Strategic alliances for smart territories: building data-driven capacity in public administration

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Abstract
This paper analyses how a coordinated partnership model among central agencies, academia and territorial authorities translates a national strategy into measurable capability for data-driven governance, recognising that fragmented upskilling often stalls digital transformation, whereas structured alliances can scale impact rapidly. The study builds on smart-territory governance and mission-based training models, extending earlier work with urban platforms and open data by aligning roles within a single, nationwide capacity pipeline. We conduct a descriptive evaluation of the Smart Territories Training Programme (STTP) delivered through strategic alliances, using programme records across four modules (10.5h, 24h, 14h, 36h), participant analytics, and evidence from tutor-guided deliverables to assess engagement, completion, regional coverage, and the production of Local/Regional Action Plans – explicitly aligned with Portugal's National Smart Territory Strategy (NSTS) data-centric priorities. Over nine months, the alliance delivered over 250 training hours in multiple concurrent editions, engaging more than 900 public servants and issuing more than 2,100 certificates (Module 1: 836; Module 2: 681; Module 3: 559; Module 4: 95), with success rates between 76% and 94%. Participation covered all regions (Centro: 32%; Norte: 20%; Lisbon Metropolitan Area: 17%; Alentejo: 14%; Algarve: 5%; Madeira: 4%; Azores: 3%), with 95% from local administration. A routine of welcome and framing, expert masterclass, quizzes and hands-on exercises, supported by tutors, reduced cognitive friction, fostered communities of practice, and generated actionable Local and Regional Action Plans aligned with NSTS's priorities and future digital-twin readiness. For academics, the findings operationalise alliance governance as a testable mechanism for organisational learning at a territorial scale; for practitioners and policymakers, they offer a replicable playbook – shared governance, mission-based pedagogy, concurrent cohorts – to accelerate analytics adoption without geographic constraints. The paper demonstrates that strategic alliances convert national ambition into interoperable capability, de-risking digital transformation and building a durable skills infrastructure for data-informed public administration.

Keywords: capacity-building; local action plans; urban management platforms; e-learning; digital transformation.

1. Introduction
Over the past decade, debates on smart cities and territories have shifted progressively from a narrow focus on technological infrastructures to a broader concern with governance, territorial cohesion, and data-informed public policy. Early contributions framed smart

cities as urban spaces where investments in human and social capital, traditional and modern communication infrastructure, and participatory governance promote sustainable economic growth and quality of life [1]. Subsequent work emphasised the interplay between technology, people and institutions in smart city initiatives [2], while more recent research has proposed integrated perspectives on smart city governance that combine innovation management, institutional design and stakeholder collaboration [3], [4]. This literature increasingly extends beyond the metropolitan focus of smart cities and informs the emergent notion of "smart territories", understood as multi-scalar, data-driven governance arrangements that seek to align urban and non-urban areas with broader sustainability, cohesion and digital transformation agendas [5], [6]. Also, it is relevant to mention that smart cities are more than technological constructs; they are governance laboratories where innovation is balanced by ethical standards, civic trust, and institutional accountability [7].

Within this evolution, smart governance has become a central analytical lens. Rather than treating smartness as a purely technological attribute, studies highlight the importance of institutional capacity, transparency and multi-actor collaboration for achieving sustainable outcomes [8], [9]. Smart governance approaches stress that digital platforms, sensors and analytics only generate public value when embedded in coherent frameworks that support data sharing, cross-jurisdictional coordination and meaningful citizen engagement. At the same time, reviews of policy and governance research in smart cities underline the growing relevance of artificial intelligence (AI), data analytics and automation for public decision-making, and the associated risks of fragmentation, bias and opacity if institutional capabilities do not evolve at the same pace [10]. These debates provide a crucial backdrop for national strategies that aim to generalise smart governance principles across diverse territorial contexts, from metropolitan regions to smaller municipalities and inter-municipal communities.

In parallel, the notion of digital transformation in the public sector has moved beyond the digitalisation of services to encompass deeper organisational and cultural change. Digital transformation is now widely understood as a process in which public organisations redesign structures, processes and service models around data-enabled capabilities, often requiring new forms of collaboration with citizens, businesses and other public entities [11]. Recent work on strategic information systems for the public sector has reinforced this interpretation, arguing that successful digital transformation depends on aligning technology investments with organisational strategy, skills and governance arrangements [12]. At the local level, empirical studies of municipal digital governance in smart city projects show how diverse institutional trajectories and capacity profiles shape the ways in which digital tools are adopted and used [13]. In this context, guidance on smart city data governance stresses the need for robust frameworks to ensure data quality, interoperability, ethics and security, particularly when multiple actors and levels of government are involved [14].

Portugal's National Smart Territories Strategy (NSTS) is situated at the intersection of these debates, providing a national framework for transforming territorial governance

through data-driven decision-making and digital infrastructures [15]. NSTS articulates a set of strategic objectives that include improving access to territorial data, strengthening data analytics, enabling real-time monitoring of critical governance domains, simulating the impacts of policy options, and promoting innovation, circular economy and public safety, supported by integrated systems. Its architecture is organised around a set of core outputs, such as a Public Policies Dashboard, Digital Twins, a Smart Territories Portal and a Local Authorities Observatory, underpinned by urban management platforms and interoperable data systems. Among NSTS's strategic objectives, capacity-building and literacy occupy a central position, recognising that the effective use of these infrastructures depends on the skills and practices of public officials at different levels of administration, as demonstrated in Figure 1. At the national level, this shift has also required a dedicated public administration school capable of consolidating knowledge, aligning training with strategic priorities and supporting the capability demands associated with digital and territorial transformation.

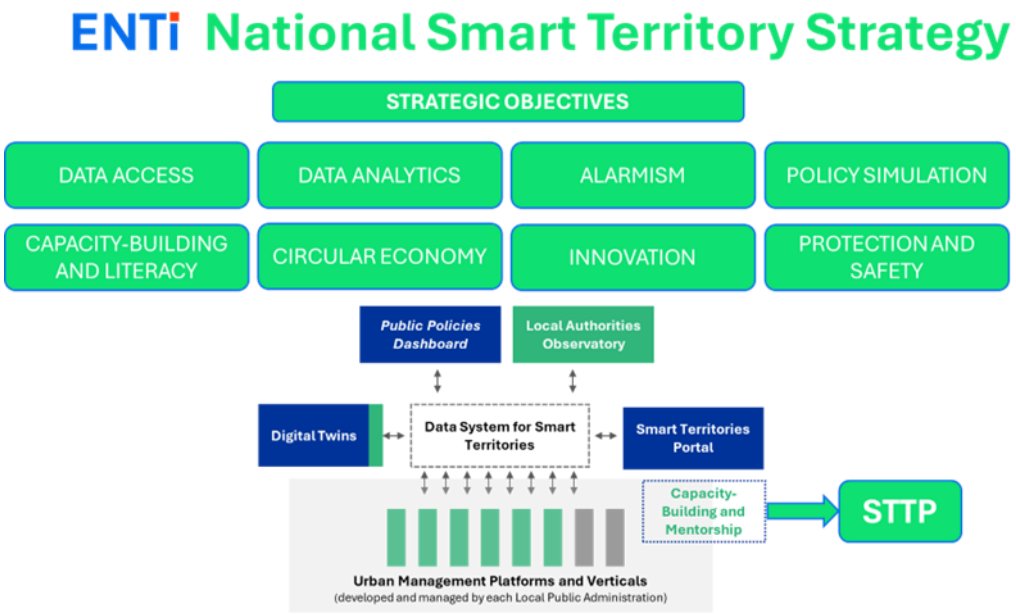


Fig. 1. NSTS architecture and Smart Territories Training Programme (STTP) inclusion
Source: NSTS (adapted)

Among the national institutions responsible for enabling this capacity-building and literacy objective, the National Institute of Administration (INA) plays a central role. As the public body mandated to train and develop Portugal's civil servants and senior managers, INA has progressively positioned itself as an integrative hub of knowledge, connecting academic research, administrative practice and emerging policy priorities. Its institutional vision – "mobilising the public administration towards knowledge, and mobilising knowledge towards the public administration" - reflects a long-term commitment to building a continuous learning infrastructure and to fostering communities of practice capable of supporting complex reforms such as NSTS. In this context, INA's contribution extends beyond the delivery of training: by translating strategic national objectives into situated

learning pathways and by mediating between conceptual frameworks, organisational needs and implementation challenges, INA functions as a key mechanism for transforming broad digital and territorial ambitions into operational capability across the public sector.

The international literature reinforces this emphasis on capability and capacity. Studies of evaluation capacity building argue that the sustainable use of data and evidence in public organisations requires the development of individual competencies, supportive organisational cultures and enabling systems [16]. Broader analyses of state capability highlight how complex public-sector reforms often fail when they are not accompanied by deliberate strategies to strengthen problem-solving capabilities and learning processes within bureaucracies [17]. Recent contributions on government analytics further stress the need to design data suites, analytical routines and feedback mechanisms that privilege problem solving and learning, rather than narrow compliance, if data-driven reforms are to improve public sector performance [18], [19]. At the same time, empirical work on digital transformation in European public administration shows how legacy systems, institutional silos and uneven skills can constrain the implementation of ambitious digital strategies [20]. These insights collectively suggest that robust capacity-building initiatives must accompany national smart territory strategies if they are to move beyond high-level vision and deliver concrete territorial outcomes.

The Portuguese context mirrors these challenges. Evidence from workers in the public sector points to persistent gaps in digital skills and the need for structured training initiatives that address not only basic digital competencies but also more advanced analytical and data governance capabilities [21]. At the same time, research on adaptability to change within public administration under the "future of work" paradigm indicates that managers and employees face increasing pressures to adjust to new technologies and organisational forms, often with limited support structures [22]. Against this backdrop, capacity-building programmes that combine conceptual grounding, practical application and multi-level participation become critical instruments for translating national digital and territorial strategies into operational practice.

It is within this policy and research landscape that the Smart Territories Training Programme (STTP) was conceived and implemented. Directly linked to NSTS and funded under the Portuguese Recovery and Resilience Plan (RRP), the STTP was designed as a national-scale training initiative to empower public administration, particularly at the local and regional level, for smart, data-informed territorial management. Developed through a strategic alliance between central administration bodies and academia, the programme brings together institutions such as the INA, the Agency for Technological Reform of the State (ARTE), the General Directorate of Local Municipalities (DGAL), the Foundation for Studies and Training in Local Administration (FEFAL) and NOVA Information Management School (NOVA IMS). Its structure comprises four modules, organised in missions and combining synchronous e-learning, masterclasses and practical exercises, with the explicit aim of equipping participants to engage with territorial data, urban management platforms and the design of Local and Regional Action Plans.

This article examines the STTP as a case of strategic alliance for innovation in public administration and as a concrete capacity-building instrument for implementing NSTS. It analyses how the programme's structure and educational model were designed in alignment with international evidence on smart territories, digital transformation and adult learning, and how the resulting training offer has contributed to building a skills infrastructure for data-informed territorial governance. The paper is organised as follows. Section 2 presents the structure of the training plan, clarifying its modules, target profiles and connection to NSTS's architecture. Section 3 discusses the education model underpinning the programme, highlighting its blended design and mission-based approach. Section 4 reports the main quantitative and qualitative results, with particular attention to participation, success rates and the programme's role in supporting the development of Local and Regional Action Plans. Section 5 concludes by reflecting on the implications of the STTP for the implementation of national smart territory strategies, outlining future work and acknowledging key limitations.

2. Training Plan Structure

The STTP was conceived as a structured capacity-building intervention directly aligned with the architecture and strategic objectives of NSTS [15]. Rather than a stand-alone course, the STTP was designed as a modular pathway that could be scaled nationally and adapted to the diverse profiles of public administration staff involved in territorial governance, directing it to be a on-the-job training, an important function for developing general technological competence and usage [23]. Its structure reflects the dual imperative identified in the literature on digital transformation and smart governance: on the one hand, dealing with legacy systems, fragmented data and uneven capabilities; on the other, creating the conditions for collaborative, data-driven decision-making in multi-actor settings [8], [9], [20].

Institutionally, the STTP is anchored in a strategic alliance that brings together central government bodies and academia. INA assumed the role of training provider within the public administration ecosystem, while ARTE, DGAL, and FEFAL provided strategic direction and ensured that the STTP was embedded in broader public sector modernisation policies. NOVA IMS was responsible for the scientific coordination and content development in the fields of smart territories, data governance, and analytics. This configuration mirrors what the collaborative governance literature describes as a joint decision-making arrangement in which public agencies and knowledge institutions share resources, risks and responsibilities to address complex policy problems [17], [24]. In the case of NSTS, the problem at stake is how to turn national ambitions for smart, sustainable territorial development into concrete local action supported by robust analytical capacity.

2.1. Smart Territories Training Programme Architecture

The STTP's architecture consists of four modules, organised in missions and delivered predominantly through synchronous e-learning, complemented by asynchronous work. Module 1, "Leadership and Innovation in Smart Territories", comprises three missions delivered in three sessions, totalling 10,5 training hours. It introduces participants to the core concepts of smart cities and territories, the multiple dimensions of sustainability and the role of innovation in territorial development, while framing digital transformation and data-driven governance as leadership challenges rather than purely technical issues.

Module 2, "Innovation and Data in Smart Territories", is more extensive, with six missions delivered over six sessions and a total of 24 hours. It deepens the analysis along the six strategic dimensions of smart territories – economy, society, mobility, environment, quality of life and governance – combining conceptual framing with national and international case studies and emphasising data governance, privacy, ethics and security.

Module 3, "Local Action Plan", is structured as one mission with four sessions and 14 hours, following NSTS's guidelines for developing, implementing and monitoring Local and Regional Action Plans. It guides participants through the articulation of strategic and operational objectives, indicator selection, alignment with local priorities and the design of implementation and monitoring arrangements.

Module 4, "Applied Analytics to Smart Territories", is also organised as a single mission, delivered over six sessions with a total of 36 hours, and is dedicated to strengthening technical skills in territorial analytics. It covers descriptive, and to some extent predictive and prescriptive, analytical techniques applied to domains such as territorial characterisation, environment, quality of life, tourism and smart services, with an emphasis on transforming raw data into actionable insights for policy and management. Figure 2 shows what was previously explained.

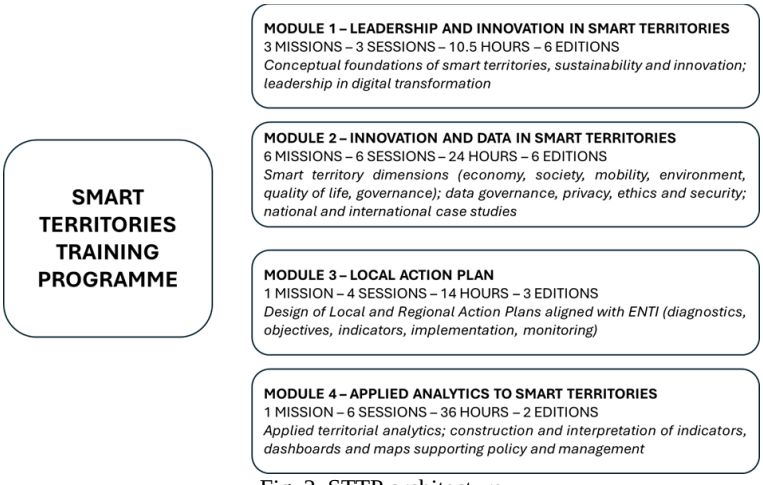


Fig. 2. STTP architecture
Source: STTP

2.2. Connection to National Smart Territories Strategy

This modular structure is closely tied to NSTS's architecture and outputs. Modules 1 and 2 provide the conceptual and strategic basis for understanding smart territories, the role of data and the implications of digital transformation for territorial governance, thereby preparing participants to interpret and use instruments such as the Public Policies Dashboard, Digital Twins and urban management platforms. Module 3 translates these concepts into the concrete design of Local and Regional Action Plans that are aligned with NSTS's strategic objectives and share common guidelines on structure, indicators and governance arrangements. Module 4 then equips participants, particularly technicians and analysts, with the analytical competencies required to populate, interrogate and interpret territorial data systems, so that Local and Regional Action Plans are not merely formal documents but are supported by evidence and ongoing monitoring. In this sense, the STTP operationalises NSTS's capacity-building and literacy objective by linking training content to the tools and processes that underpin data-informed territorial management [14], [19].

2.3. Profiles

The target audience and training paths were defined to reflect the heterogeneity of public administration actors involved in territorial governance. Four main profiles were identified as the primary recipients of the STTP: local administration decision-makers; local administration technicians and middle managers; central government decision-makers; and central government technicians and middle managers.

The structure was designed so that participants in leadership positions would obtain a broad understanding of smart territories, digital transformation and strategic planning through modules 1 to 3, while technical staff could complement this pathway with the more demanding module 4 on applied analytics. In practice, the STTP also attracted other professionals with prior knowledge in data analysis and visualisation tools, contributing to a richer peer learning environment and reinforcing the emerging community of practice around smart territories. From a capacity-building perspective, this differentiation across profiles reflects the idea that effective implementation of complex reforms requires aligned but distinct competence sets at political, managerial and technical levels [16], [17]. The capacity to structure differentiated learning paths for political, managerial and technical profiles reflects the role of national training institutions in interpreting the diverse competence needs of public administration and translating them into coherent, scalable learning architectures.

The sequencing of modules and missions also responds to practical constraints identified during the design phase. Public servants face significant time pressures and operate within organisations where legacy systems, fragmented data repositories and limited analytical support are still relevant [11], [20]. The STTP structure, therefore, aims to balance depth with feasibility: short, focused missions, a clear narrative connecting concepts, strategy and application, and progressive exposure to more technical content. As summarised in Figure 2, the four modules, their duration and mission structure form a coherent training pathway that supports both initial sensitisation and more advanced analytical capacity. In doing so, the STTP provides a concrete example of how a national smart territories strategy can be translated into a scalable, modular training offer that reaches multiple levels of public

administration while remaining directly connected to the tools and processes that underpin data-driven territorial governance. Figure 3 presents the overall process of the different training paths and expected training hours.

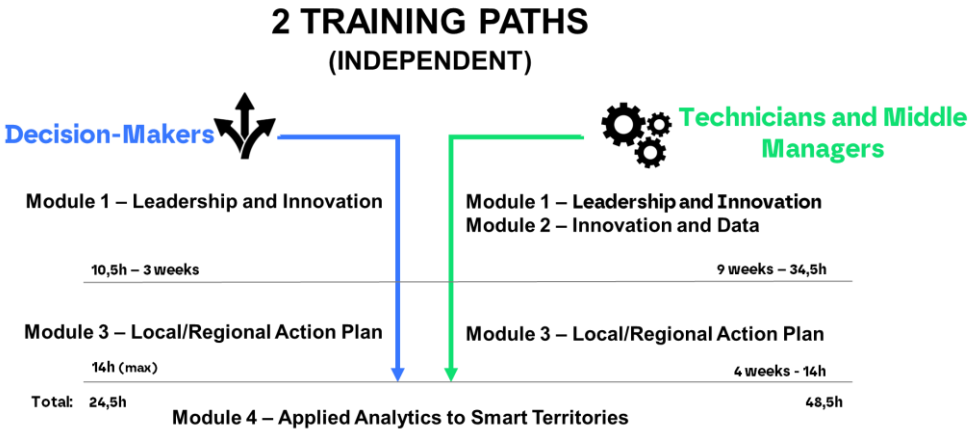


Fig. 3. STTP training paths
Source: STTP

Such design coherence also reflects the broader experience of national public administration schools, which routinely balance pedagogical rigour with the organisational constraints faced by civil servants, ensuring that large-scale training programmes remain both feasible and impactful.

3. Educational Model

The educational model of the STTP was designed to respond simultaneously to substantive policy goals and to very clear constraints of public administration practice. From the outset, the STTP had to accommodate geographically dispersed participants, heterogeneous professional backgrounds and demanding work schedules, while sustaining engagement over several months of training. To address these conditions, the STTP adopted a predominantly e-learning model, combining synchronous sessions with asynchronous work hosted on a dedicated platform for sharing materials, experiences and deliverables. Real-life elements were brought onto the STTP, adopting a problem-based approach, allowing to develop real-world competencies to solve concrete challenges [25]. This model was not conceived merely as a logistical solution, but as a deliberate pedagogical choice aligned with evidence that well-designed blended and online formats can outperform or match traditional approaches in terms of performance, attitudes and engagement, particularly when they integrate opportunities for interaction, feedback and self-paced consolidation [26], [27].

Structurally, the STTP was organised around “missions”, which served as the basic pedagogical unit in each module. Each mission followed a relatively stable sequence designed to support adult learners in making sense of new concepts and immediately connecting them to their own professional realities. Sessions typically began with a short

welcoming and framing moment, in which trainers outlined the objectives of the mission, recalled its positioning within the overall module and clarified expectations regarding participation and deliverables. This was followed by a masterclass delivered by an invited specialist, where key notions related to smart territories, digital transformation, data governance, or territorial planning were introduced and illustrated with real examples. The masterclass component provided the conceptual backbone of each mission, but it was deliberately integrated with a wider sequence that included quizzes, guided discussion and practical exercises, thereby avoiding a purely transmissive model. In line with research on blended learning, which emphasises the importance of autonomy, relatedness and competence for sustained engagement [27], participants were encouraged to use quizzes and short reflective tasks not only to test their recall but also to situate the content in their own organisational and territorial contexts.

The design of the STTP explicitly drew on principles of adult education and professional learning. Participants were experienced public servants, often with significant responsibilities in local government, inter-municipal bodies or central administration. The STTP therefore assumed, in line with andragogical perspectives, that adults bring prior knowledge, are problem-centred rather than subject-centred, and are more motivated when they see a clear connection between training content and their immediate work challenges [28]. This assumption materialised in several ways. First, case studies and examples were frequently drawn from Portuguese municipalities and regions, or from international experiences that could be meaningfully related to NSTS and to the RRP. Secondly, the missions invited participants to work with their own territorial data, strategic documents and organisational constraints, rather than hypothetical scenarios, especially in the modules devoted to Local and Regional Action Plans and applied analytics. Thirdly, interaction was framed as a key resource, since participants were encouraged to share difficulties and emerging solutions, thereby building an informal community of practice around smart territories.

Attention was also given to the cognitive and temporal load imposed by the sessions. The STTP's designers recognised that most participants would be joining from their workplace, often in the middle of competing priorities, and that long, uninterrupted expository sessions tend to erode attention and reduce learning outcomes in online environments. The structure of synchronous sessions – framing, focused masterclass, quiz and discussion, followed by practical work – was intended to segment attention demands and to alternate between listening, active recall and application. Meta-analytic evidence suggests that such blended designs, which intersperse content delivery with interactive and practice-oriented activities, tend to produce more favourable results in terms of performance and engagement than purely lecture-based or purely online self-study formats [26]. In the STTP, practical exercises were not positioned at the margins of the programme, but at its core, as they were the mechanism through which participants progressively built the components of their Local and Regional Action Plans or developed basic analytical artefacts, such as simple dashboards or maps, that could underpin future territorial decision-making. Figure 4 summarises this model, depicting the core phases of each mission and the main learning modalities associated with them.

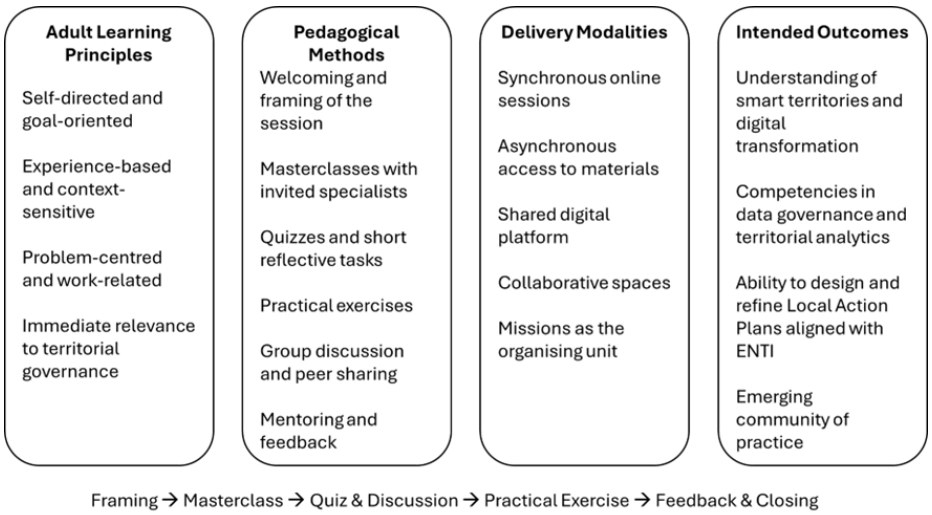


Fig. 4. Educational model of the STTP
Source: STTP

The digital platform used in the STTP served several pedagogical functions beyond simple content hosting. It operated as a shared space where participants accessed readings, slides and recordings, submitted their deliverables and engaged in asynchronous exchanges. This configuration supported the continuity of learning between synchronous sessions and allowed participants to revisit complex material at their own pace, a feature that is particularly important in data-intensive domains where concepts and tools may require repetition and experimentation. At the same time, the platform supported the STTP's aspiration to foster a community of practice by making visible the diversity of territories and institutions represented in each cohort and by opening channels for cross-territorial exchange, contributing to the emergence of informal networks that can prove valuable for the future implementation of the NSTS. From a capacity-building standpoint, such networks are consistent with the view that sustainable improvements in public sector performance depend not only on individual skills but also on collaborative routines and shared problem-solving repertoires [16], [17].

So, the educational model was conceived to support different "learning spaces" within public administration. For decision-makers, the emphasis was on strategic framing, governance choices and the capacity to interpret and use analytical outputs in steering territorial policy. For technicians and middle managers, the model provided more intensive exposure to data governance, indicator design and analytical techniques, especially in the Applied Analytics module. This differentiation, made explicit in the definition of training paths, reflects the recognition that digital transformation and smart territorial governance require complementary competence profiles across organisational levels [11], [20]. By combining a mission-based blended model, a shared platform for interaction, and carefully structured pathways for distinct profiles, the STTP educational model sought to translate international evidence on blended and adult learning into a pragmatic design capable of operating at a national scale under the constraints of everyday public administration. Table

1 links the principal design challenges identified during the STTP's conception and delivery.

Table 1. Main Design Challenges of the STTP

Main Challenges	Solution
Territorial dispersion of participants	E-learning model, with synchronous sessions and asynchronous work
Scalable capacity	Solid educational model, with a step-by-step approach, replicable and conceptually tested
Sharing knowledge and experiences	Dedicated platform designed to share materials, experiences, deliverables and specific communication challenges
"One-size-fits-all" training experience	Personalised and interactive approach, individually and with learning groups, building an informal community of practice
Availability of participants	Creation of several editions, with different time schedules and dates, having modules occurring simultaneously

Source: STTP

4. Results

The implementation of the STTP produced robust quantitative and qualitative results when compared with similar large-scale training initiatives in public administration in Portugal. Over a period of nine months, more than 250 hours of training were delivered across four modules, using a mission-based, predominantly online format. The combination of synchronous e-learning sessions, asynchronous work and practice-oriented assignments translated into high completion levels in all modules, despite the diversity of participants and the competing demands of their professional roles. In line with evidence that well-structured blended formats can sustain engagement and performance in complex learning contexts [26], [27], the STTP managed to maintain both scale and depth while operating entirely within the constraints of public-sector working schedules.

4.1. Participants and Conclusion Rates

At a module level, the STTP reached a substantial number of participants and generated a significant volume of certified training. Module 1 ("Leadership and Innovation in Smart Territories") was delivered in six editions, totalling 63 training hours and resulting in 836 conclusion certificates. Module 2 ("Innovation and Data in Smart Territories") also had six editions and 144 hours, with 681 conclusion certificates. Module 3 ("Local Action Plan") was offered in three editions, with 42 hours and 559 conclusion certificates, while Module 4 ("Applied Analytics to Smart Territories") comprised two editions, 72 hours and 95 conclusion certificates. In aggregate, the four modules generated 2,171 conclusion certificates, reflecting a substantial investment in smart territories-related competencies across the Portuguese public administration.

Success rates were consistently high: 76% in Module 1 (836 out of 1,097 participants), 87% in Module 2 (681 out of 784), 83% in Module 3 (559 out of 674) and 94% in Module 4 (95 out of 101). These figures indicate that the STTP was able to move beyond initial enrollment and sustain participation through to completion, which is particularly relevant in an online, multi-module format addressed to working professionals. Table 2 summarises these results by module, detailing the number of editions, participants and conclusions rates by edition, presenting a overall success rate across the different modules.

Table 2. STTP in numbers

Modules	Edition	Participants (n.º)	Conclusions (n.º)	Success rate (%)
Leadership and Innovation in Smart Territories	1st	255	134	76%
	2nd	198	156	
	3rd	224	163	
	4th	218	196	
	5th	107	97	
	6th	95	90	
Innovation and Data in Smart Territories	1st	138	107	87%
	2nd	138	123	
	3rd	129	116	
	4th	181	154	
	5th	103	98	
	6th	95	83	
Local Action Plan	1st	288	240	83%
	2nd	276	219	
	3rd	110	100	
Applied Analytics in Smart Territories	1st	59	57	94%
	2nd	42	38	

Source: STTP

4.2. Territorial Coverage

Territorial coverage was equally significant. All Portuguese regions were represented among the participants, with a distribution that reflects both demographic and administrative patterns:

- 32% from Centro region;
- 20% from Norte region;
- 17% from Lisbon Metropolitan Area;
- 14% from Alentejo region;
- 5% from Algarve region;
- 4% from Madeira;
- 3% from Azores.

In institutional terms, around 95% of participants came from local administration (municipalities, inter-municipal communities, metropolitan areas), while the remaining 5% represented central administration bodies and private entities involved in territorial governance. This profile is consistent with NSTS's emphasis on empowering local and regional authorities as key actors in smart territorial development [15]. It also aligns with international evidence showing that successful digital transformation and smart governance depend on strengthening capabilities at the sub-national level, where many implementation decisions are actually taken [6], [11], [13].

4.3. Qualitative Results

Beyond participation and completion metrics, the STTP produced a set of qualitative outcomes that speak to its role as a capacity-building instrument. Feedback collected during and after the modules emphasised the value of the STTP in providing a structured pathway from conceptual understanding of smart territories and digital transformation to the concrete design of Local and Regional Action Plans.

Participants reported that the missions, practical exercises and mentoring components helped them translate NSTS's strategic objectives and guidelines into locally grounded plans, incorporating territorial diagnostics, objective-setting and indicators in a coherent way. While the specific content of these plans is not detailed here, their production and refinement within the STTP illustrate how training can be integrated with real policy design tasks, aligned with the view that effective capacity building should be integrated in day-to-day problem-solving rather than detached from practice [16], [17], [18].

4.4. Digital Literacy

The results also indicate that the STTP contributed to strengthening digital and analytical competencies in areas directly connected to territorial governance. For many participants, particularly technicians and middle managers, the STTP offered a first systematic exposure to concepts such as data governance, interoperability, privacy and security in smart territories, as well as to basic analytical tools for territorial characterisation, environmental monitoring and service planning. This is especially pertinent in light of evidence that public sector workers frequently identify gaps in digital skills and the need for targeted training to cope with ongoing digital transformation [21], [22].

The high success rates in the more demanding "Applied Analytics" module suggest that, when training is carefully aligned with participants' roles and supported by practical, context-specific exercises, civil servants can engage meaningfully with analytical content and integrate it into their professional repertoire. From the perspective of government analytics, this reinforces the idea that building the skills infrastructure required to use dashboards, digital twins, and other NSTS outputs depends on combining both technical instruction with opportunities to work on real data and policy questions [19], [29].

4.5. Main Takeaways

The STTP appears to have fostered emerging communities of practice around smart territories. Participants from different regions and administrative levels reported that sharing experiences and challenges, often similar despite diverse territorial contexts, was one of the most valuable aspects of the training. The dedicated platform and the mission-based structure facilitated ongoing exchanges, enabling participants to compare approaches to Local and Regional Action Plans, discuss the use of indicators and reflect on organisational obstacles to data-informed decision-making.

Such cross-territorial networks are consistent with recent calls for capacity-building approaches that move beyond individual skill acquisition to include organisational learning and collaborative problem-solving [30], [31]. In the STTP, achieving and even surpassing the programme's quantitative targets, while at the same time generating this type of

learning community, suggests that the combination of strategic alliances, modular structure and blended educational model provided an effective vehicle for advancing NSTS's capacity-building and literacy objective and for supporting more sustainable, efficient and smarter territorial governance.

5. Conclusions, Future Work and Limitations

The STTP was conceived and implemented as a central instrument for NSTS's operationalisation in Portugal. Building on a strategic alliance between central administration bodies and academia, the STTP sought to bridge the gap between the high-level ambitions of NSTS, namely centred on data-driven, sustainable and collaborative territorial governance, and the everyday capacities of public servants responsible for implementing policy at a local and regional level [15]. The analysis presented here shows that a mission-based, modular and predominantly online training offer can, within a relatively short period, reach a large and diverse group of public officials, provide them with a coherent conceptual and practical framework for smart territorial governance, and support the design of Local and Regional Action Plans aligned with national strategic objectives.

Conceptually, the STTP illustrates how an alliance-based approach to capacity building can translate global debates on smart governance, digital transformation and state capability into a situated national intervention. The STTP's structure reflects an understanding of smart territories that integrates technological infrastructures, data governance and institutional arrangements, in line with contemporary analyses of smart city and territorial governance [1], [3], [5], [8]. At the same time, its emphasis on evaluation capacity, analytical competencies and evidence-informed planning resonates with broader work on state capability and government analytics, which stresses that reforms premised on data and digital tools will only succeed when public organisations are equipped to ask meaningful questions, interpret information and adjust their practices accordingly [16], [17], [18], [19]. In this sense, the STTP can be seen as a practical instantiation of these ideas, adapted to the institutional architecture, territorial diversity and policy priorities of Portugal.

From a practical perspective, the STTP has made a tangible contribution to NSTS's capacity-building and literacy objectives. The combination of four modules, targeted training paths, and a blended educational model enabled the STTP to address distinct competence needs across decision-making and technical roles, while maintaining coherence as a single training offer. The high completion rates, broad territorial coverage and strong presence of local administration indicate that the STTP succeeded in mobilising the key actors responsible for implementing smart territorial policies. For many participants, the training appears to have provided not only new conceptual tools but also clear opportunities to work with territorial data, design or refine Local and Regional Action Plans, and engage in dialogue with peers facing similar governance challenges. This responds directly to evidence of digital skills gaps and the pressures associated with ongoing digital transformation in the public sector [11], [21], [22], suggesting that carefully

designed, context-sensitive training can help public servants navigate these changes more confidently.

Looking ahead, several avenues for future work emerge. A priority concerns the development of more systematic evaluation strategies to track the medium- and long-term effects of the STTP. The present analysis is largely descriptive and focuses on immediate outputs such as participation, completion rates and the production of Local and Regional Action Plans. Future research should examine whether and how participation in the programme leads to changes in organisational practices, decision-making processes and territorial outcomes, for instance by analysing the integration of NSTS-related tools, such as dashboards, digital twins and urban management platforms, into routine governance, or by studying how Local and Regional Action Plans are implemented, monitored and revised over time. Such work would benefit from the frameworks developed in the government analytics literature, which emphasise the importance of designing data suites and feedback mechanisms that support problem-solving and learning rather than mere compliance [18], [29].

A second line of development affects the refinement and diversification of the training offer itself. The STTP provides a solid foundation in smart territories, digital governance and applied analytics, but there is scope to develop advanced tracks tailored to specific thematic domains, to particular types of territories, or to emerging technological trends, notably AI and more sophisticated predictive analytics [10], [31]. Further integration between the STTP and other capacity-building initiatives in the Portuguese public administration ecosystem could also be explored, ensuring that training on smart territories is embedded in broader competence frameworks for public servants and aligned with career development paths. In addition, sustaining and deepening the communities of practice that have emerged around the STTP may require explicit support mechanisms, such as alumni networks, thematic working groups, or follow-up sessions focused on specific implementation issues.

A third avenue relates to comparative and multi-level perspectives. The Portuguese experience with NSTS and the STTP speaks directly to international discussions on how sub-national governments can be empowered to design and implement smart specialisation and smart territorial policies [6], [13]. Comparative studies with other national or regional training schemes for smart cities and territories could shed light on different governance models, incentive structures and pedagogical approaches, helping to identify which elements are context-specific and which might be transferable. Such work could draw more explicitly on the collaborative governance literature [9], [24], examining how alliances between central agencies, local authorities and academic institutions are formed, sustained and adapted over time, and how they influence policy implementation trajectories.

These contributions should be interpreted in light of several limitations. First, the analysis presented here relies primarily on programme records and descriptive indicators, complemented by qualitative feedback collected during the training. It does not include a counterfactual or control group, nor does it attempt to attribute specific changes in territorial governance or policy outcomes directly to the programme. As such, the findings

should be understood as indicative of the STTP's potential and immediate achievements, rather than as definitive evidence of its impact. Second, the observation window is relatively short, and many of the tools and governance arrangements they envisage will take time to stabilise. Third, feedback data, although rich in practical insights, is subject to the typical limitations of self-report, including possible social desirability bias and the underrepresentation of less engaged participants. Finally, the paper format itself, with its space constraints, necessarily limits the depth of analysis that can be devoted to specific territories, organisational contexts or pedagogical dynamics.

Notwithstanding these limitations, the experience of the STTP offers a clear lesson: national smart territory strategies will only achieve their objectives if they invest systematically in the capabilities of the public servants who must interpret, adapt and enact them. By articulating a coherent conceptual framing, a modular training structure and a blended educational model grounded in the realities of Portuguese public administration, the STTP demonstrates that it is possible to move from rhetoric about data-driven, smart and sustainable territories to real, large-scale capacity-building interventions. STTP can be seen as both a product and a driver of Portugal's broader digital transformation efforts, contributing to the emergence of a more analytically equipped, collaborative and territorially aware public administration.

Finally, the STTP reinforces the importance of having a national institution capable of convening and sustaining strategic alliances between central agencies, territorial authorities and knowledge institutions. The programme's co-design and coordinated delivery illustrate how collaborative governance arrangements can de-risk digital transformation, distribute specialised expertise and generate shared repertoires for problem-solving. In this sense, the experience demonstrates that national public administration schools can play a pivotal integrative role in large-scale reforms, acting as catalysts for institutional learning and supporting multi-level transitions towards data-driven territorial governance.

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