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The integration and measurement of digital innovation in public schools

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Title:**The integration and measurement of digital innovation in public schools*****Selena Aureli**, PhD**

Bologna University, Department of Management
Via Capo di Lucca, 34 Bologna - ITALY
selena.aureli@unibo.it

Domenico Consoli

Bologna University, School of Economics and Management
Piazza Scaravilli, 2 Bologna - ITALY
domenico.consoli@unibo.it

*** Corresponding Author**

BIONOTES

Selena AURELI, PhD, is Associate Professor at Bologna University (Italy) where she teaches Financial Reporting to Master students and managerial accounting to undergraduate. She was formerly enrolled by the University of Urbino. Her main research interests are in financial and sustainability reporting, managerial accounting, tourism and small and medium-sized enterprises. She has extensive experience in collaborative research, in conjunction with other universities and private industry. She visited Tampere University in Finland, the Higher School of Economics of Moscow and the University of Sarazoga in Spain. She serves as referee for several academic journal.

Domenico CONSOLI is an Adjunct Professor in Data Processing at Bologna University. He holds a PhD in Computer Engineering - Artificial Intelligence Systems and a PhD in Economics and Management. His research area focuses on the use of Information and Communication Technology in business strategies. He is author of several scientific publications in journals and proceedings of national and international conferences. In the past he taught at high schools and hold the position of Head of the Computer Science Department. He was also appointed as reference person for the application of the Italian National Digital School Plan (PNSD) for the Marches region.

Abstract

At the EU level, there is wide consensus on the necessity to introduce ICTs in classrooms and incorporate digital technologies at all levels of education to prepare young school students for the future. In Italy, many innovative projects related to digitalisation have been launched since the initiation of the National Plan for Digital Education (PNSE) in 2015, which reflects the government's approach to innovation and challenges the school's mission and programmes. However, at the school level, it is not clear how this innovation strategy has been or should be integrated into existing strategic objectives and which performance measures are being used by principals to monitor its implementation.

Empirical data, based on desk research and interviews, indicate that current managerial tools and reports used by public schools do not clearly include digital innovation among the key areas of self-reflection, nor help school leaders to visualise the possible outcomes generated by digital technologies. Therefore, this paper aims to suggest how schools could use a strategic control system like the Balanced Scorecard to better visualise and implement digital-related innovation at the strategic level. In detail, the paper elaborates on the advantages of adopting this managerial tool, contributing to the debate on what extent measurement in public sector organisations can be based on frameworks originally developed in a private sector context.

Keywords: digital innovation, school, management control, EFQM, Balanced scorecard, information technology, planning, improvement

1. Introduction

In today's knowledge era, where information and communication technologies (ICTs) have penetrated all areas of contemporary life, the ability to use digital tools has become fundamental. Governments continually issue policies and programs to foster the development of digital competences among citizens and the diffusion of digital technologies in all aspects of social and economic realms (Livingstone, 2012; Hanna, 2018). They believe that the knowledge of and the ability to use digital technologies is a key determinant for economic development (ICTs favour innovation, productivity and growth according to the OECD, 2006), social inclusion (ICTs may favour citizens' participation in social and political life, reducing the digital divide as reported by Selwyn, 2002 and Warschauer, 2003) and for preparing students to contribute to and succeed in a rapidly changing society (Calvani et al., 2010).

The European Union and single national governments had emphasised the necessity to introduce ICTs in classrooms and incorporate digital technologies at all levels of education (Kampylis et al., 2015) several years before we were forced to make changes due to the Covid-19 pandemic. The Recommendation of the European Parliament and the Council of 18 December 2006 on Key Competences for Lifelong Learning (EU 2006/962/EC) invites educational institutions to review the basic competences they teach by raising them from three (reading, writing and mathematical competences) to eight, including digital competence. Several countries have carried out school digitalisation projects, resulting in mainly positive experiences, but some had questionable results (Calvani et al., 2010; Eshet-Alkalai & Chajut, 2010). In 2015, the Italian Government launched the National Plan for Digital Education (PNSD). Thus, today the question we should answer is not if digital competences and technologies should be introduced but how they should be integrated into the school's mission of educating and providing competences to students.

Digital competence or digital literacy (Gilster, 1997) is not the simple ability to use a computer (a technical capability) or the acquisition of specific knowledge (i.e., how to write computer programs). It refers to a set of skills that includes the capability to search and select digital information, analyse data, represent problems, communicate, create networks and collaborative solutions and test these solutions with digital instruments. The expected outcome from teaching digital skills is to help students to face real problems, build their critical thinking and develop their capability to continue learning throughout their entire life (Law et al., 2009). Technology is meant as a <<resource to help students develop higher-order thinking, creativity, problem solving and research skills>> (Ringstaff and Kelley, 2002). In line with this, schools cannot simply add some lectures on how to use the Internet or Excel to existing traditional curricula. Nor the replication of standard classroom dynamics via the internet, as occurred during the Covid-19 pandemic (Giovannella et al., 2020), is the way to create digital literacy. Schools have to understand how to use digital technologies to develop new learning styles and cognitive processes. In other terms, the introduction of digital technologies forces schools to question what and how to teach, challenging their mission and imposing changes in almost all aspects of the educational value chain (e.g., curricular reform, students' learning practices, assessment methods, initial and continuing teacher professional development) and involving all educational actors (teachers, students and school leaders) (Calvani et al., 2012).

The digital transformation of education, described here and encouraged by several Europe 2020 flagship initiatives, requires schools to review their organisational strategies. They need to change as regards three basic dimensions: pedagogical, technological, and organisational. In managerial terms, this means that digital technology provides the opportunity to innovate both the "product offered"

and the “processes” of educational institutions, which could benefit from digital innovation, allowing them to offer more competitive educational programs (i.e., in line with what the society and industry demand) and making them more efficient (Nylén and Holmstrom, 2015).

Because of its magnitude, the digital transformation needs to be underpinned by a clear strategy and requires adequate managerial capabilities to be successful. While, during the Covid-19 pandemic, schools have developed digital emergent solutions or an emergent strategy as Mintzberg (1994) theorises, European governments want schools to develop a long-term plan for digitalisation based on a clear vision of the future. Therefore, teachers’ digital knowledge and skills cannot be self-taught (as occurred in 2020 to solve the crisis generated by Covid 19 pandemic); relational and didactic aspects of ICT should be purposefully incorporated in teachers’ training so they can help students learn digital competence (Napal Fraile et al., 2018). In a similar vein, Herdin and Egger (2018) have indicated how digitalisation is not about getting internet access and being connected to networks. Real ICTs adoption occurs when people develop the skills to consciously use these technologies and achieve cognition of why, how, to what end and with what outcome digital technology is applied. Therefore, as for all change programs, schools need to plan and monitor the innovations that digitalisation can produce. But how? Two key questions have emerged: How do schools integrate the digital transformation into their strategic plans? And how do schools monitor the results achieved after the introduction of digital innovation in students’ curricula and organisational processes?

Italy represents an interesting case study. The Italian national government issued a plan in 2015, called the PNSD, which is a systemic, country-level policy tool aiming to change the culture in schools and the way they perform their educational activities. This plan provides suggestions (not compulsory activities) and funds concerning actions that schools should take, i.e., the introduction of digital devices, the appointment of a digital animator and the creation of creative labs and virtual classrooms, strengthening professors and students’ digital skills, digitalising schools’ administrative processes and the way schools interact with students and their parents. However, the plan does not support schools with an operative tool that can guide them in planning, implementing and benchmarking the change associated with digitalisation.

This paper investigates whether schools have adapted or integrated current managerial tools, already used by schools, to plan and monitor their actions, to include aspects of digital transformation. The analysis focuses on the most important managerial tools used by Italian schools: the School Plan (named PTOF) and the Self-Evaluation or Self-Assessment Report (RAV). The limitations of these tools in helping school principals in planning and monitoring students and school organisations’ digital competence suggest that research propose other tools that may better support schools in planning their digital transformation.

2. The need for planning the digital change has emerged in Italy

After some discontinuous national initiatives for introducing ICTs in education (Schietroma, 2011; Avvisati et al., 2013), Italy launched the National Plan for Digital Education (PNSD) in 2015 in connection to the latest School Reform named “La Buona Scuola” (Law n. 107/2015). The Reform has identified the development of digital competences among the primary educational goals of the school and has advanced digital technology as a key educational instrument for building general competences. The Plan represents the driving document (140 pages) of the Italian Education Ministry to launch a comprehensive strategy for promoting innovation in Italian schools. Its purpose is to reposition the Italian education system in the digital era by giving teachers and students a competitive

advantage based on digital technologies. The aim is to digitise schools starting from primary school, introducing computational thinking (Bizzarriet al., 2011), coding (Consoli, 2015) and laboratory experiments, thanks to which children can develop technical skills to create objects inspired by the principles of the digital factory (Magone and Mazali, 2016). It is based on the following assumption: technologies should serve as active learning for students and innovative practices for teachers.

The Plan consists of 35 actions, which had to be implemented by the end of 2020. Starting from the school year 2015-2016, schools were invited to 1) introduce dedicated professional roles responsible for implementing the PNSD in each school (i.e. the 'digital animator or digital catalyst' and a team of teachers exclusively devoted to promoting digital innovation); 2) improve the digital infrastructure in terms of broadband connection, creation of new labs, libraries and spaces like the Future Classroom (Bardi et al., 2014) and the adoption of new technologies like 3D printers and e-books (Domingo and Marquès, 2011); 3) train the entire school staff (managers, teachers, administrative and general school staff) to acquire the skills needed to manage the schools' digital transformation.

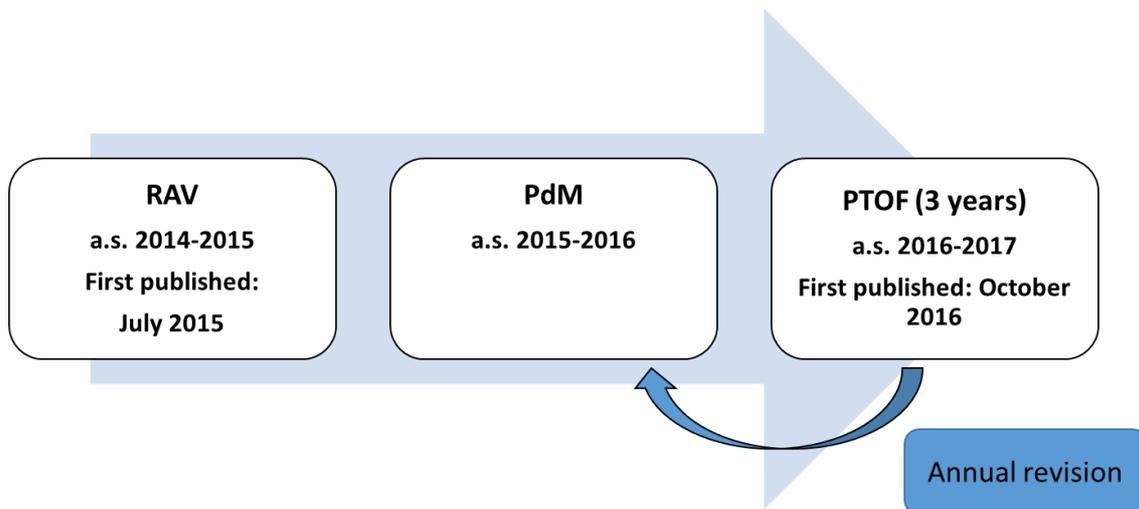
However, the plan is a programmatic document, a nationwide instrument that does not say anything about how individual schools should introduce this digital change in practice, nor has the Plan defined a framework or tool for monitoring and evaluating the results achieved in the different organisations. Moreover, the deployment of the Plan is delegated to Ministerial decrees and announcement notes that focus on specific items/actions from time to time (i.e., a decree that gives 1,000 euros per year/school if one teacher has been identified as a digital animator and another decree for the training of the digital team of teachers. This makes it difficult to plan a long-term digital strategy for a school (Iacono, 2016).

The risk is that schools start different types of initiatives at the same time, trying to obtain public funds, launching disjointed programmes not linked to the overall mission as happened in universities (PWC, 2015). A school may merely introduce some digital content in class without developing a digital culture among its students. There is also the risk of inertia when schools believe that young students are digital natives that do not need additional teaching, while academic studies demonstrate that being a digital native does not necessarily mean being digitally competent (Li and Ranieri, 2010). Finally, schools may delineate action strategies without defining the results to achieve and how to monitor them. Thus, schools need a planning process to make informed decisions and avoid unintended consequences. What is needed is a managerial logic, close to the Plan-Do-Check-Act method (PDCA) proposed by Deming, with which some schools have introduced the principles of Total Quality Management and started a process of continuous improvement (Venkatraman, 2007). In other words, digitalisation raises the need to improve strategic planning and control in schools.

Three key managerial tools are currently adopted by Italian schools to support decision-making and report on planned actions and the outcomes of these actions to stakeholders (Paletta et al., 2020) (Figure 1). The first one is the Triennial Educational Offer Plan (PTOF), which has been designed to help schools define their cultural and planned identity. It is a document drawn up by the Teachers' Council (Collegio dei docenti) that contains the public declaration, expected by law, where the school's purposes and commitments can be found. It describes both the curricula offered and the organisational resources (e.g., teachers, equipment) that the school plans to acquire. The second fundamental instrument used by schools is the Self-Assessment Report (RAV), which describes the schools' situation through some narrative comments and indicators based on a self-rating process. The RAV was introduced by the new 'Regulation of the National School Evaluation System' (DPR 80/2013) to "educate" schools on the culture of effective use of resources, control and reflexivity to

generate improvements. Its structure should help schools analyse the causes that influence schools' outcomes. In fact, the RAV has been designed to favour internal discussion about the outcomes achieved and then be the starting point for drawing up an Improvement Plan (PdM). This third instrument aims to improve schools' educational and organisational practices, starting with the results of the self-evaluation. It should guide future decisions. At the same time, it is a statement of intended actions that schools disclose to the public. As such, it is inserted into the annual revision of the PTOF. Thus, like the other EU Member States, Italy requires schools to use internal evaluation findings to produce strategic documents that illustrate improvement measures (EC/Eurydice Report, 2015).

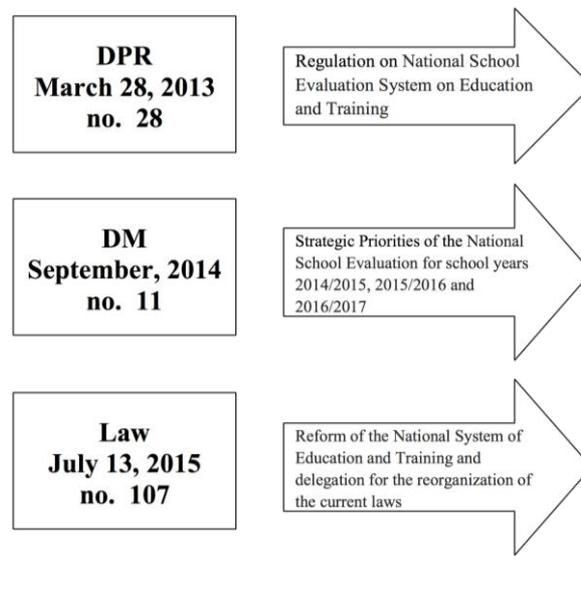
Fig. 1. Introduction of the schools' key managerial and reporting instruments in Italy



All cited instruments are mandatory documents. They are the outcome of three key legislative interventions (Figure 2), which completely changed schools' evaluation approach starting in 2016. The underlying idea is to evaluate schools and push them to self-reflect by requiring the disclosure of specific information and creating a strong relationship between self-assessment and the design of improvement plans (Barzanò, 2002). Evaluation is external (the audit is performed by the Ministry based on the examination of PTOF, RAV and PdM) and internal (self-assessment made by school teachers and staff). The adoption of these instruments is recent but their origin dates back to the recognition of school autonomy, which occurred in most European countries in the 1980s and granted more decision-making power and areas of flexibility to each school and also increased the demand for teachers and school leaders' accountability (Woessmann et al., 2009). In other terms, schools are called to "account" for their policies, actions and educational organisation through the production of data.

Italy has not yet reached the level of datafication of England (Ozga, 2009). However, the request of data production generated by the RAV is quite demanding. Moreover, these data allow principals to make an automated comparison of their school performance with those obtained by other schools. This benchmark easily generates strong pressures for continuous improvements on school leaders and teachers as has happened abroad (Roberts-Holmes and Bradbury, 2016).

Fig. 2. The legislative framework



The tools designed by the Italian Government have a structure and reporting contents, which are strictly regulated according to a top-down approach, thus hindering the necessary flexibility in planning and control that a changing environment requires. This is especially true for the self-assessment report (RAV), which has to be compiled according to a reference framework prepared by the National institution for the evaluation of the educational system (Invalsi). The Government has defined the list of topics (called macro-areas) and the indicators to report (schools have to report mandatory indicators and may add some indicators from a pre-defined list) so that schools can be easily compared. Similarly, but to a lesser extent, the PTOF is regulated by the Ministry of Education, which has issued indications on its content (Nota ministeriale AOODPIT 2805 del 11/12/2015). These indications have been used by the national association of school leaders (ANP) to structure a model for reporting schools' three-year plan. Also, the PdM is regulated by the Italian Ministry of Education (Nota ministeriale AOODGOSV 7904 del 01/09/2015), which requires schools to follow the guidelines prepared by INDIRE, the National Institute for Documentation, Innovation and Educational Research¹ and to fill out some tables regarding the actions planned, their time of deployment and the people involved.

Besides not being very flexible, the cited instruments do not explicitly refer to digital innovation and do not help us understand how digital technology impacts students' outcomes. The structure of the RAV and the related map of indicators released in November 2014 by the Ministry of Education (MIUR, 2014) do not include a sub-section on digital innovation. Information related to digital resources and educational practices on digital competences may appear (if implemented in the school) in separated sub-sections of the RAV (e.g., among the list of physical resources together with the gym and library or among the list of educational practices together with experiments on learning with music). Thus, it seems difficult to get a clear visualisation of the global effort put forward by the school concerning digital transformation. Moreover, information on digital aspects is constrained by

¹ INDIRE, together with INVALSI (National Institute for the Evaluation of the Education and Training system) and the inspectorate of the Italian Ministry of Education, is a part of the National Evaluation System for Education and Training.

the topics and indicators offered by the Ministry as included in the INVALSI questionnaire. For example, the questionnaire asks to indicate (if present) how many tablets, PCs and multimedia interactive whiteboards the school owns, and these devices allow us to calculate the indicator named “n. of devices per student”. However, it does not offer the possibility to list other types of unforeseen, yet innovative, technological devices acquired by the school.

Similarly, the PTOF does not explicitly address digital innovation. The PNSD invites schools to insert digital-related actions within their PTOF but then the Government delegated the digital animator (if appointed) to prepare a separate “intervention plan” describing school projects related to digital innovation². The intervention plan can originate from the self-evaluation of RAV or not, thus being completely independent of the priorities identified by the school. Moreover, the digital animator has to merely describe how he/she used the funds (e.g., the type and number of workshops, the number of teachers and students involved) without trying to assess the impact of the planned actions on students’ outcomes or process efficiency and efficacy.

3. Method and data

Considering the need to integrate the digital agenda into schools’ strategic plans, though poor attention is devoted to digital aspects in the three key documents required by the Government (RAV, PTOF and PdM), empirical research was conducted to see if schools have been adapting these documents to include the “digital dimension” or if new tools are necessary to plan and monitor the impact of digital innovation.

The research relies on multiple case study analyses. **Although only a few studies in the field of school management have used qualitative methods as their form of data collection (Bezzina et al., 2018)**, we have opted for qualitative research informed by an explorative case study because the topic we aim to explore is quite novel, complex and difficult to structure into a questionnaire, considering the different types and characteristics of Italian schools. We have used the inductive approach, which is widely used in international managerial literature (Flick, 2009) because it allows for a better understanding of real situations through an in-depth analysis of complex phenomena characterised by a high level of non-homogeneity, novelty and/or dynamism (Eisenhardt, 1989; Yin, 1989).

We have resorted to both document analysis and direct interviews. The analysis of official school documents (PTOF, RAV and PdM) helped us identify the formalised inclusion of digital initiatives within the schools’ strategies and the possible indicators used to monitor the related results. The interviews were designed to understand if these documents help schools plan and monitor the digital innovation strategy. The interviews involved both the school leader (the Director in charge of leading the school, also named Principal) and the digital animator. These two subjects represent the key informants from which information can be extracted (Halinen and Törnroos, 2005), as depositaries of an integrated vision of the organisation, its actors and stakeholders.

We have opted for purposive sampling. So, after contacting and dialoguing with about 30 school principals, three schools were selected to represent contrasting cases. These schools have very different situations although they are in the same territory (context becomes less relevant). One school (the red one) is “in love” with digital technology. It started its digital strategy with the PNSD. The

² Projects may focus on three areas: (i) methodological and technological training of colleagues; (ii) involving and motivating the whole school community, from students to their families, in digital innovation; (iii) planning and spreading, in the school and among colleagues, sustainable methodological and technological innovative solutions.

second school (the blue one) refers to the “indifferent spectator” that knows what the national plan for digitalisation expects from schools but does not make relevant investments to implement new technologies. The latter (the green one) is the “experienced school”, which introduced digital technologies several years before the PNSD. This selection strategy is helpful when checking the relationship between the degree of school’s intimacy with digital technology and the usage of managerial tools to monitor its outcome. In other terms, a contrasting case may help explain the reasons for contrasting results.

Then, results stemming from the empirical analysis will be used to understand whether schools need to adopt some managerial instrument that could help the school leader to better identify how the actions and projects related to digital innovation impact the final outcome of preparing students for the future.

4. Results from the empirical analysis

By reading the RAV documents published by each school, it is possible to identify the areas and indicators where a school may include the measuring and evaluation of aspects related to digital innovation. First, we describe the RAV structure as required by the Government and then we report on the topics and indicators related to digital innovation that schools have introduced to self-reflect on their projects and activities related to ICTs (Figure 3). Different colours refer to information on digital aspects reported by different schools.

The RAV of each school is divided into four macro-areas: 1. Context and available resources, which represent the contingent elements or constraints and opportunities related to the territory, 2. School outcomes, 3. Internal processes and 4. Identification of Priorities. The first three areas are composed of sub-dimensions of analysis and are described by indicators and the use of narratives. The latter area (Identification of Priorities) should stem from a process of critical reflection that schools have to carry out and is the logical conclusion of the self-assessment process. Here is where the school identifies the priorities, i.e., the long-term objectives on which to improve. The law states that priorities have to refer to school outcomes. Priorities are described and measured through targets that can be achieved by changing or improving processes. Thus, process objectives refer to short-term goals that are functional to the achievement of priorities. This macro-area constitutes the starting point for the preparation of the Improvement Plan (PdM), which often takes the form of a list of projects to be implemented.

Fig. 3. The structure of the RAV and the information on actions related to digital competences

1. CONTEXT AND AVAILABLE RESOURCES	2. OUTCOMES related to students	3. PROCESSES	
		3.1. Educational and teaching practices	3.2. Management and organisational practices

1. School population	1. School results (e.g., n. of students passing on to the following year)	1. Curricula, design and evaluation (e.g. how final exams are structured)	1. Strategic orientation and organisation of the school (n. of projects) <i>(n. of projects on ICTs)</i>
2. Territory and social capital	2. Results in the standardised national tests (e.g., number of students passing the mathematics test)	2. Learning environment (e.g. timetable of classes; presence of a library) <i>(n. of classes/students that can benefit from a computer lab and/or a multimedia room; n. of hours per week dedicated to the use of ICTs in class; description of a project on cooperative learning on the use of ICTs)</i> <i>(n. of classes/students that can benefit from digital devices and internet connection; score in the usage of computer labs; use of innovative teaching methods and collaboration between teachers for the implementation of innovative teaching methods)</i>	2. Human resources development and enhancement (e.g., hours of training) <i>(n. of training courses on how to teach with ICTs and digital innovation attended by teachers and other staff; creation of a digital space for the sharing of tools and materials)</i> <i>(n. of training courses on how to teach with ICTs; n. of teachers with digital competences measured through ECDL certification; score on the use of computer labs and interactive whiteboards)</i> <i>(n. of training courses on how to teach with ICTs and the meaning of digital culture and related competences, e.g., cyber security; new project on the creation of digital repository on teachers competences; use of Dropbox, Moodle and other digital instruments to improve internal administrative processes and the sharing of practices among teachers)</i>

<p>3. Economic and material resources <i>(n. of PCs, tablets, multimedia whiteboards; n. of ebooks, Internet connections)</i> <i>(n. of PCs, tablets, multimedia whiteboards, Internet connections)</i> <i>(n. of PCs, multimedia whiteboards, electronic register in all classes; Web bulletin board for all internal and external communications, online booking of interviews with parents; use of platforms and the cloud for teaching)</i></p>	<p>3. Key skills and citizenship <i>(the school evaluates the digital competences of students in terms of certifications obtained e.g. ECDL)</i> <i>(Project on the perils of cyberbullying as a means to develop citizenship competences)</i></p>	<p>3. Inclusion and differentiation (e.g., hours of recap for students with problems) <i>Project on the correct use of digital media open to teachers, pupils and their families (to avoid the misuse of the Internet and cyberbullying)</i></p>	<p>3. Integration with the territory and relationships with families (n. of networks with other schools; n. of agreements) <i>(n. of networks created to implement common projects related to the PNSD; use of the website and other ICTs to communicate with parents; creation and use of the digital school register to access students' evaluation)</i> <i>(attempt to get additional funds from external sources to buy new devices, labs and technologies; use of the digital school register; mailing lists to divulge information; online booking service for parents willing to meet professors)</i></p>
<p>4. Professional resources <i>percentage of teachers who attended training on ICTs usage in the last two years (e.g., electronic register, use of the interactive multimedia whiteboard, laboratory teaching)</i></p>	<p>4. Distance results (n. of students enrolling in university programs or students being employed after one year of graduation)</p>	<p>4. Continuity and orientation (e.g., service orientation for university enrolment; hours of alternation between school and work) <i>(use of the Internet to identify the needs of and dialogue with prospect students willing to enrol)</i></p>	

4. PRIORITIES

Priorities that identify the most important areas of improvement (*increase digital competences*)

Targets that describe and help measure the achievement of priorities (*ECDL certification*)

Process objectives that help achieve priorities

Source: *digital aspects included in the official RAV structure by the three schools*

The school identified by the red colour welcomed digital innovation and made investments in both resources and training. They are engaged in different projects and great emphasis is attributed to the rollout of a “Creative lab” designed to develop creative thinking and the skills and mindset needed to create innovations. However, the school principal stated (both in the RAV document and during the interview) that *“they do not use tools to evaluate students’ achievements in digital and citizenship competences. The attainment and/or increase in competences is the expected final result, which is implicit”*. From the interview, it emerged that the digitalisation of teaching practices is necessary. *“Children are fascinated by technology, images and therefore traditional lessons risk being ineffective. Children’s style of learning is different and therefore the way of teaching must change”*. ICTs can increase the level and duration of children's attention and the lasting memory of what is learned.

Tools like the RAV, PTOF and PdM do not help support the integration of digital projects into the school’s current strategic plan. As supported by the interviewees’ comments, these tools only help formalise the process of evaluation and reflection that were already in place. *“The formalisation allows us to be more transparent with families and public entities (more communication and accountability towards stakeholders) and to give continuity to the improvement plans even when managers, teachers and staff change (which happens quite often in Italian schools)”*. However, dialogue with the staff indicates that the RAV structure cannot support schools in drawing plans; *“The RAV does not help us understand how much training is necessary to persuade teachers to use innovative teaching methods, nor does it help us to assess the impacts on students’ outcomes”*.

The school identified by the blue colour has made fewer investments in digital technologies and pinpoints the necessity to increase digital competences among the key priorities reported at the end of the RAV document. *“Digital innovation will be measured in terms of the number of students obtaining the ECDL certification. There are no alternative measures/targets.”* Digital competences mean the capability of using technology (computers and software). On the other hand, the school is very active in developing other competences. *“We have started an international curriculum to develop language competences, and we have a virtual enterprise lab, which helps nurture critical thinking and an entrepreneurial attitude. On the contrary, school digitalisation is hard to develop because there are no relevant funds for this aspect from the central government; on average, teachers have a fairly high age, and there is no middle management or teachers with a reduced teaching load that can dedicate time to digital projects”*. According to the school leader, the lack of managerial resources is a strong weakness that characterises this and all Italian schools.

For this reason, the RAV and PTOF are mainly conceived as documents to fulfil and not as instruments that support schools’ self-reflection, improvement and planning. School staff believes that the school improves thanks to continuous dialogue with parents, students, firms and the territory.

Moreover, the interviewees affirmed that decisions are made almost every day and cannot be postponed to the end of the year (i.e., when the RAV is fulfilled) nor can decisions depend on Government funds that are discontinuous and uncertain. *“The Government decided to favour digitalisation through a series of decrees. These decrees often require schools to participate in calls for bids to access public funds. In other terms, schools cannot plan their digital transformation carefully because they depend on the timescale of Ministerial decrees, and they do not have the certainty of resources as the school has to submit competitive projects for each bid hoping to obtain funds”*.

The school identified by the green colour is a technical institute. Because of its nature, the school has invested in ICTs, digital technology and the development of ICTs skills among its students for some time. *“We have an IT curriculum and teachers with high computer and digital competences. We purchased our first multimedia interactive whiteboard 12 years ago. Now we have 52 whiteboards, one in each class. The digital team has recently increased from 3 to 10 members.”* Teachers with higher expertise in ICTs are quite active in providing technical support to other teachers. There is internal training (from teacher to teacher) on how to use the cloud, how to make a video to use it as a teaching tool in class, how to operate online exams, etc. Yet, the focus of the school is still on “learning about technology” and not “learning with technology” because they believe that their students need to improve their capability in using digital technologies that change at a high-speed rate. Similarly, they are still investing in training teachers about technology because there are several teachers with poor digital competences. Continuous training is necessary because of the high personnel turnover (*“every year new teachers with poor digital competences could be transferred or assigned by the central government”*). Additionally, the school believes its potential digital development is hindered by the absence of intermediate managers who can dedicate time to projects and development strategies. At the moment, teachers dedicate their personal time to planning projects.

To evaluate the progress of teachers and other school personnel in digital competences, the green school uses self-developed assessment tools (intermediate tests and final test after training). The school states (both in the RAV document and interviews) that they use internal forms of strategic control or monitoring of the actions, which allow them to redirect the strategies and redesign future actions. Control is performed by the school leader, the person responsible for quality assurance and school procedures. They may use reports, questionnaires, inspections and interviews. *“The school does not use the RAV and the mandatory documents for this purpose. PTOF and RAV are official documents used by the government to evaluate schools”*. However, the interviews demonstrated appreciation for the School reform and the PNSD because it is the first, nationwide attempt to rejuvenate Italian schools. Despite several limitations encountered because of the scarce and often delayed financial resources for digital innovation, the interviewees said that the PNSD has the advantage to push schools and teachers to enhance this area of knowledge. *“The PNSD generates a sort of psychological pressure to change. However, it does not provide full support. Schools need an organisational framework capable of supporting them in the ‘formulation’ and ‘translation’ of the strategic change into concrete actions”*.

The digital animator of the green school believes that the use of digital technologies is fundamental to improve teachers and students’ competences and to enhance the functioning of the school. This is the only school that emphasises the use of tablets, e-books and other digital solutions as key instruments for teaching in the PTOF. The interviewees also said that all the teachers at this school agreed on the goal of migrating all schools processes to the cloud. This information is not reported on the RAV. However, the school has planned to ban the use of paper and USB pens to file minutes and other information. Moreover, each teacher will become a user of the Google suite for educators

(Google ClassroomTM), which is designed to manage assignments and communicate with students quickly and easily.

Unfortunately, the interviewees also acknowledged that they are not able to measure the impact of digital technologies on students' achievement. The belief is that students' style of learning is more visual and less verbal than in the past, but their current assessment methods (context-related proofs, simulation, and traditional written tests) do not provide insights into long-term impacts.

5. Discussion and conclusions for better school planning and monitoring

The first result that emerged from the case studies is that the national plan for digital innovation does not necessarily lead to a change in schools' programs, least of all in the schools' missions. As reported by the case studies, one school poorly reacted to the PNSD.

Moreover, where there is a plan to invest in digital technologies (in two out of the three case studies), this can be reported or not in the official school documents like the PTOF and the RAV. Changes related to digital innovation seem not always planned, i.e., formalised in official documents. The school identified by the blue colour extensively recurs to digital technologies to teach and benefit teachers with high expertise, but if our examination were limited to the poor information disclosed in its RAV document, we would be mistaken. This school does not report detailed information on its projects related to digital innovation in the RAV document, and the use of digital-related Key Performance Indicators is very poor. Consequently, document analysis might be misleading if external evaluators and researchers decide to use the reported indicators and narratives to assess the level of technology usage within schools.

With reference to our research question on how digital technology is integrated into existing strategic objectives, we found two different situations. One school (the blue one) includes the objective of teaching students about technology. Digital knowledge is one of the key competences that students have to develop. The change refers to the content of "the product offered". Coherently, in this school, the development of digital competences is monitored as other competences that students have to learn. In this particular case, it is measured in terms of ECDL certifications as language proficiency is measured in terms of certifications obtained by students. Another school (the red one) includes the use of digital technology in its programs as a means to learn about other concepts and competences. Technology is a tool to develop citizenship skills, a collaborative attitude and critical thinking, which represent the school's aims. However, no specific indicators to monitor the results have been employed.

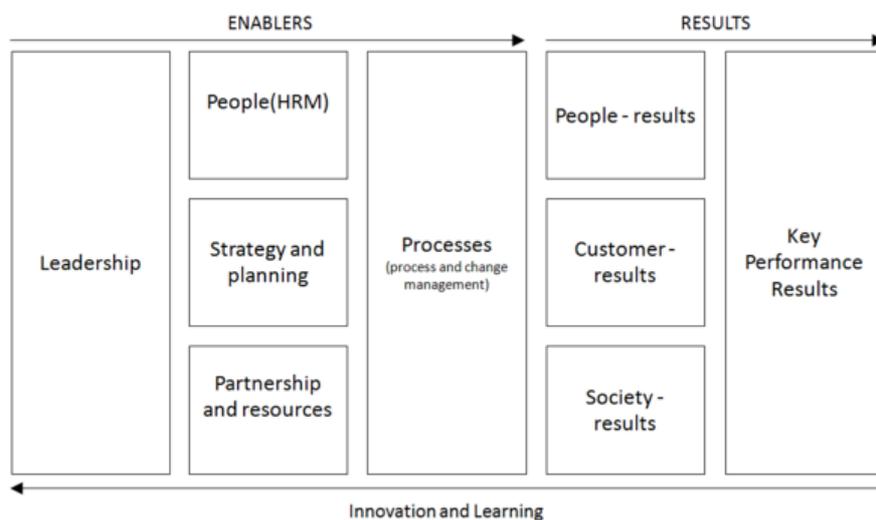
With reference to the second question on how schools monitor their performance, we found that in the two schools with plans of digital progress, there is a lack of performance measurement regarding the digital competence of both students and teachers. On one hand, we have to consider that the only key indicator proposed by the RAV structure that schools can use to monitor students' digital competences is the amount of ECDL certifications. Therefore, schools might think that this indicator is adequate. On the other hand, the schools' autonomy theoretically allows them to introduce additional methods of evaluation regarding students' outcomes. For example, schools could describe an internal method of evaluation in the narratives of the RAV document. Nevertheless, none of the schools examined seems to have experimented with alternative evaluation methods (e.g., tests, written exams, experiments, essays), despite academic research proposing several alternatives for assessing digital literacy (Van Deursen and Van Diepen, 2013; UNESCO, 2019). Evaluation techniques seem to be underdeveloped. In these schools, digital competence is assessed through traditional means like

social and citizenship competences that are assessed in terms of a score in behaviour attributed to the pupils. The penetration level of digital technologies among teachers is mainly monitored through the number of teachers attending training courses and the number/hours of training. This focus on the teaching resources highlights the linkage between organisational processes (i.e., the training), teaching practices (the use of digital technology in class) and possible benefits that students can get from these more skilled teachers (i.e., higher grades or new competences). However, staff opinions and the current usage of the RAV demonstrate that school leaders do not fully analyse all cause and effect relationships and the impact of teachers' training on students' outcomes.

Our first conclusion, stemming from the analysis of the school documents, indicates that neither the PTOF nor the RAV can be used as managerial tools to respectively plan and monitor the digital innovation of Italian schools. The structure of these two documents is defined by the central government and neither of them explicitly address the topic of digital competence. The RAV only requires them to report on the number of computers, the number of Internet connections and the number of hours of training in ICTs, but mainly for benchmarking purposes with other schools so that families and students can compare different schools' technical assets. Modifications or integrations to the RAV structure do not seem to be diffused among schools, even if possible. The RAV is perceived by principals as a means for the Government's evaluation and the schools' accountability, but not as a tool for improving decision-making.

The conceptual reference of the RAV structure is the CIPP (Context - Input - Process - Product) model, which was created in the late 1960s in the United States, to implement a system that would allow schools to account for their work (Stufflebeam, 1971). The RAV has links with managerial models developed to support the monitoring of planned actions in schools (Paletta, 2011). For example, the RAV has similarities with the EFQM framework (Figure 4). The educational outcomes (macro-area n. 2) are the heart of the school and correspond to the "Key performance Results" of the EFQM model proposed by the European Foundation for Quality Management (Galimberti e Maiocchi, 1998). The internal processes (macro-area n. 3) correspond to the enabling "Factors" of the EFQM model (e.g., people, technical and financial resources). However, the cause and effect relationships it examines are bounded by the areas identified in the structure of the RAV. Thus, external factors or other possible drivers are not considered, limiting the school leaders' strategic vision.

Figure 4. EFQM Model



Considering the structural limitations of the RAV, we propose the introduction of a managerial model based on the Balanced Scorecard (Kaplan and Norton, 1992; 1996) logic that could better support schools in both the planning and strategic control processes. The strategic maps of the BSC ask principals to identify the cause-and-effect relationships between digital technologies and schools' outcomes, instead of assuming that digital technologies will produce, almost enchantingly, meaningful improvements in the pupils' cognitive processes. Schools need to understand how much they should invest in digital technologies because past studies suggest that the correlations between computer use and improvement in students' results (reading, maths, science, reading digital) remain positive up to a certain level and then decrease; at a certain threshold, the more computers are used in schools, the worse the pupils get (OECD, 2011). Contrasting studies suggest that digital technologies may decrease students' learning and achievements because it generates overload and dispersion (Clark et al., 2006). Moreover, some studies indicate that methodologies and the teachers who use them make the difference, not the technologies or the digital infrastructure (Hattie, 2009).

Another important advantage of the BSC is that it is a multi-dimensional framework that suggests that organisations look at different dimensions of analysis at the same time. Therefore, it may help school leaders to become aware of digital technology's impact on different dimensions other than students' outcomes. For example, technologies may contribute to improving some aspects of school life and the context of students' learning. Digital technologies may not have any positive or counterproductive effects on students' achievements, but their introduction may still generate some "humble" organisational advantages, for example in terms of communication and the sharing, conservation and management of educational resources within the school (Hattie, 2009). Digital technologies may also improve communication and engagement with the actors located in the local context. Web sites, mailing lists and social media can help them dialogue with families and firms, offering job opportunities to students.

In the field of education research, another framework of analysis, named DigCompOrg, has been recommended to support schools in the monitoring and improvement of their digital strategies. DigCompOrg (the European Framework for Digitally Competent Educational Organisations) has been designed to encourage self-reflection and self-assessment within educational organisations as they progressively deepen their engagement with digital learning and pedagogies and to enable policymakers to design, implement and evaluate policy interventions on digital technologies. It is promoted as a framework to guide the integration and effective deployment of digital learning technologies in schools. However, it focuses on the teaching, learning and assessment undertaken by a given educational organisation. As such, it is not intended to address the full range of administrative and management information systems that may be in use within the organisation. Therefore, organisational impacts other than students' learning are completely ignored by this framework.

A third option is continuing to use the RAV as an instrument for monitoring digital strategies. Supporters of this line of thought argue that its structure has room for accounting for innovation in all four key categories used to classify innovations by type (OECD and Eurostat, 2005): operational processes (section 3.1. of the RAV on teaching with ICTs), organisational methods (section 3.2. of the RAV on training), services/products provided (section 3.1. of the RAV on the type of curricula offered) and the way the organisation communicates with users (section 3.2. of the RAV on integration with the territory). However, its fixed structure (necessary to allow for benchmarking) is also its inherent limitation as not all schools are the same and can translate their digitalisation strategy in different ways as the examples demonstrate. Moreover, the RAV does not truly support the critical

evaluation of school strategies. It mainly focuses on issues related to operational aspects that may necessitate short-term improvements. Lastly, the RAV is mostly perceived as a control toolset by the Italian Government. It reinforces the idea that policy comes from outside the school and practices are prescribed by the Government (Murgia, 2017). On the contrary, the introduction of a flexible instrument, such as the BSC, which can be adjusted according to the specific situation (perspectives and indicators should be created and modified according to company strategy) can give teachers the sensation that they play a key role in strategy implementation.

In conclusion, this paper suggests that the introduction of digital innovation in schools as an imposed policy-driven change (Fuglsang, 2010) that can be obtained from intentional actions (Koch and Hauknes, 2005) should be planned and monitored adequately at both the government and the school levels to generate a “real adoption” of digital technologies for human beings’ empowerment (Herdin and Egger, 2018). However, current managerial tools used by Italian schools seem to be inadequate instruments to plan, implement and measure the strategic objective of achieving students’ digital literacy. Therefore, a proposal to introduce and modify the balanced scorecard managerial tool in schools emerged and is discussed in comparison with alternative frameworks and instruments. Making the schools, their principals and teachers aware of how beneficial cognitive outcomes associated to the use of digital technologies can be achieved is fundamental as digitalization will continue to be pursued and nurtured over the years. Otherwise, digitalization may stop in schools when dedicated funds run out.

Moreover, results suggest that principals play a central role in building and changing organisational capacity for school improvement (Bezzina et al., 2018; Paletta et al., 2020), also when focusing on digital improvements. The sensibility of principals on the topic and how they involve teachers in the process of digitalisation appear to be crucial in promoting change in teaching and teacher commitment.

From a practical point of view, this paper aims to help school principals understand how the change introduced by digital technologies should be carefully planned and monitored to help students with future work and life challenges. From a theoretical point of view, this work contributes to the debate on what extent measurement in public sector organisations can be based on frameworks originally developed in a private sector context (Block and Bugge, 2013; 2016).

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