local solutions—the system designed and implemented in the Tuscany Region (see Table 1).

Considering a multilevel policy, this theory-building case study to discover whether the 'where' of actors' relations triggers mechanisms related to positive, neutral or negative learning is based on the reconstruction of the implementation processes at the different levels. The case has been selected considering its representativeness—it allows us to study the reasons for failures and successes based on the characteristics and relations among the actors involved at the different stages and levels of the implementation process (Beach and Pedersen 2013; Dente 2014).

The national programme 2001–2009: no learning from the top-down

The narrative that follows is one in which failure can be connected with typical features of organisational capacity, understood as a lack of coordination powers and, to some extent, cognitive limitations of the public administrations involved. In light of the

conceptualisation introduced by Bovens and 't Hart (1996), the policy failure described is certainly *programmatic*, as implementation outcomes had been completely inconsistent with the goals.

The Ministry of Education started to design the register in the early 2000s. This process took place in two separate venues. The first involved a representative of the Ministry along with three educational representatives of Italian regions and one representative each of the national associations of municipalities (ANCI) and provinces (UPI). This team worked on elaborating the information to be included in the data sheet to which local governments should have transferred data concerning their school institutions for the NR.

The second involved the development of hardware and software components of the system and took place almost entirely within the Ministry. This task was assigned to a leading Italian ICT company, Engineering SpA., after a competitive tender. Signed in 2001, the contract established a close partnership between the two organisations, as a team from Engineering SpA. was deployed full time at the Ministry to manage the register. According to the policy actors interviewed, the development of the system faced no relevant budget constraints; the overall resources allocated amounted to Italian ₤ 20 billion (approximately €10.3 million). One-third had been transferred to the different regions to cover data collection costs, while the rest was the financial basis for the multiyear contract between the Ministry and Engineering SpA., an amount that has been defined as 'reasonable' (Interview 1).

The implementation of the register occurred in 2002 after an earthquake in the Molise Region caused the collapse of an elementary school that resulted in the death of 26 children and one teacher. The event inevitably highlighted the condition of school infrastructure. Therefore, the Ministry unit responsible for the NR gained momentum and worked closely with *Cittadinanzattiva [Active Citizenships]*, a general interest group traditionally focused on the field of education. According to the chief of the Engineering SpA. team, 'the manager responsible for the NR was very committed to the project and deliberately involved *Cittadinanzattiva* and accepted many of its instances' (Interview 1).

The implementation of the system was inconclusive. The programme envisaged the creation of a data warehouse in each of the 20 regions where local governments were expected to upload the data sheets concerning the schools they owned. Later, the regional hubs would have transferred the data to the national data warehouse. According to all the policy actors interviewed, the expected outcome did not occur, even if the way in which they have defined the failure varied according to the role they played in the process. For Engineering SpA.'s operational manager, the basic problem was that the school managers 'just did not upload their data because they had no incentives', and the Ministry had no effective hierarchical influence on them. Despite the personal commitment of the Ministry's director responsible for the NR, the project hardly represented a priority within the Department for Information Systems, which was much more focused on the human resources management information system—mainly because this lays in the domain of influential stakeholders such as trade unions. Recognising the problems in these terms, the reaction was to organise meetings in each region with the stakeholder to promote the project and convince them that its effective implementation would be in their interest due to the availability of usable data and better planning conditions. Therefore, Engineering SpA. distributed a codebook with the collaboration of Tuscany Government that contained instructions for local governments on how to collect and upload data. Nevertheless, such activities were very rare (a one-shot event for each region), mainly because they were not included in the management contract (Interview 1).

The perspective of the interviewed regional directors is different and more articulated. They confirmed the lack of compliance already mentioned but also raised issues related

to the architecture of the system, highlighting several problems in the transmission of data and, more importantly, revealing that there was no functioning reporting system that allowed regional and local government users to get back usable data concerning the school they own (Interviews 2, 5). Moreover, the data sheet for the collection of information had as the basic unit the 'school' which was understood as an institution and not a single building. This solution might have given rise (if effectively implemented) to reliability problems and ambiguities because 'a school might well be structured in more than one building as well as one building can host more than one school' (Interview 3).

The NR experiment ended in 2009. Another earthquake with fatal implications for school infrastructure helped put the NR at the centre of attention, even if this time the lack of data about buildings' characteristics and security standards was framed as Ministry non-compliance with the project. This fostered a major change in the way the national administration dealt with the NR, which will be discussed in "The diffusion of the Tuscany system: a case of 'intelligence of democracy'" section.

Down-scaling the certification mechanisms: the rise of two local solutions

While the first attempt to build the NR had been on the whole a failure, it had nonetheless made some positive impact at the local level. In fact, in two regions—Tuscany and Piedmont—local policymakers started independently to develop their own solutions.

In Tuscany, the process started in 2001, when the regional branch of the Court of Account (the highest public accountancy body in the country) solicited the regional governments to deploy the financial resources transferred by the Ministry for the data warehouse and survey activities. At this point, backed by the region's executive and the head of the Education General Directorate, the regional official responsible for school infrastructure started to cooperate with the Provincial Government of Pisa—in particular with its School Observatory, a policy unit which had experience in dealing with the governance of education—through participatory and deliberative venues including the main stakeholders of the field such as deans, teachers and families' representatives. This unit had been developing information systems for education management since the late 1990s. According to the regional project manager: 'We knew that there [in Pisa's Observatory] they were experimenting [with] innovative solutions, such as the Student Register, a monitoring system to track students' performance throughout their educational paths, that they created in 1996… They knew what we needed, and we thought that collaborating with them could have been more promising than involving the Region's Information System Department' (Interview 2).

The organisational resources to carry out the project in the Provincial Government of Pisa were far from abundant. Apart from the programmer, who was part of the province's Information System Department, the only full-time members of the team were a teacher working on a voluntary basis and two conscientious objectors, an architect and a computer technician, who opted to serve the province instead of joining the army. Therefore, the regional register was very 'primitive' at the beginning, but 'it had the merit of embodying a "philosophy"… The mission was of being useful for the different types of stakeholders involved' (Interview 5). The main difference between the NR and the register designed in Tuscany was the engagement of the final users, which partially overlapped with the duties of the actors responsible for collecting data. Making them aware of the potential benefits of

complying with the programme was key. For example, a dean who has access to the platform can download safety certificates for his school that he needs once a year; thus, he can avoid direct interaction with the responsible office. Moreover, the multi-access nature of the platform is vital for the quality of the data, as the same dean in the example has a direct interest in checking that the certificate he needs is the latest version; if it is not, he is likely to signal the responsible authority to update the field.

The system created in this context solved some of the implementation problems that the national level failed to tackle. Despite Tuscany's system being better crafted and designed based on the needs of the stakeholders, it was still local, and its diffusion within Tuscany was not so easy, as 'not all the territories could take advantage of the expertise developed by Pisa's School Observatory in terms of dialogue with stakeholders' (Interview 2). With the aim of encouraging compliance as much as possible, the regional government institutionalised its partnership with the Provincial Government of Pisa, making it the operational branch of the project. This strategy pushed the two objectors working for the province of Pisa to set up a spin-off, the company Soluxioni Srl, as they had no chance of being stably employed by the administration. This team started to diffuse the data collection methodology across the region in a way that would have been unmanageable for a top-down national implementer such as the Ministry.

The solution developed by the Piedmont Region was released in 2005, immediately after the NR was launched. The regional project manager admitted that the decision to develop an independent system 'had been taken soon after I came back from the NR start-up meeting at the Ministry. I immediately realised that their project would have problems in terms of compliance. There wasn't any serious methodology to involve local governments and make them comply' (Interview 4). Therefore, the regional government organised several meetings with local government directors and personnel responsible for school infrastructure to instruct them about the project's mission and how they should enter data about their schools. 'We gave them some symbolic rewards for their participation such as certificates of attendance, which have been highly appreciated' (Interview 4). However, to make local governments comply, the region has fixed correct data entry as a necessary condition for them to be eligible for funding.

From the technical standpoint, the system was implemented by CSI, an ICT company directly owned by the region with a 39% stake. 'It was an obliged choice, since everything [that] has to do with ICT in the region must be assigned to that company' (Interview 4), but the system proved to work well, particularly as far as the quality of data is concerned. Different from Tuscany's application, that of Piedmont is highly centralised. To be correctly uploaded, each record concerning a school building must pass the validation of the regional office. This function is based on a system that automatically controls the internal consistency of the data entered. If more than five anomalies are detected, the data entry is automatically blocked, at which point 'we intervene to help the local governments responsible to solve the problem' (Interview 4; Regione Piemonte 2004).

Even though Piedmont's system obtained excellent results in terms of coverage and consistency of collected data (99.9% of the region's buildings have been surveyed), limits have arisen in the technical development of the system and the partnership with CSI. It has been judged that the technical development cannot be improved further with ad hoc maintenance: 'Since regulations concerning schools' infrastructures change continuously, the cost of upgrading each single field of the register is becoming not manageable… Even because of its higher security standards [the Piedmont system] is much more rigid than that developed by the others [Tuscany]' (Interview 4). Moreover, the relationship between the regional office and CSI is not perfect in terms of managing the system because CSI 'often

Table 2 Comparison of the main positive and negative feedback regarding the two solutions. *Source*: Author compilation

Solution	Positive feedback	Negative feedback
Toscana	Flexibility/adaptability of the system	Potential lack of control in the data entry process
Piemonte	Data consistency	Rigidity/low adaptability of the system

changes the operational personnel working on the register, and this brings lack of knowledge' (Interview 4; see Table 2 for a comparison of the two systems).

The diffusion of the Tuscany system: a case of 'intelligence of democracy'

As mentioned above, the NR launched in 2015. The disclosure of its data concerning more than 42,000 buildings across the country was the last event in a process that altered the inertia of the Ministry after the repeated shortcomings of the original project. In 2009, a new earthquake that had a severe impact on school infrastructure gave new media salience to the NR issue. This time, unlike what happened in 2002, *Cittadinanzattiva* blamed the Ministry for years of inactivity.[2] This context pushed the head of the Ministry to implement a reshuffling so that in the new organisational chart, the NR issue was structured in a dedicated general direction, whereas in the past—according to our interviewees (Interviews 4, 5)—the powers over NR were ambiguously attributed, and the programme suffered from lack of support.

In 2009, the Ministry of Education radically shifted its implementation strategy towards a bottom-up approach aimed at taking advantage of the two locally developed working solutions. As a first move, it declared that the original, national NR project was a failure and invited all regional governments to adopt one of the existing (Piedmont or Tuscany) solutions. Interestingly, despite the independent, local development of the software, there were no intellectual property issues to contend with; regional administrations were entitled to the solutions developed by the Tuscany or Piedmont Regions for free as a result of an existing legislative framework on 'ICT re-use' in the public sector (Art. 69 c.a.d., D.L. 80/2005). The only costs to the regional governments were those associated with the management services necessary to adapt the solution and eventually to develop it according to their own needs. As the various regions developed their own systems based on the successful models, the role of the Ministry changed from that of a top-down implementer to that of a coordinator/manager of the network, thus fostering a collaborative governance arena (see Sørensen 2012).

[2] In 2012 and later in 2016, two new earthquakes in the Emilia-Romagna Region and in the Marche and Umbria Regions fixed the issue of the agenda as an important issue in the national and regional political spheres: 'The political focus on these issues has increased sensibly… There have been lots of question times at the regional Assembly raised or pushed by stakeholders' inputs' (Interview 3).

The new strategy quickly gained momentum, and in February 2014, the Ministry, regional governments and municipalities reached an agreement on the implementation process. More specifically, the national strategy refocused on fixing incentives for local governments to collect and update the information in the new system. Basically, the main emergent strategy—already struck in 2011 in a Ministry–regions deal—linked eligibility for receiving EU and national investment funds with compliance with the NR (Presidency of the Council 2014). Thus, the need to manage the implementation of the unprecedented amount of resources coming from the State and the European Investment Bank (EIB) funds led the newly appointed government of Matteo Renzi—who fixed the education field as a priority in his political agenda—to establish a task force on school infrastructure within the Presidency of the Council: *ItaliaSicura* ('Safe Italy'). Incidentally, *ItaliaSicura* found that the NR could have represented a valid policy instrument to steer the process and correctly monitor the financial resources that would be allocated (Interview 1). Thus, the Presidency task force pushed regions to adopt a working register. The impulse of *ItaliaSicura* and the particularly close relationship between the undersecretary of education and the prime minister at that time created favourable conditions for the Ministry of Education to implement the programme: Such a new political setting 'created competition between the school infrastructures' General Direction of the Ministry and the Presidency, and competition, in turn, boosted change' (Interview 4).[3] *ItaliaSicura* played a crucial role in persuading the minister of education to take advantage of the two locally developed solutions (Interview 6; Interview 4).

At that time, a few regional governments had already adopted the system developed for the Tuscany Region by Soluxioni, and thanks to the new national governance structure, other regional governments adopted the system as well—with the obvious exception of Piedmont, where officials chose to keep their own system. Why Tuscany's rather than Piedmont's system was adopted represents an interesting research question that has to do with the mechanisms by which an emergent bottom-up policy programme with no relevant financial or technical constraints could have been implemented with some success. The governance architecture and the basic characteristics of the two solutions helped answer this question, shedding light on the mechanisms that affect the implementation of the programme as a result of the diffusion process.

The subjects of the interviews we conducted univocally highlight that the system developed by the Piedmont Region was unattractive because of its higher costs compared to the system developed by the Tuscany Region. For instance, the licenses for the Piedmont database management system cost €15,000, whereas those for the Tuscany system cost €2,000 (Interview 5). A further source of costs was represented by the management of the register; that is, if a region was not willing or not capable of providing their own internal resources, the Tuscany solution also proved to be the better investment. The 'cost argument' could certainly be assumed to be a simple and trivial explanation, but the technical characteristics of the two solutions reflect more complex configurations of actors and preferences.

As mentioned earlier, the Tuscany solution emerged from an operational partnership that the regional Education Department directors established with Pisa's School Observatory. This partnership benefitted greatly from the commitment of a small but highly motivated staff at the provincial administration who developed the regional register by building on some existent ICT skills they were able to apply to the education sector.

[3] The role of political oversight for administrative learning has been discussed by Craft (2017).

When the system became more effective thanks to the increasing compliance of local regional governments, it started to attract the interest of the heads of education departments of other regions: 'The interest of our colleagues increasingly rose since, at a certain point in our intergovernmental meetings in Rome, we started to have data on buildings that they simply don't have… So, regions more committed to the Register's issue asked us to have our own system, and we managed to organise the technology transfer directly involving the Pisa crew' (Interview 2). In this way, regional governments such as Liguria, Marche and Emilia-Romagna adopted the system between 2008 and 2009—before the Ministry started to play its coordinating role. In this period, the two fixed-term employees of Pisa province established a company that would enable them to deliver NR servicing, thus becoming the crucial partner for all the regions starting to adopt the Tuscany register system. To date, this company is still virtually the sole player in a market created de facto by the new course of the NR programme. In fact, in 2016, when the Emilia-Romagna Regional Government announced a competitive tender for servicing their regional register, there was a sole player attending the procedure. Despite such a monopolistic context, however, Soluxioni is providing services 'at a reasonable value for money' (Interview 3). The same company in fact seems to pay particular attention to offering affordable basic services and is very flexible in accepting customisations (Interview 5), thus building a market strategy aimed at creating a niche that is hard for newcomers to enter.

The evidence collected on the Piedmont system and its non-diffusion depicts a completely different design environment. In this sense, the deployment of more expensive technologies could be explained by the scale of the company and by the fact that this was based on a rationale that is not aimed at reducing costs for every single programme but at increasing its size and defending its technological core. Also, the Piedmont solution raised interest among different regional governments, especially in the South of Italy, but the management contract CSI proposed to them was considerably more expensive than that of the main competitor: 'CSI has 1000 employees, Soluxioni only 12… They're much more flexible' (Interview 4). This point is indirectly supported by an observation made by one of the Tuscany Region's directors about the development of their project: that it 'could have been so smooth because we had the possibility to bypass the Region's ICT Department and by the fact that it did not exercise any veto to contrast our Register project' (Interview 2). In the case of Piedmont, if the involvement of the best certified expert in the region did not create a hurdle for the design and implementation of the solution, it certainly represented an unfavourable condition for its diffusion. Tuscany's directors (confirmed by interviewees) were very proactive with other regional governments, for example, sending Pisa's operating crew to demonstrate the system and offer assistance, while the Piedmont managers had a far less open attitude (Interviews 1, 3).

In 2016, Soluxioni became a subcontractor of the multinational *Hewlett Packard* (which is currently the information systems' general contractor for the Ministry of Education) to realise the national data warehouse. In a first draft of the new architecture aimed at creating a more unified system, the Tuscany director proposed to go beyond the regional hubs and create a single data warehouse that could be hosted in that regional institution and that could be managed by Soluxioni. This proposal was immediately rejected by the Region of Piedmont, which wanted to defend its own system and peculiarities in terms of secure access and data validation, although the persistence of regional hubs might hinder economies of scale (Interview 4).

Discussion and conclusion

The study about the design and implementation of the NR presented three distinctive outcomes derived from three different phases of the implementation process. The first is the failure of the original programme pursued by the Ministry of Education. The second is the rise of effective local solutions, such as those developed by the Regions of Tuscany and Piedmont. The third is the diffusion of the Tuscany solution and its adoption as a standard by almost all the other regional governments across Italy as well as by the Ministry itself for the implementation of the national data warehouse (implementation of the national data warehouse is still in process).

In light of the interpretation of these outcomes based on learning mechanisms and contextual features such as the localisation of learning processes throughout a multilevel implementation structure, it is worth noting that the case study allows controlling for some of the possible implementation barriers discussed in "E-government as an implementation game" section. In fact, the financial resources allocated for realising the original programme, although it failed, have been judged to be adequate, while the development and diffusion of the local solutions did not benefit by ad hoc funding. The same goes for the technical feasibility that was not mentioned as a serious hurdle by the implementers of the first NR, while the in-house development of the Tuscany solution testifies per se that the system was not intrinsically too complex. Moreover, regulative barriers, such as security and privacy laws, that often constitute a hurdle were not a serious issue in this case; as the data are not sensitive, there are no privacy issues to contend with.

Two findings emerge from this article, and both concern the contextual condition for the successful design and implementation of multilevel programmes dealing with technological innovations of public administrations and the policies related to them.

The first finding relates to the first two outcomes: the failure of the original NR and the rise of two functioning local systems. What emerges is that effective innovative solutions are more likely to come about if developed locally. Proximity among policymakers, technicians and users is thus a condition enabling the mechanisms related to the certification of actors and problem tractability. In fact, the degree of experts' legitimation in terms of technical competence (Dunlop and Radaelli 2013) does not account for the outcome since the company appointed by the Ministry for the NR was clearly capable of coping with the system on purely technical terms. Instead, a local solution proved to be effective because experts there had been more capable of bringing about usable knowledge due to their proximity with users and the rich exchange of information regarding the micro-characteristics of the instruments and procedures that proximity fostered. In fact, the failure of the original NR was not due to a learning failure related to the technical aspects of the system but derived from a lack of governance learning. Despite the company being aware of the importance of engaging local policymakers and users, the governance architecture proved to be unfit to involve local governments in the programme and make them comply with it. However, local solutions could have been carried out by down-scaling the certification process; this would have allowed grassroots experts the possibility of building on locally crafted ICT solutions, even if somewhat primitively at the beginning. It was this sort of local ingenuity that led to the solution developed by the Region of Tuscany.

The second finding is related to the diffusion of effective local technological solutions on a national scale and its successful implementation. What explains the successful diffusion of one of the two local solutions is the combination of two elements. First, and consistently with the literature on ICT implementation in government (Margetts and Naumann

2017), the solution designed in the Tuscany regional sub-system proved to be much more flexible as both a technology and a management system, allowing it easier scalability in comparison with the other solution. Such a feature, in turn, derives to some extent from the loosely coupled environment in which the solution was developed without any substantial backing from the Information System Department of the Tuscany Regional Government. More specifically, what occurred was the coordination among the regional directors who promoted their solution nationally—incidentally creating a greenfield market—and the Pisa Observatory's spin-off, which profited from that emerging market. This configuration—higher adaptability to new contexts and lower costs of management contracts with developers—therefore produced an application that is more attractive for new users. Conversely, the Piedmont solution proved to be more rigid exactly as a consequence of the hierarchical sub-system in which it was designed.

The second element that explains the successful diffusion of the Tuscany solution—and through it, the effective implementation of the whole programme—is the new strategy adopted by the Ministry in 2009. This change in approach emerged as governance learning based on previous negative feedback, in which national policymakers' causal assumption about the implementation process has been completely reversed: National departments eventually recognised the existence of local working solutions and acted to create the institutional framework to allow them to scale up, fixing incentives for regional and local governments to comply with the programme. Also, such a diffusion process is consistent with the 'government as a platform' literature, namely with the idea of centralising coordination and standardisation functions while allowing market actors to develop working solutions (Margetts and Naumann 2017). Moreover, this case shed light on the possibility of learning by means of bargaining and social interaction, also associated with Lindblom's idea of the 'intelligence of democracy' (as discussed in Dunlop and Radaelli 2013). To this regard, nonetheless, the case analysed—which to date represents a successful conversion of a persistent policy failure—may hide the seeds of new pitfalls. In fact, the funding opportunities for attracting investment in school infrastructure might represent for local government an incentive to enter data that do not relate to the real conditions of buildings in order to maximise the possibility of gaining resources. However, the case highlights how the implementation of a nationwide technochange for public administration is basically a matter of incentivising and coordinating the diffusion processes of solutions that are better designed locally but need a pivotal actor (not necessarily a central administration) to ease their transfer to non-native contexts.

Appendix

List of interviewees

1. Engineering spa, *Head of National Register Project (2001–2006)*, 14 July 2017.
2. Regione Toscana, *Director of School's Infrastructures Unit*, 12 December 2016.
3. Regione Emilia Romagna, *Responsible of the Region's Schools Buildings Register*, 30 January 2017.
4. Regione Piemonte, *Responsible of the Region's Schools Buildings Register*, 27 July 2017.
5. Soluxioni Srl, *Founders*, 19 January 2017.

6. *ItaliaSicura* (Task Force on School Infrastructure)—Presidency of the Council, Coordinator of the Office, 18 January 2018.

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