

POLICY ANALYTICS AND TEACHERS' DIGITAL COMPETENCES IN ITALY: A MULTIPLE CASE STUDY

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ABSTRACT

Teachers' digital competences (TDC) are crucial to let students thrive in the digital era. However, policies that aim at fostering their development are still immature. Data-driven approaches could help improving decision-making in this field, but evidence-based policymaking is not sufficiently equipped to do so.

Our research studies two relevant cases in the Italian context – the national policy package dedicated to TDC and a regional project with the same purpose – to see how a more comprehensive Policy Analytics (PAn) approach can be effectively implemented, underlining benefits and hindering factors.

By means of qualitative evidence extracted from 15 interviews, we extend the high-level PAn framework already developed in the literature. As a result, we provide actionable propositions and a full policy wheel to support the structuring of education policies and decisional processes, ensuring stakeholder involvement.

Keywords: *policy analytics; digital competences; schoolteachers; Italy; ICT training.*

1. INTRODUCTION

In the last three decades, ICT has increasingly played a pivotal role in education. The literature (e.g., Fraillon et al., 2014) emphasizes the necessity of successful adoption of ICT within schools in order to let students thrive in a smart and sustainable future.

This undertaking heavily depends on teachers' digital expertise, which has to be passed on to students and is mainly determined by their ICT training, cooperation with peers, self-confidence, self-efficacy, self-perception, and accessibility of digital assets (Gil-Flores et al., 2017). Indeed, the effective integration of ICT within classrooms is determined by teachers' capacity to incorporate it into their teaching methods (Comi et al., 2016). This evidence proves relevant especially in Italy, where only 35% of teachers reported using ICT when teaching in most class, before the pandemic (OECD, 2019).

Therefore, opportunities for Teachers' Professional Development (TPD) should be provided to optimize their capabilities and should evolve beyond simply mastering specific technical competences. Digital competence is a broad concept and, as such, training activities also necessitate educational systems to offer methodical and long-term assistance (Krumsvik, 2008).

This study identifies a comprehensive approach to support policy processes that address the above-cited educational needs. By applying and further developing the *Policy Analytics* (PAn) framework (Tsoukias et al., 2013), we build a model for the development of Teachers' Digital Competences (TDC) based mainly on the use of already existing data analytics and infrastructures.

We analyze two relevant policy packages in Italy, and we show how PAn are more effective than traditional evidence-based approaches in supporting the entire policy cycle and in capturing how public actors fuel continuous innovation in policymaking.

2. THEORETICAL AND EMPIRICAL BACKGROUND AND RELEVANCE

2.1 FROM EVIDENCE-BASED POLICYMAKING TO POLICY ANALYTICS

Information technologies facilitate monitoring activities, data interchange, analytical investigations, and benchmarking activities, and have increasingly targeted policymaking (Esty & Rushing, 2007). Thus, it is fundamental for policy analysts and for practitioners to understand how such wealth of data can be put to good use also for policy purposes.

Over the last three decades, Evidence-Based Policymaking (EBP) has answered this need. EBP “helps people make well informed decisions about policies, programmes and projects by putting *the best available evidence from research* at the heart of policy development and implementation” (Davies, 1999). Indeed, policy decisions involving logical reasoning, founded on analytical data, are thought to deliver superior results with respect to opinion-based policymaking (Glied, 2022; Sutcliffe & Court, 2005).

Despite its noble purposes and its benefits, EBP has failed to turn into a comprehensive and standardized framework (Greenhalgh, 2009; Saltelli & Giampietro, 2017). In the end, research evidence is frequently left out of policy formulation processes (Jacobs et al., 2012; Radu et al., 2018), many public organizations and NGOs have poor analytical competences (Newman et al., 2016), and the “legitimation challenge” has been frequently left unmet (De Marchi et al., 2016). As a result, EBP may cause drastic simplifications (De Marchi et al., 2016), incorrect policy prescriptions, and the marginalization of other legitimate stakeholders’ relevant views (Saltelli & Giampietro, 2017).

Multiple factors influence decisions at each stage of policymaking, and evidence does not subsist independently from policies nor it does “objectively” lead the policy cycle; policies always mirror what is essential to the people involved (De Marchi et al., 2016).

2.1.1 THE POLICY ANALYTICS APPROACH

This is when Policy Analytics come into play. PAn represent “the development and application of [...] skills, methodologies, methods and technologies, which aim to support relevant *stakeholders* engaged at any stage of a *policy cycle*, with the aim of facilitating meaningful and informative *hindsight, insight and foresight*” (Tsoukias et al., 2013). PAn denote data analytics specifically related to public policy, i.e., taking into account all the peculiarities of decision-making in public settings (Daniell et al., 2015).

PAn rely upon the construction of knowledge through a wider range of tools than “research evidence”: data mining, statistics, business intelligence, knowledge engineering and extraction, decision support systems, and, to a more considerable extent, operational research and decision analysis (Gil-Garcia et al., 2018). These tools are implemented at different levels, with the distinguishing peculiarity of employing a “constructive approach to surfacing, modeling and understanding the opinions, values, and judgments of the range of relevant stakeholders” (Tsoukias et al., 2013). PAn merge data-driven and value-driven approaches to examine contextual factual, scientific, and expert information and goals expressed by stakeholders (Daniell et al., 2015; Dell’Ovo et al., 2020).

PAn constitute a significant evolution of digital administrations, with the utilization of existing (and novel) data possibly in conjunction with those owned by private companies (Janowski, 2015; Lachana et al., 2018). PAn are obviously conceived in a parallelism with Business Analytics and with the concept of *ubiquitous data* (Akerkar & Hong, 2019).

However, PAn are still in their infancy. The data and Big Data that governments own for informing and improving policymaking have been little exploited so far (Pencheva et al., 2018), and further in-depth research is required, especially regarding their use in a wide range of policy fields (Loukis & Arvanitis, 2018).

2.2 DIGITAL COMPETENCES AND THE POLICIES TO DEVELOP THEM

2.2.1 DEFINING DIGITAL COMPETENCES AND TEACHERS' DIGITAL COMPETENCES

We adopt the definition of DC as: “The set of *knowledge, skills, attitudes, abilities, strategies* and *awareness* that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning and socializing” (Ilomäki et al., 2016).

As for TDC, Krumsvik (2012) defines them as: “The teacher/TEs’ [teacher educators’] proficiency in using ICT in a professional context with good pedagogic-didactic judgement and his or her awareness of its implications for learning strategies and the *digital bildung* of pupils and students.”

In recent years, several frameworks and self-assessment tools have been developed internationally and nationally to assist educators in identifying their training needs and providing targeted training opportunities (Pettersson, 2018) – such as in Røkenes & Krumsvik (2016). In Europe, the Digital Competence Framework for Educators (*DigCompEdu*; Redecker, 2017) has become the reference for the EU’s school systems. The European Commission has coordinated also a multistakeholder initiative to build and deploy a self-reflection tool to assist schools in integrating digital technologies into teaching, learning, and evaluation: *SELFIE* (Bocconi et al., 2020).

However, there is no general consensus about how to *measure* such competences.

2.2.2 POLICIES FOR TEACHERS' PROFESSIONAL DEVELOPMENT AND TDC

TDC have often struggled in climbing the political agenda. Whereas policies clearly articulate pupils’ competences, TPD is often overlooked, giving leeway for varied approaches and failing in the attempt to close teachers’ gaps (Ottestad, 2010).

In order to make an impact, TDCs must be embedded in policies at different levels of the educational system (Dexter, 2008; Newland & Handley, 2016; Wastiau et al., 2013). For instance, Dexter (2008) emphasizes the importance of regional or municipal policies that may subsequently be translated into concrete goals and activities at the school level.

Furthermore, TPD is a critical factor only insofar it directly impacts on the instructors’ propensity to develop teaching and learning activities using ICT (Wanjala, 2016). To this end, Wastiau et al. (2013) emphasize the importance of informal learning environments, professional online learning communities, and other sorts of TPD efforts that are tightly interwoven into teachers’ regular practices. Analogously, Dexter (2008) stressed the importance of local or regional school networking, where expertise and practices in DC may be exchanged inside and beyond school contexts – as observed in the context of the European initiative *eTwinning* (Pettenati et al., 2021).

In this landscape, digital technologies – and data analytics in particular – offer new opportunities for policymakers to shape education policies, including TPD policies (Vanthienen & De Witte, 2017). Instefjord & Munthe (2016) and Krumsvik (2012) have identified an emerging need for information on how to incorporate DC into institution-wide policies.

2.2.3 THE ITALIAN CONTEXT

Italy is a relevant empirical field to analyze the dynamics of policymaking regarding TCD, as it has witnessed significant evolutions over time. The Ministry of Education has published in 2016 a *National Plan for Digital Education* (PNSD), to promote the use of ICT, stimulate innovation, redesign TPD activities, and boost students’ DC (Bocconi et

al., 2020). The PNSD is a pillar of *La Buona Scuola* school reform (Law 107/2015) – the latest overall reform of the Italian education system –, which tackled several issues including teachers’ recruitment and TPD in general (Bocconi & Panesi, 2019).

By means of this reform, TPD stand out as an element of pivotal importance across all education levels, although it was downsized in successive amendments. The reform, however, did not intervene on the governance of the education system, which is highly centralized especially in the management of teachers’ careers (OECD, 2013; p. 131). The Ministry has been vested with the responsibility to implement the reform also through the development of specific digital platforms, while regional actors remained involved only in the management and regulation of part of the vocational education system.

3. RESEARCH OBJECTIVE AND RESEARCH QUESTIONS

Starting from the analysis presented in section 2, our objective is to use the context of Italian policies for TDC development to further enhance the Policy Analytics framework. The high-level models illustrated in Daniell et al. (2015), De Marchi et al. (2016), and Tsoukias et al. (2013), in fact, are limited to a mere list of aspects and analytics not to be overlooked, but do not provide actionable tools and procedures to manage each phase of the policy cycle systematically. This has been done only in policy fields – such as environmental policy (Meinard et al., 2021) – that present features which differ from those of education policy.

Hence, we formulated the following set of research questions:

- RQ1. How do Policy Analytics roll out throughout the policy cycle, in the case of TDC?
- RQ2. Who are the main stakeholders and what roles do they have?
- RQ3. Which obstacles need to be overcome to build TDC development paths by leveraging the data available? What are the main benefits of such approach?

4. RESEARCH DESIGN

To reach conclusions as generalizable as possible, this research has been designed as an exploratory multiple case study, with the objective of filling the current gaps in the theoretical background regarding both PAn and DC.

We adopt as holistic unit of analysis the policy package (PP), defined as the set of policies, processes, instruments, documents, and actors that preside over a specific policy area (Fischer & Miller, 2017) – where the policy area under consideration is that of TDC.

We selected two relevant cases via empirical setting – i.e., as unique cases in Italy that address the development of TDC making use of specific analytics:

1. the PP steered by the Ministry of Education at the national level and centered upon the digital platform SOFIA¹ – unique in terms of relevance within the Italian education system and in terms of degree of centralization in the management of teachers’ careers;
2. the PP developed by Regione Liguria and its in-house IT service provider Liguria Digitale, based on the project *Scuola Digitale Liguria* (SDL) and its Observatory on Innovative Projects (OIP) – unique in terms of centrality and activism of regional actors in the fields of teacher training and educational innovation.

¹ Acronym for *Sistema Operativo per la Formazione e le Iniziative di Aggiornamento del personale della scuola* (tr. Operating System for the Training of school staff), available at: <https://sofia.istruzione.it/>

Case	Interviewees	Mode	Duration	N. of interviewees	N. of items
National PP	1. DG, Ministry of Education	Video	45 mins	4	9
	2. Executive, Ministry of Education	Video	60 mins	1	9
	3. Executive, Ministry of Education	Phone	15 mins	1	4
	4. Executive, Ministry of Education	Email	–	1	9
	5. Researcher, European Commission JRC	Video	45 mins	1	7
	6. Researcher, Indire	Video	60 mins	1	7
	7. University Professor	Video	30 mins	1	7
Regional PP	8. Executive and Consultant	Video	135 mins	2	9
	9. Head, Digital Team	Video	60 mins	1	9
	10. Schoolteacher	Video	45 mins	1	6
	11. Schoolteacher	Video	45 mins	1	6
	12. Schoolteacher	Video	45 mins	1	6
	13. Schoolteacher	Video	45 mins	1	6
	14. Director, Regional School Office	Video	45 mins	1	9
	15. DG and Official, Regione Liguria	Video	45 mins	2	9
			12 h	20	–

Table 1. Summary of the interviews performed

We collected data through the triangulation of multiple data feeds: semi-structured video interviews (primary source) and written interviews, e-mails, websites, reports, and journal articles. The primary data source consisted of 15 interviews with pivotal figures with leading roles in the two case studies appointed, carried out between July and October 2021 (Table 1).

Our protocol consisted of three sets of semi-standardized questionnaires, slightly varying depending on the case and on the type of interviewee. The interviews were recorded and then transcribed verbatim; all respondents were assured anonymity and provided access to both recordings and complete transcriptions.

Each interview was then coded using the Gioia Methodology with a deductive approach, employing the steps of the policy cycle as aggregate dimensions and different sets of theory-driven categories as 2nd-order themes, grouping the 1st-order concepts that emerged from coding texts either *in vivo* or paragraph by paragraph (Gioia et al., 2013). Figure 1 illustrates an example extracted from our coding tree.

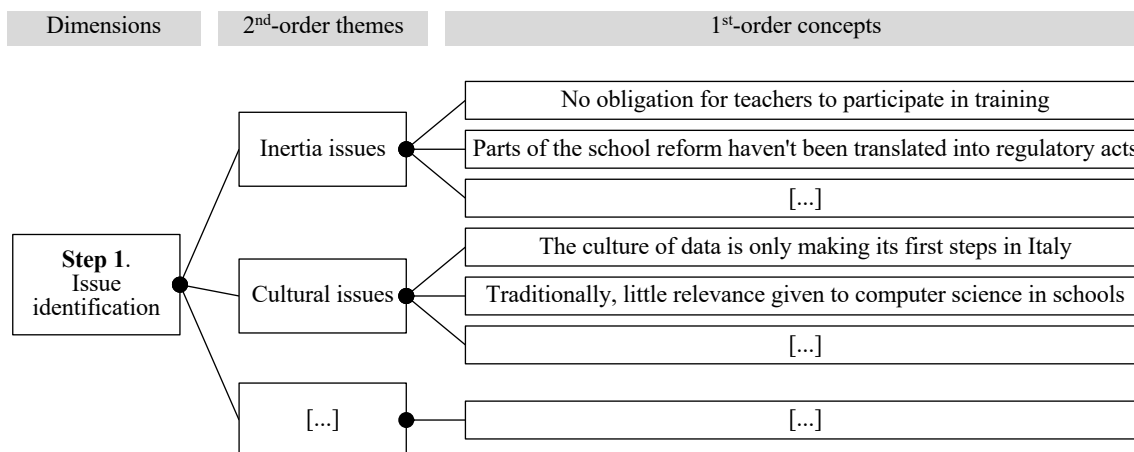


Figure 1. Extract of the coding tree

5. RESULTS

The results of our qualitative analysis have been synthesized graphically in a policy cycle “wheel” (Figure 2) and in a set of propositions about the deployment of PAn.

5.1 PROPOSITION 1: HETEROGENEITY AND FRAGMENTATION

The national PP is characterized by multiple databases containing information on teachers, a constellation of information silos. For instance, a national Digital School Observatory has been established since 2015, but it has been ineffective in collecting data about the activities carried out in schools, and it is not connected to other platforms. According to Int. #1, “the integration of data to generate knowledge to inform decision-making is a very difficult step to be done, for now” as “information systems do not communicate with each other. [...] They are all disconnected worlds.”

Teachers’ demand for ICT-related courses is growing, but SOFIA’s environment is “limited to a showcase to match supply and demand. It does not perform well in terms of indexing” (Int. #6). Also, “ICT-related training funded by European resources is generally not covered by SOFIA” (Int. #2).

Within the regional PP, the Observatory on Innovative Projects “allows teachers to share their projects and ideas. It is very useful, because an instructor can access it and search for a certain type of project by category” (Int. #12). The OIP “has never been a mere list of projects but a scientific collection of data. It was intended to represent a sort of dashboard for the Region, that could guide digital investments and innovations” (Int. #8). Furthermore, the OIP “is not a repository. [...] It has all the potentialities and possibilities of integration with other datasets, through web services or any other type of mechanism of application cooperation, and it is accessed using digital identity” (Int. #12). Integrating regional and national data (included that of regional school offices), however, is only “an emerging theme” (Int. #14).

Nonetheless, schoolteachers are not yet used to explore the map to design new didactic activities: “Honestly, I do not consult the Observatory, I have never exploited it [...] but it has given me other possibilities. The fact of having a reference [...] regarding all the activities around it” (Int. #9).

This leads to formulating the first proposition:

Platforms, datasets, and frameworks are very heterogenous and fragmented; integration and interoperability are the first priorities to fully benefit from PAn, otherwise limited to the sharing and monitoring of good practices.

5.2 PROPOSITION 2: DATA CULTURE AND ANALYTICAL SKILLS

As the key figures of SDL claim: “the real difficulty regarding data is not to have it, but to organize it, and above all to make people understand its value.”

SDL has structured a continuous process of data analysis and has concentrated different skills within the project team: “we have all the capacity to use the data gathered, and we use these data for all the activities, i.e., everything we do starts from and is traced back to the Observatory, or it is documented inside of it” (Int. #8). However, other stakeholders are not taking advantage of such wealth: “nobody has asked for our data yet [...] as the other regions are far behind about the theme of data, back to the Stone Age” (Int. #8).

The regional school office – the territorial office of the Ministry – is not in the same situation: “Within our office there is no person or group that systematically analyzes data,

each official presides over an entire area. [...] There is no precise statistical analysis [...] while we know that in Liguria Digitale they have the capabilities to do so” (Int. #14).

The Ministry, instead, is equipped with the right skills and more than adequate resources, but it does not push for in-depth analyses to take advantage of PAN: “About 11 people work in our internal statistical office, however data processing is a service that is entrusted to our external supplier [a consulting firm]. I do not know precisely how many people they employ for this, but it a consistent group, I think about 20 people” (Int. #1).

Nonetheless, also at the regional level the monitoring approach is focused on outputs, not outcomes, and no structured evaluation has been designed, e.g., to assess the impact of experimental elements that have been introduced incrementally over time. As a result, steps 4 (testing), 5 (finalization), and 7 (monitoring and evaluation) of the policy wheel (Figure 2) have been little enriched by our analysis, in relative terms.

This leads to the formulation of the second proposition:

A pervasive culture of data is required for policymakers and stakeholders to adequately integrate PAN in the cycle. Poor culture translates into non-structured data analyses, lack of testing, and basic monitoring and evaluation activities.

5.3 PROPOSITION 3: CENTRALIZED POLICIES VS DISPERSED ECOSYSTEMS

The national PP encompasses the participation of numerous stakeholders: “With Invalsi we have carried out an activity [...] to enable the certification of teachers’ competences. Then there is Indire which carries out a series of activities in this sector, and in parallel we also have a collaboration with the National Centre for Research, in particular with the Institute of Educational Technologies. [...] Then we also collaborate with the Department for Digital Transformation, for the national strategy for digital competences” (Int. #2).

SOFIA itself originated from the proposal of various stakeholders – including unions – who wanted to optimize the management of teacher training; also, “the platform [...] is placed within the Ministry of Education, but it is managed by Indire” (Int. #2) and “the IT company that takes care of the management of the platform SOFIA is the same that deals with the collection of its data” (Int. #1).

Moreover, private accredited bodies provide educational activities on the platform, while other actors will be increasingly engaged: “non-profits that are already active in the digital field may provide support. [...] These processes may be originated either by professionals in the digital sector, creating courses for teachers, or by groups of teachers with high levels of DC, who create courses for other colleagues, as well as by organizations such as bank foundations or trade unions” (Int. #6).

As for SDL, the network of stakeholders is explicitly described as “a series of concentric circles” (Int. #8), centered on the most innovative teachers identified in the initial phases of the project. Then “schools, teachers and regional officials contributed to the creation of the contents, because they validated together with us the project proposal.”

Stakeholder involvement in SDL has been serendipitous though always translated into structural project features: “We have given answers to a series of subjects who may have not been immediately identified as stakeholders” but “the role that stakeholders played for us has been to make us authoritative and to be perceived as a point of reference on the territory. On the other side, they have been clever, because they understood that we were the only ones who had created a database of contacts covering almost all teachers in the region” (Int. #8).

Hence, we have observed two very different approaches: many stakeholders participate in the national policy cycle, but their role has not been structured and decisional process

and data sharing are highly centralized; at the regional level, instead, policy management, PAn, and conscious stakeholder involvement has been characterized as a key feature of the project. This leads to formulating the following proposition:

While policymaking and policy management can be highly centralized, the stakeholders' ecosystem is extensive and dispersed. Successful use of PAn depends on the structural integration of such network in the decision-making process.

5.4 PROPOSITION 4: ENABLING FACTORS AND HINDERING FACTORS

Lack of system interoperability is not the only obstacle to a full PAn approach.

First, there is hostility towards teacher training: “There are groups of people who want to move forward, and there is an overwhelming majority who refuses to take this leap. [...] I perceive teachers' advanced age as a very significant, as the average age of Italian teachers is above fifty. Thus, being innovative is challenging” (Int. #11).

The lack of a clear regulation reinforces (and is caused by) this issue, as claimed by several interviewees: “Teachers move on the edge of this strong ambiguity: they have to do it [training], but then in the end if they do not, it does not matter” (Int. #5).

Hostility towards training is coupled with that against assessment: “It would be significant to create a culture of self-reflection by teachers [...] which is very complex due to the nature of this competence [...] and to the fact that within not only the Italian culture but also the European one, teachers' evaluation has never been made or foreseen, it has always been controversial” (Int. #6).

Cross vetoes and political instability hinder the solution to such hostility: “Policymakers have raised awareness around the issue [...] but the everchanging political seasons with the related decisions and governance, prevent us from carrying out a perfect, or imperfect, plan. [...] It is a problem caused at a central level, rather than in territories, because [...] in the end territories always make do. [...] That fundamental piece is always lacking because Ministries and Department Heads keep changing [...] It is not feasible anymore, it takes too much time to hand over each task, to rebuild a chain of command” (Int. #6).

SDL, on the other hand, is struggling in having a sizeable impact on teachers' behavior: “Personally, I go check and look around it every now and then, also out of my personal and professional curiosity. [...] Although I must say that it has never happened to me personally to contact colleagues to discuss and collaborate with them” (Int. #13).

The methodological basis has created a common ground, since “the project is centered on the value of teaching documentation”, but “currently, few principals understand that their schools are on the map. If they do not use it, they think the map states: this school has no innovative project. This is a dramatic fact for a school and it does not encourage formal collaboration from school principals” (Int. #8).

This leads to the formulation of the fourth proposition:

Conceptual frameworks enable analytical approaches; However, political instability, the lack of precise regulatory acts, and stakeholders' inertia are the main threats to continuous policy innovation.

5.5 PROPOSITION 5: SHORT-TERM AND LONG-TERM BENEFITS

Despite the functional limits, SOFIA has achieved important results: “At the moment, over 400,000 teachers and over 6,000 educational institutions are registered” (Int. #3). This brings concrete administrative benefits: “SOFIA contains the functions that allow the administration to calculate the resources to be distributed annually to the training centers. [...] We had never been so quick in doing so” (Int. #2).

Within SDL, however, stakeholders perceive a much wider range of benefits: “The OIP is one of the most important benefits that is in front of everyone's eyes, available to all. [...] it makes visible everything Ligurian schools do, and allows you to get in contact with teachers interested in the same topics, technologies, or methodologies” (Int. #10).

Above all, SDL is for teachers “An important network for sharing good practices, a real community [...] to periodically consult or ask for advice on some topics, or even in general. The professional dialogue among teachers has remained very active even after the ending of the activities” (Int. #11) – including during the pandemic.

More effective investment decision, however, are an explicit goal also at the regional level: “Specific investments on teachers and trainers have been allocated not with an identification of the needs *a priori*, as it often happens in a regional administration, but through an immersion in the needs that arise from the community. The training plan was born as a bottom-up project” (Int. #8).

This leads to formulating the final proposition:

Sharing of good practices and better targeted investments are quick wins of a PAN approach; deeper impacts on the policy targets can be obtained only with a systematic implementation.

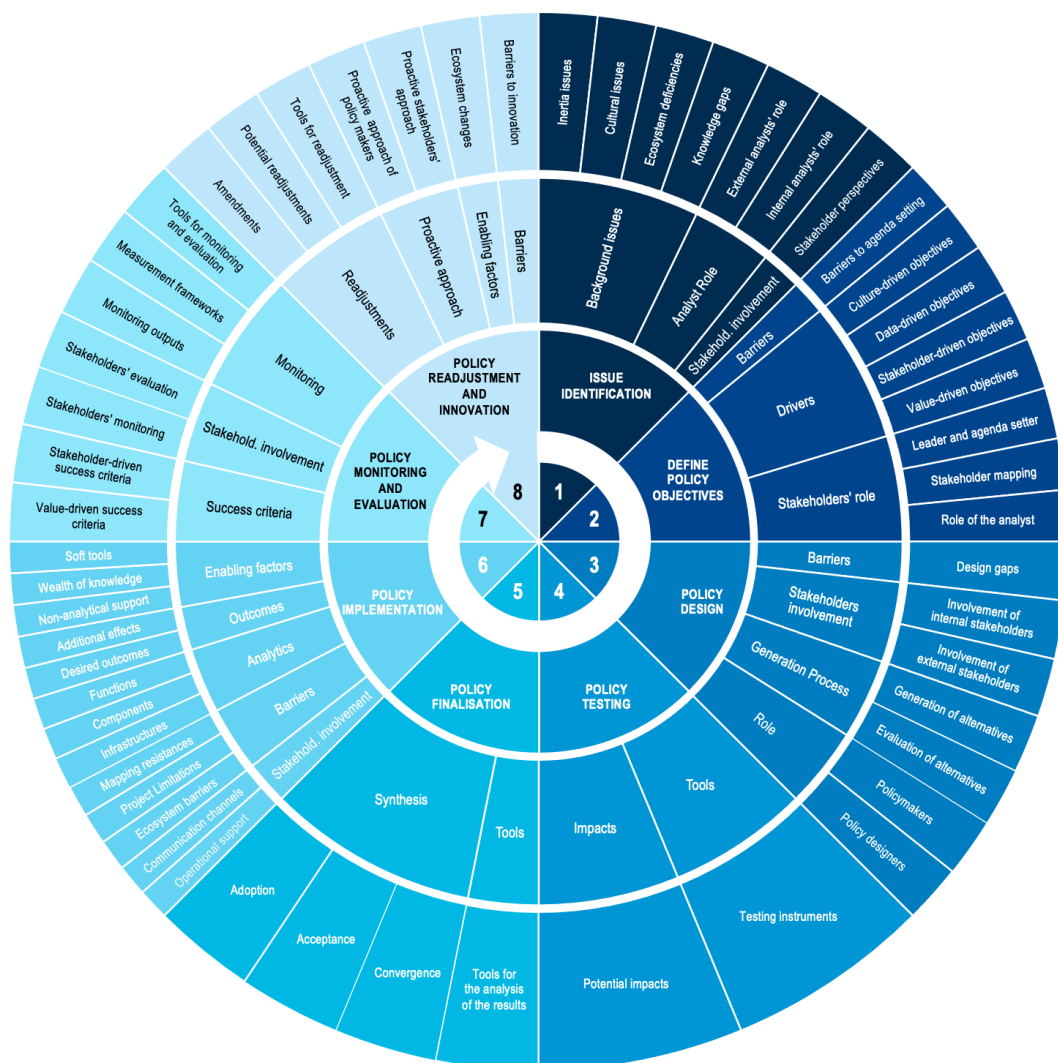


Figure 2. The Policy Analytics wheel for Teachers' Digital Competence development

6. DISCUSSION

Our research contributes to expanding and structuring the general PAn framework (the inner circle in Figure 2; see Tsoukias et al., 2013) by detailing each step of the policy cycle, with relevant implications also for policy and practice.

6.1 THEORETICAL IMPLICATIONS

The case study clearly illustrates how limiting the analysis of evidence-driven decision-making to research evidence loses sight of a plethora of analytical instruments and complementary leverages. We have seen with TDC that the ecosystem is populated by different platforms and databases, managed by and stemmed from different stakeholders, enabling varied analytical approaches. This characteristic is pivotal both in policy formulation and in its implementation.

However, so far, PAn research has underestimated the impact that this shift in perspective has in terms of skills requirements and system interoperability. Moving from EBP to PAn reduces but does not solve the high need for skills and requires more structured processes for inter-organizational collaboration.

Furthermore, a policy approach that relies on diffused evidence could struggle in context where data culture is scarce. Once again, while EBP and its critics focused on the cognitive limits of decision-makers, PAn can still be hindered by a poor overall analytical culture – though it structures processes that internalize such bounded rationality.

One of the main theoretical contributions of our work, in fact, deals with detailing how the role of stakeholders rolls out throughout the policy cycle. Each step requires a specific type of stakeholder involvement, to enable participation and transparency without freezing decision-making.

The final picture has clear implications also for continuous policy innovation: while EBP constrains policy innovation to research cycles (typically medium-long term horizons), PAn continuously provide feedback and fuel multiple cycles – depending on the decisional level, the evidence produced, etc. – that foster agile, accretive, and experimental readjustments and innovation over time.

6.2 POLICY AND MANAGERIAL IMPLICATIONS

Implications for policy and public management are manifold though quite straightforward. First, the policy cycle is inherently instable and serendipitous, but such non-linearities can be managed and actually provide opportunities for stakeholder involvement and for the creation of analytical tools that support decision-making.

Second, PAn do not imply a complete shift of focus from policymaking to policy management. PAn enable layering of tools, of interactions with actors, of decisions; decision-makers should structure the decision processes in order to translate different analytical results into either strategic, tactical, or operational decisions.

Third: as in the case of TDC, a relevant share of the evidence that comes into play is represented by qualitative data, which is in turn integrated with community activity. Organizations that want to benefit from PAn should structure processes that enable the analysis, interpretation, and integration into decisional phases of such information.

Lastly, PAn open up windows of opportunity to review highly centralized policy packages, shifting towards higher degrees of collaboration, subsidiarity, and even decentralization. Through the analysis of different types of evidence, decision-makers can allocate decisions at the optimal level, involving the legitimate stakeholders, benefiting from high volumes of data collected at the central level.

7. CONCLUSIONS

Perdurable political instability, generalized shortage of digital competences, complex governance of the education system, and structural rigidities in the management of the teaching workforce qualify Italy as a powerful context to test PAn.

We have been able to move PAn forward, since the features described in the literature with respect to EBP were not sufficient to operationalize policy analyses as in the case of TDC. To do so, our research has produced five propositions and an extensive policy wheel to further advance the integration of analytics into policy decision processes.

Furthermore, the final model can be interpreted as a checklist to be followed in order to fully benefit from policy analytics.

Such checklist has been developed in light of the two cases studied, which are placed at different maturity stages in the use of PAn. While SDL has structured processes that enable continuous policy innovation and cover most of the steps of the policy cycle, the national policy arena lags behind in benefiting from existing (and rich) analytics.

To summarize the key messages of our work, with reference to our RQs:

- RQ1. Each phase of the policy cycle requires specific sub-processes, depicted in Figure 2; interoperability is key in order to unfold the potentialities of PAn;
- RQ2. The network of stakeholders is always very extensive and dispersed, with a key role played by research centres, teachers' communities, but also private actors (NPOs and providers); the regional level itself qualifies as a key (underrated) stakeholder involved and to be involved in the national PP;
- RQ3. Obstacles are both cultural, contextual, and organizational. Having developed conceptual frameworks to classify TDC enables the deployment of PAn, but without a systematic approach the benefits remain limited.

Nonetheless, the study presents some limitations to be tackled by future research.

First, both cases are not conscious applications of the PAn approach. This has resulted in the impossibility to properly observe stages like policy testing, policy finalization, or to fully separate monitoring and evaluation.

Second, although the Ministry is a pivotal actor in education, the cases are limited to the education system and to TDC. Future studies should target other regions,² other education policy areas, and more in general other policy fields.

Third, the model could be consolidated by improving data triangulation – accessing the data collected by SOFIA and SDL – and by simplifying its structure to make it more readable and applicable by policymakers. Data disclosure and the adherence to open data guidelines should be taken into consideration, too.

Uttermost priority, however, should be given to coupling studies on teachers and on data-driven policymaking with studies on students and on policy impact. Without an idea of the impact on students (and on their wellbeing), digital competences and education policy itself are at risk of being perceived as superfluous and burdening structures.

² For example, Lombardy and Autonomous Province of Trento have created structured projects, also financed by European funds and in collaboration with national actors like Indire, to foster innovation in teaching with a focus on digital competences.

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