

An economic appraisal of the SE(C)AP public interventions towards the EU 2050 target: The case study of Basilicata region

Luigi Santopietro^{a,*}, Silvia Solimene^b, Manuela Lucchese^c, Ferdinando Di Carlo^d,
Francesco Scorza^a

^a University of Basilicata, School of Engineering, Laboratory of Urban and Regional Systems Engineering (LISUT), Via dell'Ateneo Lucano 10, 85100 Potenza, Italy

^b School of Engineering, University of Basilicata, Via dell'Ateneo Lucano 10, 85100 Potenza, Italy

^c Department of Economics, University of Campania Luigi Vanvitelli, Capua, Italy

^d Department of Mathematics, Computer Science and Economics, University of Basilicata, Via dell'Ateneo Lucano 10, 85100 Potenza, Italy

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ABSTRACT

Since 2008, among the European initiatives related to energy efficiency, the Covenant of the Mayors (CoM) has been one of the most important because of the significant engagement of small municipalities. The scope of the study is to understand how adherence to the EU CoM initiative by the municipalities has affected their expenditures in supporting and developing public energy efficiency investments, focusing on the analysis of the SEAPs. Two research questions are posed: firstly, exploring which are the main fields of intervention where municipalities have oriented their action plans on energy efficiency, published in SEAP (these being public lighting, education, and public buildings); secondly, the investment expenditure related to these fields of intervention that result from the first analysis and which are increased after SEAPs approval. The sample consists of 81 SEAPs evaluated and approved by the Joint Research Centre of the EU Commission of the Italian Basilicata municipalities in 2008–2021. The main result is that the education sector exhibits significant incremental changes in investment expenditures for each period, considering that, with reasonable certainty, this depends also on the CoM initiative.

1. Introduction

Climate change is one of the main issues that is being addressed globally through sustainable development initiatives, which entail the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (UN Secretary-General, 1987).

Energy efficiency is a priority; it includes reducing energy consumption, decreasing dependence on non-renewable energy sources, and reducing greenhouse gas (GHG) emissions to support economic development by protecting the environment and natural resources. (Wang et al., 2017).

Within the framework of the European policies, in 2008, the “20–20–20 package” (European Commission, 2020) ensured that the European Union (EU) met its climate and energy targets by the year 2020 on three key targets: 20 % cut in greenhouse gas emissions (from 1990 levels), 20 % of EU energy from renewables and 20 % improvement in energy

efficiency.

The same target of the “20–20–20 package” was pursued (but with a different baseline) until 2016 by a European initiative: the Covenant of Mayors (CoM 2020). This initiative gathers municipalities that are voluntarily committed to reducing their emissions by at least 20 %, in collaboration with city networks, to help municipalities achieve sustainable energy goals. (Rivas, Urraca, Palermo, & Bertoldi, 2022).

In reaching this target, CoM 2020 signatories developed and implemented Sustainable Energy Action Plans (SEAPs) (Bertoldi et al., 2018). In 2015, the Covenant of Mayors evolved into the Covenant of Mayors 2030 (CoM 2030), increasing up to 40 % of the minimum mitigation target for 2030 and including two new pillars: adaptation to climate change and securing sustainable, affordable access to energy. A year later, the initiative merged with the Compact of Mayors into the Global Covenant of Mayors for Energy & Climate (GCoM). The two initiatives, CoM 2020 and CoM 2030, coexisted for 5 years and the CoM 2020 signatories were able to submit their SEAPs until 2019 (Rivas, Urraca,

* Corresponding author.

E-mail addresses: luigi.santopietro@unibas.it (L. Santopietro), silvia.solimene@unibas.it (S. Solimene), manuela.lucchese@unicampania.it (M. Lucchese), ferdinando.dicarlo@unibas.it (F. Di Carlo), francesco.scorza@unibas.it (F. Scorza).

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Palermo, & Bertoldi, 2022).

From January 2016, municipalities could join the CoM 2030 initiative, committing to reduce the total GHG emissions in their territories and paving the way to a more resilient city by 2030 through the implementation of the SEAP into the so-called Sustainable Energy and Climate Action Plan (SECAP) (Rivas et al., 2021).

This requirement implies that Local Governments (LGs) enforce their commitment to climate (sustainable) goals. The roadmap of the commitments that the CoM signatories could provide is available infra Section 2.2.

Starting from the above motives, the aim of this paper is to understand how adherence to the EU CoM initiative by the LGs has affected their expenditures in supporting and developing public energy efficiency investments (within the green transition), focusing on the analysis of the SEAPs. The research only considers SEAPs, as the EU requirement for SECAP started in 2015, therefore the number of LGs that have published SECAP in 2008–2021 (observation period) is very small. The research is carried out in two main steps, which are also our research questions: 1) exploring which are the main fields of intervention in which municipalities have oriented their action plans on energy efficiency, published in SEAP. From this initial analysis, the authors deduced that public lighting, education (schools and school equipment and facilities) and public buildings sectors registered a relevant occurrence in terms of the energy efficiency interventions developed; 2) selection of the investment expenditure related to these sectors that result from the first analysis, in order to evaluate whether the voluntary commitment of municipalities affected their investment decisions.

This study offers a comparative analysis between investment expenditures before and after approved SEAPs so as to investigate whether municipalities have changed as a response to the voluntary commitment of the CoM. The authors observe investment expenditures, current expenditures and investment ratios related to approved SEAP sectors using the paired *t*-test method in different time ranges.

The authors focused on municipalities of the Basilicata Region (Southern Italy) because of the EU-27 CoM signatories, 49 % came from Italy. Thus, Italy is the first country per number of CoM 2020 signatories, and as highlighted by (Santopietro et al., 2021), over 70 % of the total CoM signatories are related to the “smaller” cities (i.e. under 10,000 inhabitants). The Basilicata region was selected because of the considerable number of CoM 2020 signatories (92 CoM signatories out of 131 total municipalities), and also as 92 % of these are small municipalities. Consequently, a sample size consisting of 81 SEAPs provided by the CoM signatories, was collected, evaluated and approved by the Joint Research Centre (JRC) in the period 2008–2020.

The relevant result is that the education sector shows the most positive impact of the CoM initiative because it is the sector that exhibits significant incremental changes for each time period considered.

This study contributes to providing an analytical framework to assess the CoM initiative impacts on LGs via the analysis of the expenditures in order to demonstrate the benefit of voluntary commitment (limited to the SEAPs provided) that CoM signatories affirm in scaling down global energy transition policies (Domorenok, 2019; Domorenok et al., 2020). It results in an innovative way to get advantages from the expenditure analysis in the complex evaluation procedure of the CoM initiative on the financial impact. Indeed, it improves the existing research on CoM impact assessment by providing a financial perspective on this topic to fill the gap in previous literature at local and regional levels. In addition, it contributes to exploring the elements that could lead the decision-making process on energy efficiency for the practitioners.

The paper is structured as follows: Section 2 illustrates the conceptual framework and the theoretical background, explicating the legitimacy and stakeholder theories within the energy efficiency policies related to Local Governments. Furthermore, it provides an overview of the CoM initiative, with a focus on the SE(C)AP considered a voluntary planning tool. Section 3 illustrates the research methodology design and the dataset investigated, while the main highlights of the research are

discussed in Section 4. Section 5 presents the conclusions and future perspectives of the research.

2. Conceptual framework and theoretical background

2.1. The legitimacy and stakeholder theories for social accounting: LG and energy efficiency policies

Applying a conceptual framework is useful because it enables the researcher to critically reflect on the phenomena under study, and to understand, evaluate, elaborate and assess, in this case, the accounting practices (Deegan, 2011). In accounting, positive theories predict or explain disclosure based on observations and their description (Deegan, 2011).

In an attempt to explain the evolution of the energy efficiency initiatives by municipalities within the CoM, this paper adopts the conceptual framework of the legitimacy and stakeholder theories. Specifically, (Marcuccio & Steccolini, 2009; Roberto et al., 2020) state that to justify the implementation of sustainability-promoting practices in the public sector, they are generally to be addressed in terms of Legitimacy Theory and/or Stakeholder Theory (Navarro Galera et al., 2014).

These are used to better understand the role that municipalities play in pursuing sustainability actions throughout the SEAPs and how they (should) communicate the achievement of these goals into the reporting system (Chen & Roberts, 2010; Deegan, 2002; Gray et al., 1995; Scott, 1987). There is an increased need for entities (business entities and public administrations) worldwide to be responsible for, and to, society. Consequently, there is an increased need for these entities to adapt their corporate approach to documenting and disclosing the Environmental, Social and Governance (ESG) performance. In first place, this implies that entities must integrate sustainability choices/actions into their strategic planning process (Lokuwaduge & Heenetigala, 2017).

Many theories explain the reasons for entities to provide ESG information. ESG reporting motives relate to regulations, standards, legitimacy and stakeholders (Deegan, 2014). (Deegan, 2002) states that an organisation can employ the reporting information to manage or manipulate the stakeholders to gain their support and approval or to avoid opposition and disapproval to obtain legitimacy. Managers will receive an incentive to be compliant with ESG issues and report them, mainly focusing on initiatives for which stakeholders have a particular interest in the organisation to suggest that they are conforming to stakeholder expectations (Bhattacharyya & Cummings, 2015; Deegan, 2002) in the business environment. There is increasing pressure on management to report sustainability (ESG) information to its influential stakeholders (Coleman, 2011); entities need to preserve and maintain their legitimacy to guarantee their survival.

Legitimacy theory states that organisations continuously try to ensure they carry out activities by social boundaries and norms (Deegan et al., 2002). By gaining legitimacy from the community around the entity, it can operate and use economic resources (natural resources and employees). Under the Legitimacy theory, social information is undertaken to accommodate different interests, expectations, and needs (Guthrie & Parker, 1990) which derive from a pluralistic world where, for example, a compromise between the social impact of an organisation and the economic impact of that organisation are required for legitimacy to operate. The need for legitimacy is usually associated with highly contested topics such as social and environmental issues (Deegan & Gordon, 1996; Guthrie & Parker, 1989; Patten, 1991). Organisations might conduct their operations in line with social and environmental accountability (Campbell, 2000). Specifically, the previous literature on the choice of public organisations to disclose sustainability issues recognises the legitimacy concept as (Dowling & Pfeffer, 1975; Navarro Galera et al., 2014) “social acceptance of organisations and their actions” (Etter et al., 2016; Rocca et al., 2021).

Over the last 20 years, the public sector in Italy has invested in a

series of reforms known as 'New Public Management' that have influenced the role of Public Administrations (PA), requiring the adoption of managerial behaviour (Giacomini et al., 2018; Mussari & Monfardini, 2010; Roberto et al., 2020).

Legitimacy theory considers the disclosure of voluntary information as a means by which organisations that want to gain or maintain legitimacy can potentially influence external perceptions of the organisation and public opinion (Deegan, 2007; Dowling & Pfeffer, 1975; Gaia & Jones, 2020).

Legitimacy is an organisation's strategic resource for survival (Dowling & Pfeffer, 1975). Although public organisations do not have to fight for survival and prosperity and do not face competition properly, they should always be oriented towards a good reputation of transparency and openness to the scrutiny of the stakeholders (namely citizenry). Consequently, even nonformalized pressure to report voluntarily, comes from stakeholders, and this is being perceived as a fundamental requisite to maintain legitimacy (Mussari & Monfardini, 2010; O'Donovan, 2002; Suchman, 1995).

According to (Lindblom, 1994), an entity gains legitimacy when its value system is congruent with the value system of its larger social system. Under the Legitimacy theory, an organisation must consider the rights of the public at large, not merely the rights of investors. Thus, this theory is used to explain why management undertakes specific actions, such as disclosing particular items of social and environmental information as part of its strategy (Lokuwaduge & Heenetigala, 2017), just because they need to legitimise the operations of the organisations.

The stakeholder theory is based on the proposal that, according to the Corporate Social Responsibility (CSR) model, a company has a responsibility towards all its stakeholders, including the shareholders and suppliers, customers, employees, the government, and society at large (Ferrell et al., 2011). Consequently, the entities' social and environmental reporting, refers to issues that are relevant to a wide range of stakeholders. These issues are not economic but can affect financial aspects (Jenkins, 2004).

Thus, since sustainability reporting and sustainability decision-making are closely connected with the stakeholders' needs, companies are obligated to fulfil these needs both within and outside the firms (Freeman & McVea, 2003). Addressing stakeholders' interests and needs in a sustainable business strategy is the primary goal of a company. The stakeholders' pressure could exert varying levels of power, legitimacy, and urgency, characterising the sustainability strategy as part of the larger business strategy (Mitchell et al., 1997).

According to (Chen & Roberts, 2010), the stakeholder theory recognises the diversity of stakeholder expectations and the potential conflict between them. Managing stakeholder expectations is crucial, especially in a public context. The accountability duties of local governments towards their stakeholders exceed those in the for-profit sector. Local government officials act as agents of the citizens who elected them. They must be accountable to the society for the authority they exercise (Barton, 2005). The disclosure of information about how the local area is managed represents a means to manifest their accountability to the stakeholders. Stakeholder theory expands Legitimacy theory as it helps to identify which stakeholder group expectations the organisation should take into account in order to comply with its social contract (Gaia & Jones, 2020; Gray et al., 1996).

This paper extends stakeholder and legitimacy theories by showing that municipalities use voluntary reporting to satisfy key stakeholder information needs and ensure that their policies and practices are consistent with the values and expectations of the community they represent. According to (Lai & Stacchezzini, 2021), times have changed. A number of incentives are now motivating organisations to enact sustainability practices in a more holistic and system-wide manner: corporate reporting is increasingly required not only to disclose social and environmental performance but also to communicate how sustainability is embedded within corporate vision and governance, informs business strategy and sustains financial performance. Indeed, a more

holistic, integrated representation of sustainability is increasingly required from companies by both financial and non-financial stakeholders. Engagement with the United Nations Sustainable Development Goals (SDGs) represents one of the more recent examples of sustainability-related disclosure (Lai & Stacchezzini, 2021). Several authors (Bouckaert et al., 2016; Guarini et al., 2021; Jones & Comfort, 2020) and international organisations such as United Cities and LGs emphasised the primary role that public administrations play in the preparation of policies, strategies and measures suitable for achieving these goals. Therefore, these SDGs could provide the normative framework to implement them nationally and locally (Guarini et al., 2022).

A relevant body of literature reviewed sustainability principles and SDGs in PA (Fiorino, 2010; Marques et al., 2021). In this field, saving energy and promoting energy efficiency are considered urgent global issues that require the strong commitment of international and national governments (Wang et al., 2017). For PA, engagement in promoting policies and actions to improve energy efficiency is an essential step towards lasting sustainability (Malandrino et al., 2019). In the last decades, government commitment has been evidenced by a number of initiatives (e.g. Agenda 2021; Rio + 20 "The future we want"; Agenda 2030) to improve the PA's energy and environmental performance.

Among the public authorities, LGs are the closest to citizens and, can therefore promote the sustainable use of natural resources through partnerships with citizens and private-sector entities operating in high-impact areas, such as agriculture, forests, and fisheries (Bisogno et al., 2023; Guarini et al., 2022). The proactive role of LGs in energy and climate change policies is necessary, as they could take the lead in the innovation and implementation of sustainability policies (Wang et al., 2017).

In recent years, many authors have analysed the topic of energy efficiency in local governments (Fiorino, 2010; Saha, 2009; Saha & Paterson, 2008). (Malandrino et al., 2019), pursued the goal of critically analysing Italian PA policies and strategies on the topic of energy efficiency. Through a literature analysis, they highlighted the strengths and weaknesses of the Italian PA in its attitude towards environmental sustainability issues. (Tozer, 2018), instead, analysed the sustainability plans of 15 Canadian municipalities to bring out the relationship between climate change and sustainability within the local government planning.

Nevertheless, some authors analysed such initiatives from a financial point of view. Financial resources and a solid financing system are crucial for the success of energy efficiency measures (Buntin, 2009; Eyraud et al., 2013; Sarkar & Singh, 2010). (Wang et al., 2017) explained the adoption of energy efficiency financing (EEF) strategies by US city governments.

CoM initiatives and, consequently, SE(C)APs, might be understood as initiatives needed to improve the energy and environmental performance of the Public Administration and which are able to shift paradigms from the current socio-economic perspective, so as to review them from the "sustainable" development point of view (Malandrino et al., 2019). In fact, this study interprets CoM commitments as a way for LGs to achieve SDGs, to report social and environmental performance but also to communicate how sustainability should characterize all the entity decisions (from the corporate vision to the business strategy throughout the financial performance).

2.2. The Covenant of Mayors (CoM) initiative: Theoretical background

The Covenant of Mayors (CoM) is an initiative within the European energy policies framework, started in 2008, which gathers local authorities through a voluntary adhesion in developing local interventions related to climate change and energy efficiency towards the ambitious target of climate neutrality (see Fig. 1).

In 2015, the CoM initiative evolved into the CoM 2030, extending the target year to 2030. The two initiatives, CoM 2020 and CoM 2030 coexisted for 5 years, and CoM 2020 signatories were able to submit

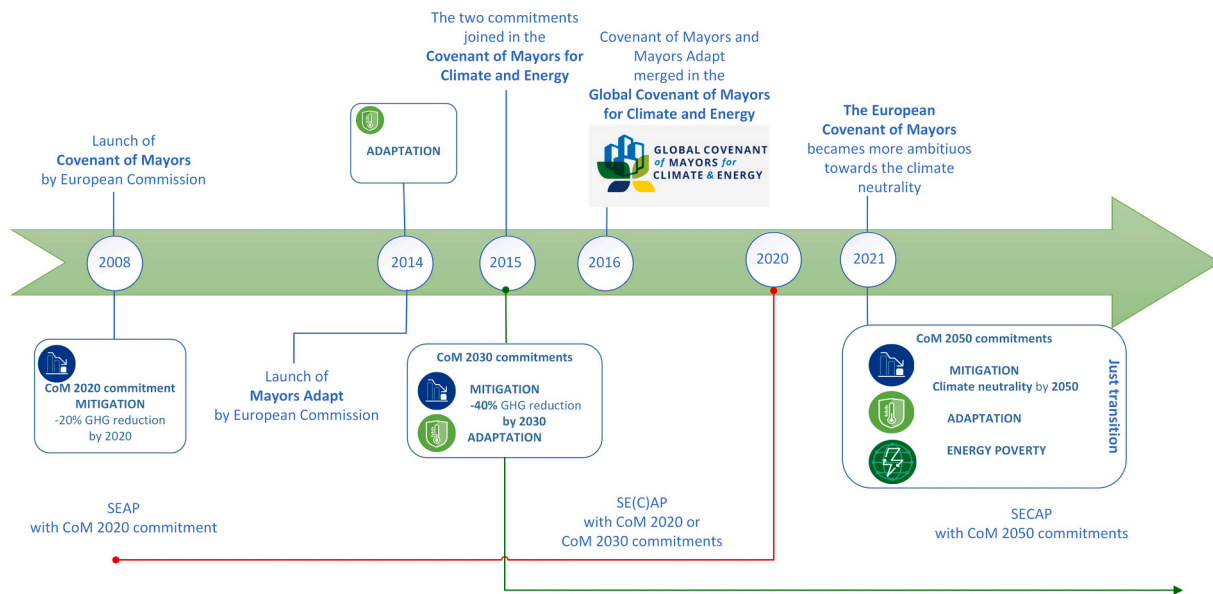


Fig. 1. CoM roadmap over the years, including the evolution of the signatories' commitments.

their SEAPs until 2019. In 2021, the European CoM became more ambitious (according to the (Regulation (EU) 2021/1119)) by including, in its framework, climate neutrality by 2050, upgrading the 2030 GHG emission reduction target to at least net 55 %, and including the energy poverty pillar.

This initiative was chosen because 67 % of the CoM signatories (7592 according to the MyCovenant dataset (Melica et al., 2022; Treville et al., 2021)) are XS municipalities (i.e. municipalities with <10,000 inhabitants), and this commitment of XS municipalities is relevant considering their technical and financial barriers (Rivas, Urraca, Palermo, & Bertoldi, 2022). The CoM has contributed to bridging this gap (del P Pablo-Romero et al., 2015; Reckien et al., 2015), supporting and empowering small municipalities to take action and highlighting their key role in climate transition. In this respect, the role of regional or provincial authorities acting as Covenant Territorial Coordinators (Melica et al., 2018), as well as the possibility granted to smaller signatories to develop joint action plans, have been instrumental (Covenant of Mayors for Climate & Energy Office, 2023). Moreover, SEAPs design actions through a standard set of sectors concerning environmental, social and urban themes rather than focusing only on specific sectors like energy (see (Reckien et al., 2014)).

As remarked by previous research (Santopietro & Scorza, 2021), SE (C)AP introduced a renewed approach towards voluntary planning that is relevant for those countries, similar to Italy, that are closely linked in a top-down approach to the development of urban planning (see also (Romano et al., 2018)).

Comparing the number of CoM signatories to the action plans evaluated and accepted by JRC (see Fig. 2), a gap emerges: of 11.183 signatories, 7.068 have submitted and approved an action plan. This gap is narrowing; in 2008, the ratio between approved plans and signatories was 10 %, while in 2022, it was at 63 %. From an overall view, it also shows how, from the initial enthusiasm linked to the first phase of CoM adhesion by the municipalities, some delays occur along the way, that political commitment brings to the implementation of actions on the territory. This is typical in many planning frameworks and represents a weakness also for the CoM initiative.

Concerning the two phases of CoM implementation, today, among the approved plans, 5980 are SEAPs with CoM 2020 commitment, while only 227 are SECAPs with CoM 2030 commitment.

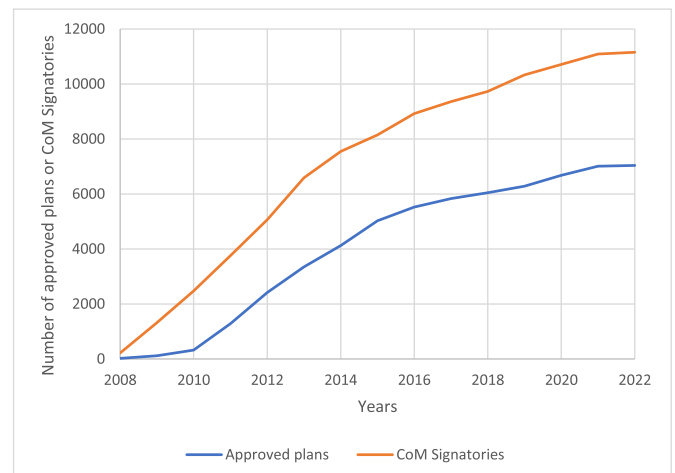


Fig. 2. Comparison between approved action plans and CoM signatories.

2.3. SE(C)AP as voluntary planning tool designing energy and climate interventions

According to the authors, the SE(C)AP is a “planning tool”. To be more specific, even if it doesn't belong to the entire sphere of planning tools that derive from the Italian normative planning framework which refers to the Italian National Planning Law 1150/1942 and the system of Regional Laws (in the case of the Basilicata Region, LR. 23/1999 (Regione Basilicata, 1999), it is currently adopted by municipalities as an effective operative tool to design and implement local urban development strategies and interventions in the sector of energy transition. We are in the case where the voluntary planning approach represents a more effective way to tackle the current planning issues despite the formal institutional spatial planning approach mainly overcharged by bureaucratic and technocratic constraints (Newman & Thornley, 2002; Romano et al., 2018). The CoM initiative offered the local communities with a way out to affirm the principles of strategic planning in a perspective oriented towards the usefulness of the results (see Fig. 3).

The CoM played a pioneering role in dealing with energy and climate considerations at a local level, which were long neglected by urban planning (Santopietro, Palermo, Melica, & Scorza, 2024). Previous

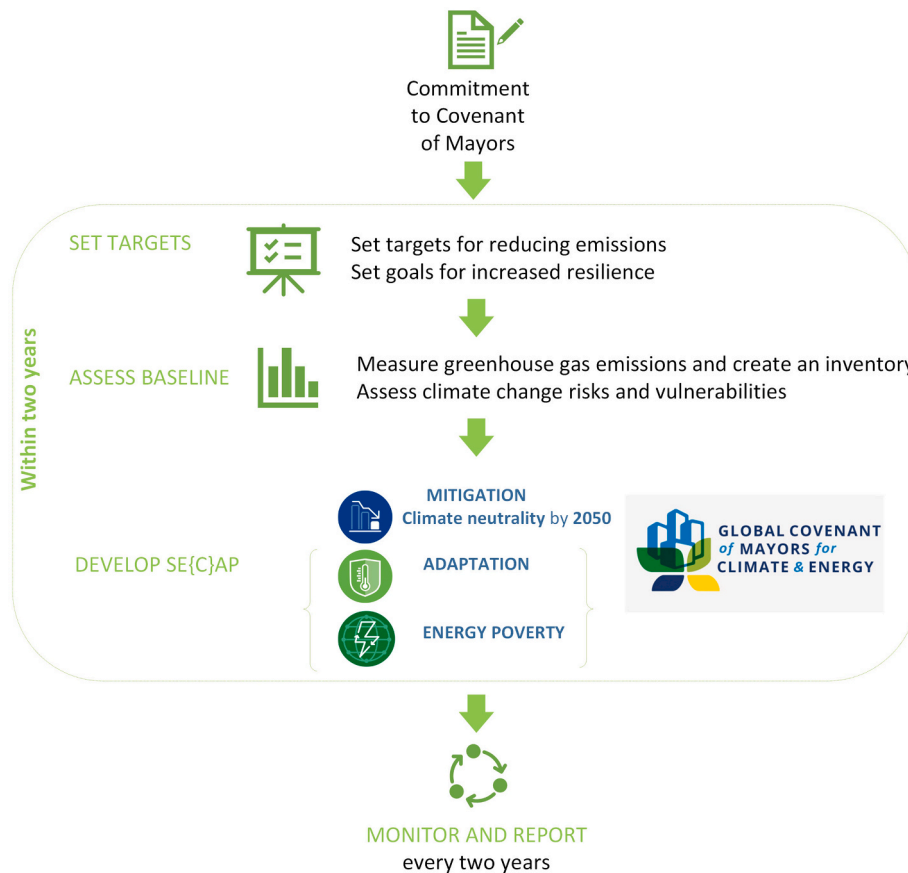


Fig. 3. CoM signatory roadmap.

works (Bernstein & Hoffmann, 2018; Biesbroek et al., 2009; Laukkonen et al., 2009; Madlener & Sunak, 2011; Palermo et al., 2020; Pietrapertosa et al., 2019; Reckien et al., 2018; van der Heijden, 2019; Zanon & Verones, 2013) explored the recent and emerging inclusion of climate and energy change in urban planning.

More specifically, (Pietrapertosa et al., 2019) highlight that climate action planning is one of the top priorities for cities to reduce greenhouse gas emissions and strengthen climate resilience. At the same time, improving mitigation and adaptation strategies in urban areas is crucial for sustainable development. (Reckien et al., 2018), by reviewing the local climate plans of 885 cities in the EU-28, find that the engagement of European cities in climate mitigation and adaptation efforts has been partially assessed and that how and why cities engage in climate policy is a matter of current debate. (Laukkonen et al., 2009) note that the integration of both mitigation and adaptation is crucial, as service infrastructures and planning structures are defined by functionality and spatial planning, whereas (Palermo et al., 2020) examine the distribution of policies that have been planned and implemented by CoM signatories to assess the presence of certain common factors influencing policies to achieve energy goals. (Zanon & Verones, 2013) suggest the activation of appropriate urban policies in pursuit of a less energy consuming, polluting and vulnerably-built environment. The last four researches (Bernstein & Hoffmann, 2018; Biesbroek et al., 2009; Madlener & Sunak, 2011; van der Heijden, 2019) address the need for renovated spatial planning practices for 'low carbon' policies and pathways in the challenge of decarbonisation, although there is no single indicator (e.g. energy use, citizen engagement or carbon emissions) that best capture the outcomes of effective urban climate governance. Moreover, the CoM can support climate planning processes where national or regional guidelines are lacking, as in many Southern and Eastern European countries and cities (Pietrapertosa et al., 2018; D.

Reckien et al., 2014).

Many remarkable features characterize the SE(C)AP process within its schema (see Fig. 4): CoM helps to advocate better multi-level governance on climate and energy issues linking the local level of municipalities to the national and international decision-makers, facilitating technical and financial support (Hendriks, 2018) under the subsidiary principle in planning.

3. Research design and methodology

The study was conducted in four stages with a descriptive analysis and quantitative research method (see Fig. 5).

The first stage of the descriptive analysis was performed on the SEAPs deriving from the MyCovenant platform (Melica et al., 2022; Treville et al., 2021). The analysis is based on a sample of 81 municipalities from the Basilicata region (Italy). Specifically, it focused on the SEAPs that were developed and approved by the JRC in the first CoM commitment period (2008–2020) for several reasons. Firstly, to provide homogeneity in the analysis allowing for easy temporal comparison between the pre- and post-approval period. Secondly, most municipalities in Basilicata adopted the SEAP plan during the first commitment period to the initiative of the CoM. Thirdly, the SEAPs represent a minority in the overall framework of the Basilicata SEAPs.

The Basilicata municipalities were divided into CoM signatories with SEAP approval, CoM signatories without SEAP approval, and non-CoM signatories.

The second stage considered the plans (SEAPs) that were published and approved by CoM. Among the technical contents of the plans, an assessment of proposed actions per intervention sector was delivered to point out the main areas of intervention in the municipalities. This phase was directed towards identifying the most frequent energy efficiency

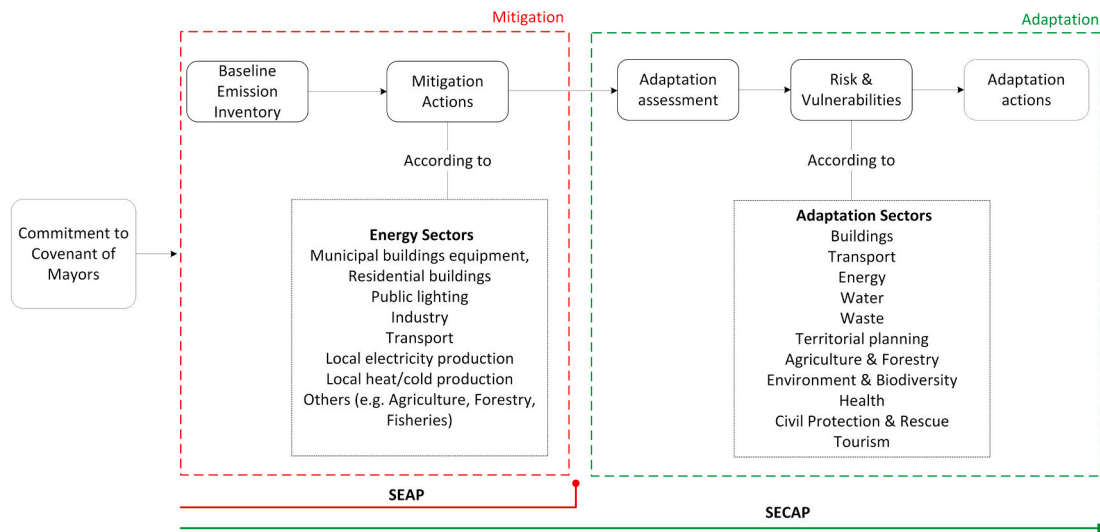


Fig. 4. A schema of the SE(C)AP section.

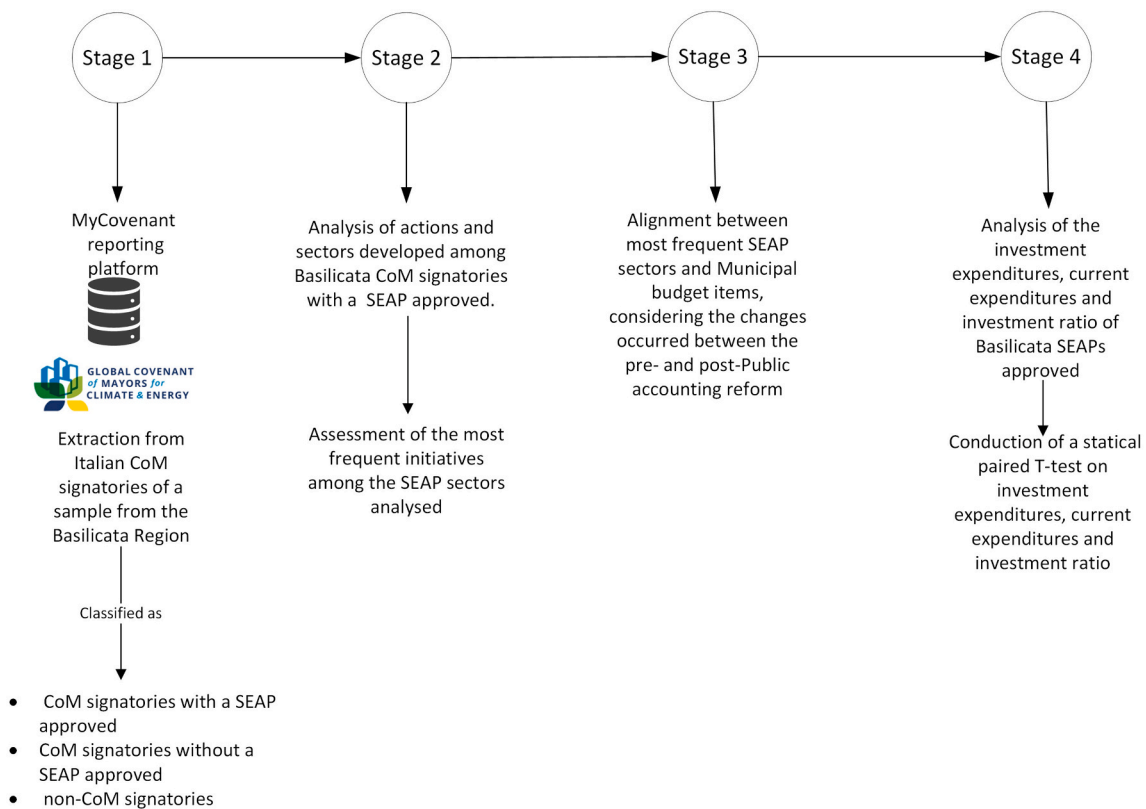


Fig. 5. Flowchart of the stages.

actions and analysing the sectors that represented a priority for the municipal investments in accordance therewith.

The third stage is the alignment between most frequent SEAP sectors and municipal budget items, bearing in mind the changes that came about between the pre- and post- public accounting reform.

To clarify, the present study summarily explains the main structure of an Italian municipality budget pre- and post- Decree 118/2011 (Manes, 2015). In the last decade, the accounting system of Italian LGs has changed significantly due to several legislative amendments that have modified its entire structure (Pozzoli & Ranucci, 2013). Law 196/2000 started to modify the PA accounting systems with the introduction

of the principle of harmonisation, which impacts the different levels of government, as defined in Decree 118/2011. The aim of the Decree is to use standardised statements and a single chart of accounts common to all LGs. The decree was enforced in January 2015 after 3 years of experimentation (Manes, 2015).

Table 1 explains synthetically the main macro-difference between budget items pre- and post-reform.

The fourth stage is based on a quantitative analysis (Franzese & Iuliano, 2019) that involves the investment expenditures, current expenditures and investment ratio of the approved Basilicata SEAPs.

The investment ratio was calculated as the ratio of investment

Table 1
Comparison between pre- and post-reform budget items.

	Budget items pre-reform (D. 118/2011)	Budget items post-reform (D. 118/2011)
REVENUE	<i>Title</i>	<i>Title</i>
	Source of financial resources	Source of financial resources
	<i>Categories</i>	<i>Typologies</i>
	Type of revenue	Nature of revenue
	<i>Resources</i>	<i>Categories</i>
	Specific object of revenue	Type of revenue
		<i>Missions</i>
	<i>Titles</i>	Main functions and strategic objectives of the relevant administration
	Main economic aggregates	<i>Programmes</i>
		Categories of activities that implement the objectives defined by the politicians
EXPENDITURE	<i>Functions</i>	
	Type of activity carried out	
	<i>Services</i>	
	Individual offices required to manage financial resources to achieve assigned objectives	
	<i>Intervention</i>	
	Economic nature of the factors of production of each service	

(Adapted by Manes, 2015)

expenditure to current expenditure. This index has already been used in the literature (Bisogno et al., 2023) to represent the relevance of long-term projects. A paired *t*-test was conducted for investment expenditures, current expenditures and the investment ratio.

In general, the paired sample *t*-test was conducted in situations in which “the measurement scores in one group correlate with the scores in the other group, as seen when two measures are taken in each individual (e.g. before and after the intervention), which confirmed that the two groups are no longer independent”. In this research, the paired *t*-test was used to compare the difference in the average investment expenditures, current expenditures and investment ratio, ante- and post-SEAP approval period (Casella & Berger, 2021).

Thus, the paired *t*-test was conducted according to two periods: pre-approval of the SEAP (pre-SEAP) and post-approval of the SEAP (post-SEAP). The years structuring the two periods were selected because public investment follows a different logic to that of the private sector. The evolution of financial data does not immediately capture the evolution of public works in the country, as this expenditure is only recorded after the various execution stages. Therefore, financial data are the basic variables for the observation of the arrival of resources in the territory, but they only capture the behaviour of the entities with a certain delay.

Three tests were carried out for all sectors involved in the analysis and were performed through the Statistical Package for the Social Science (SPSS) version 28.0.1.1. These tests are:

α. absolute value of investment expenditure, current expenditures and investment ratio in the year following SEAP approval of each Municipality as the post-SEAP period ($t + 1$), and the expenditure in the years of approval of the action plan as the pre-SEAP period (t_0).

β. average of investment expenditures, current expenditures and investment ratio choosing, as the post-period, the average of the three subsequent years ($t + 3$), and as the pre-approval period, the average of the last three years, including the year of approval ($t-3$).

γ. average of investment expenditures, current expenditures and investment ratio, choosing as the post-period, the average of the five subsequent years ($t + 5$), and as the pre-approval period, the average of the last five years, including the year of approval ($t-5$).

Moreover, two additional paired *t*-tests were conducted in order to provide further validity to the analyses:

δ. average of investment expenditures, current expenditures and the investment ratio by choosing the years after 2016 (post-2016) as the

next period and the average of 2005 to 2016, excluding the year 2016 (pre-2016) as the period before approval.

ε. average of investment expenditures, current expenditures and the investment ratio by choosing the years after 2017 (post-2017) as the next period and the average of the years 2005 to 2017, excluding the year 2017 (pre-2017) as the period before approval.

The years 2016 and 2017 were chosen because about 92 % and 95 % respectively of the municipalities received SEAP approval in those years.

Exploring the impact of SEAPs on municipal investment expenditures, current expenditures and investment ratio, the authors tested two explorative hypotheses: the null hypothesis (H_0) and the alternative hypothesis (H_1).

H_0 . “The adoption of the SEAP has no effect on investment expenditures, current expenditures and investment ratio in the Basilicata Municipalities”;

H_1 . “The adoption of the SEAP has an effect on investment expenditures, current expenditures and investment ratio in Basilicata Municipalities”.

The probability (p) for statistical significance was determined as $p < 0.05$ (Casella & Berger, 2021).

The authors selected, as a data source, the “Open Bilanci” database (“Open Bilanci” database, n.d.). It is an Italian public platform where each Municipality can publish its balance sheet by collecting and detailing their investments, expenditures, and interventions related to several sectors (road maintenance, public lighting and public buildings). Currently, the coverage is from the years 2005–2021.

A southern Italian region, Basilicata, was selected as a case study (see Fig. 6), because of the relevant number of CoM signatories (92 CoM signatories out of 131 total municipalities), 92 % of which are XS municipalities.

In analysing the Basilicata CoM signatories (see Table 2), 81 municipalities have approved their SEAP by JRC, with only two yet to begin the updating process towards the SECAP, which includes the climate component. Thus, a detailed analysis of the SEAPs approved in the first commitment period (2008–2020) was performed in order to achieve a comprehensive assessment of the public investments selected in the SEAP sectors.

4. Results

In analysing the MyCovenant platform, the SEAPs of the Basilicata Region have been detailed according to the occurrences of the SEAPs sectors, and it emerged that there are three sectors selected by almost all the signatories: local electricity production, residential building and public lighting. The occurrences related to the remaining sectors remark on the relevance of public interventions planned by the CoM 2020 signatories.

The main results from the CoM database analysis highlight that the Basilicata CoM 2020 signatories have a preferential interest in developing actions related to sectors managed through “public” investment, like public lighting or municipal building equipment facilities. Instead, considering “private” sector investments (involving not only public actors but also a private company, stakeholders, etc.), there is a relevant development of interventions related to the improvement of energy production (i.e. photovoltaics and wind power) and energy efficiency of the buildings.

To proceed with the analyses regarding the investment expenditures, current expenditures and investment ratio of the municipalities in the sample, it was necessary to find an alignment on two fronts. Firstly, by aligning the chosen budget items with the sectors in which most of the Basilicata municipalities designed SEAP actions. Secondly, (Santopietro, Solimene, et al., 2023, 2022) found an alignment between the pre- and post-reform budget items. In detail, the authors discovered an alignment of three budget items (see Table 3) with two SEAP sectors (“public

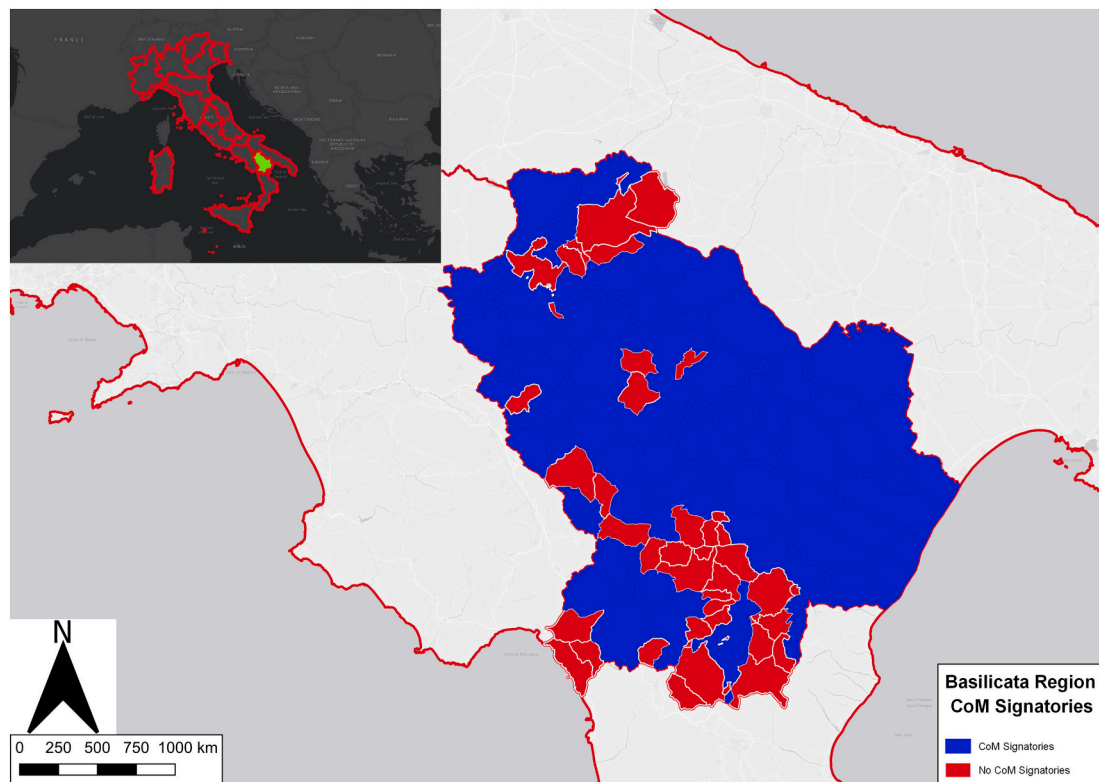


Fig. 6. Geographical distribution of Basilicata CoM Municipalities.

Table 2
Classification of Basilicata CoM Municipalities.

Status of commitment	No. of municipalities
CoM signatories with a SEAP approved	81
CoM signatories without a SEAP	11
Non CoM signatories	39

lighting” and “municipal building, equipment/facilities”) where signatories collected mainly public interventions. Specifically, CoM signatories in the SEAP “municipal building, equipment/facilities” sector, included the investments related to the “education” element of the municipal budgets.

Taking into account these considerations, the authors have chosen the macro-categories listed in Table 3 as a focus area of the analysis, based on the sector in which the CoM Basilicata municipalities planned their interventions to enable them to achieve their energy efficiency objectives.

Fig. 7, presents a geographical distribution of the Basilicata CoM 2020 signatories that have developed their SEAP interventions related to the public lighting and municipal buildings, equipment and facilities

Table 3
Comparison of municipalities budget items.

Titles in the first-time frame (2005–2015)		Missions in the second time frame (2016–2021)	
<i>Education</i>	Expenditure for school services and maintenance of buildings owned - excluding kindergartens	<i>Education and the right to study</i>	Amount of all expenditure on education and school buildings (excluding kindergartens)
<i>Public lighting</i>	Expenses for public lighting installations	<i>Energy and diversification of energy sources</i>	Expenditure on administration and operation of activities and services relating to the use of energy sources, including electricity and natural gas
<i>Public buildings</i>	Expenditure on public housing, the operation of offices, the provision of benefits to citizens in need, and the construction and maintenance of facilities.	<i>Public and local housing and social housing plans</i>	Expenses for the construction, purchase and renovation of public and social housing

(Source: “Open Bilanci” Database)

sectors. Expenditures related to the “Education” item in Table 3 were included in the “Municipal buildings, equipment/facilities” SEAP sector by the CoM 2020 Signatories.

To provide a general overview of the budget data of the municipalities, the investment expenditures, current expenditures and the investment ratio were analysed taking into account the absolute values over the time period covered.

Descriptive statistics were calculated for each expenditure item and sector considered. The assessment covered the years before approval of the SEAPs, i.e. from 2005 to 2016, and the post-approval years from 2016 to 2021 (see Tables 4, 5, 6).

From the descriptive statistics, education is the sector that shows, on average, an increase in the post-approval period for the category of investment expenditure. All the sectors on average, sustained, for the current expenditure, a decrease in the period after SEAP. Public Lighting and Education presented an increase in the post-approval period in terms of investment ratio. Only the Public Building sector registered a sharp decrease in the years following 2016.

The authors carried out three paired *t*-tests in the quantitative analysis of the public lighting, education and public buildings sectors.

The first paired *t*-test α (see Table 7) conducted on investment expenditures shows a significant difference in the mean values of the three

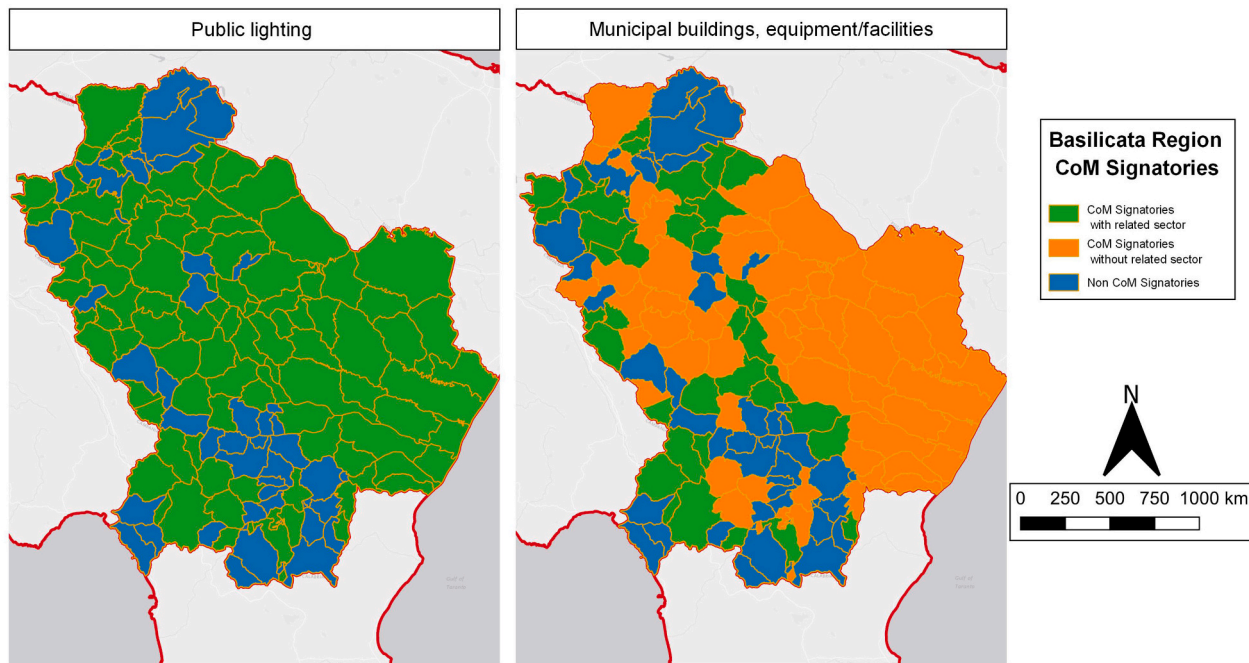


Fig. 7. Geographical distribution of CoM Signatories with interventions related to the public lighting or Municipal buildings, equipment/facilities.

Table 4

Descriptive statistics calculated based on investment expenditure for each sector.

Investment expenditures	Means	Std. Dev.	Min	Max	Median
Public lighting_pre2016	38,094,150	35,062,109	0	144,125,188	33,618,602
Public lighting_post2016	23,783,492	28,864,251	0	103,704,452	9471,760
Education_pre2016	123,685,536	194,661,223	0	1,308,623,876	64,936,030
Education_post2016	244,860,689	267,565,583	0	1,369,957,490	164,391,898
Public building_pre2016	135,663,295	314,985,429	0	2,426,739,386	33,847,538
Public building_post2016	67,362,109	144,508,796	0	1,150,802,080	23,147,200

Table 5

Descriptive statistics calculated based on current expenditure for each sector.

Current expenditures	Means	Std. Dev.	Min	Max	Median
Public lighting_pre2016	159,908,778	221,950,168	0	1,439,660,908	98,968,830
Public lighting_post2016	78,236,947	216,669,805	0	1,346,516,586	1319,400
Education_pre2016	698,118,757	3,240,632,394	0	27,724,342,090	141,542,970
Education_post2016	465,734,072	2,075,490,203	17,686,4	18,694,698,868	145,455,400
Public building_pre2016	17,357,098	88,150,262	0	749,950,426	0
Public building_post2016	17,116,973	118,129,949	0	1,053,681,048	0

Table 6

Descriptive statistics calculated from the investment ratio for each sector.

Investment ratio	Means	Std. Dev.	Min	Max	Median
Public lighting_pre2016	0,350	0,472	0	2087	0,159
Public lighting_post2016	0,448	2574	0	23,024	0
Education_pre2016	0,606	1001	0	7515	0,317
Education_post2016	1460	1444	0	9872	1049
Public building_pre2016	15,450	56,293	0	445,541	0
Public building_post2016	1888	8006	0	60,248	0

sectors after and before the approval of SEAP. The effect of SEAP adoption is statistically significant in the education $t(80) = 2607, p = 0.011$ and public lighting sectors $t(80) = -2906, p = 0.005$. However, in the third sector, that of the public buildings, the difference between the averages was not statistically significant, $t(80) = -0,316, p = 0,753$.

The second paired t-test β remarked the statistics significance of the

education sector $t(80) = 3610 p = 0,001$. The mean differences in the public lighting sector after and before the SEAP are not statistically significant, with $t(80) = -1662 p = 0,100$. In contrast to the short-term analysis, the third sector, public buildings, has a statistically significant difference between averages, $t(80) = -3634, p = 0,000$.

The third paired t-test γ showed values for the education sector equal to $t(80) = 5040, p = 0,000$, the public lighting sector obtains values of $t(80) = -2305, p = 0,024$; the public building sector has values of $t(80) = -2990, p = 0,004$. As comprehensive results, when the analysis is conducted over a longer time span, all sectors turn out to be statistically significant, showing an impact of the CoM initiative on investment expenditures.

The three paired t-tests (α, β, γ) were also conducted on current expenditures and the investment ratio using the same time references. The analysis conducted on current expenditures (see Table 8) shows inconsistent results. However, the only sector where current expenditures are statistically significant, over the periods considered, is the

Table 7
Results of the paired-sample t-test conducted on investment expenditures.

Paired differences				95 % confidence interval of the difference		t	dl	Sig. (2-tailed)
Investment expenditures	Mean	Std. Dev.	Std. Err. Mean	Lower	Upper			
Public lighting α test	-31,421,451	97,304,532	10,811,615	-52,937,250	-9905,652	-2906	80	0,005
Public lighting β test	-11,148,279	60,362,961	6706,996	-24,495,626	2199,068	-1662	80	0,100
Public lighting γ test	-12,715,883	49,639,308	5515,479	-23,692,035	-1739,730	-2305	80	0,024
Public lighting δ test	-15,860,772	60,105,040	6678,338	-29,151,088	-2570,456	-2375	80	0,020
Public lighting ϵ test	-10,907,872	65,098,214	7233,135	-25,302,269	3486,525	-1508	80	0,135
Education α test	93,234,121	321,907,637	35,767,515	22,054,497	164,413,744	2607	80	0,011
Education β test	78,494,775	195,692,420	21,743,602	35,223,628	121,765,923	3610	80	0,001
Education γ test	121,640,514	217,222,522	24,135,836	73,608,671	169,672,358	5040	80	0,000
Education δ test	218,313,533	264,615,041	29,401,671	159,802,343	276,824,723	7425	80	0,000
Education ϵ test	234,134,307	315,351,097	35,039,011	164,404,453	303,864,161	6682	80	0,000
Public building α test	-4931,906	140,385,910	15,598,434	-35,973,780	26,109,968	-0,316	80	0,753
Public building β test	-42,931,709	106,312,042	11,812,449	-66,439,232	-19,424,186	-3634	80	0,000
Public building γ test	-65,860,305	198,219,464	22,024,385	-109,690,227	-22,030,382	-2990	80	0,004
Public building δ test	-62,101,429	263,675,751	29,297,306	-120,404,925	-3797,932	-2120	80	0,037
Public building ϵ test	-66,952,945	325,298,346	36,144,261	-138,882,316	4976,426	-1852	80	0,068

Table 8
Results of paired-sample t-test conducted on current expenditure.

Paired differences				95 % confidence interval of the difference		t	dl	Sig. (2-tailed)
Current expenditures	Mean	Std. Dev.	Std. Err. Mean	Lower	Upper			
Public lighting α test	-46,006,356	196,408,549	21,823,172	-89,435,853	-2576,860	-2108	80	0,038
Public lighting β test	-63,603,711	232,453,522	25,828,169	-115,003,406	-12,204,017	-2463	80	0,016
Public lighting γ test	-86,795,609	177,547,110	19,727,457	-126,054,499	-47,536,720	-4400	80	0,000
Public lighting δ test	-115,603,678	243,587,339	27,065,260	-169,465,261	-61,742,094	-4271	80	0,000
Public lighting ϵ test	-105,051,299	218,528,845	24,280,983	-153,371,995	-56,730,604	-4326	80	0,000
Education α test	-60,545,327	1,099,001,859	122,111,318	-303,554,593	182,463,940	-0,496	80	0,621
Education β test	-127,370,449	929,618,207	103,290,912	-332,925,914	78,185,017	-1233	80	0,221
Education γ test	-229,468,714	1,318,541,589	146,504,621	-521,022,201	62,084,774	-1566	80	0,121
Education δ test	-391,934,109	2,607,698,854	289,744,317	-968,543,676	184,675,458	-1353	80	0,180
Education ϵ test	-372,275,540	2,456,982,653	272,998,073	-915,559,018	171,007,938	-1364	80	0,177
Public building α test	5769,816	44,162,435	4906,937	-3995,300	15,534,932	1176	80	0,243
Public building β test	1899,453	33,292,514	3699,168	-5462,126	9261,032	0,513	80	0,609
Public building γ test	1268,993	37,182,873	4131,430	-6952,816	9490,801	0,307	80	0,760
Public building δ test	-2611,870	27,180,451	3020,050	-8621,961	3398,221	-0,865	80	0,390
Public building ϵ test	-3102,965	24,365,659	2707,295	-8490,654	2284,725	-1146	80	0,255

Public Lighting sector. The education and public building sectors in most of the analyses conducted, are not statistically significant.

Several considerations can be made regards the investment ratio (see Table 9). It is interesting to note that, regardless of the significance of the statistical test (which again shows satisfactory results in the education

sector), the coefficient of the averages calculated by the software is mostly positive. This means that, on average, the ratio of investment expenditure to current expenditure increases in the post-SEAP period. With a higher ratio in the post-SEAP period, it is reasonable to assume that investment expenditure is proportionally higher than in the pre-

Table 9
Results of paired-samples t-test conducted on investment ratio.

Paired differences				95 % confidence interval of the difference		t	dl	Sig. (2-tailed)
Investment ratio	Mean	Std. Dev.	Std. Err. Mean	Lower	Upper			
Public lighting α test	-0,254	1016	0,113	-0,479	-0,030	-2252	80	0,027
Public lighting β test	0,037	1453	0,161	-0,285	0,358	0,227	80	0,821
Public lighting γ test	0,108	2652	0,295	-0,478	0,695	0,367	80	0,714
Public lighting δ test	0,278	3486	0,387	-0,493	1049	0,717	80	0,475
Public lighting ϵ test	0,379	4174	0,464	-0,544	1302	0,816	80	0,417
Education α test	0,413	1454	0,162	0,092	0,734	2557	80	0,012
Education β test	0,480	1757	0,195	0,091	0,868	2456	80	0,016
Education γ test	0,850	1635	0,182	0,488	1211	4676	80	0,000
Education δ test	1494	1805	0,201	1094	1893	7446	80	0,000
Education ϵ test	1588	2105	0,234	1123	2054	6791	80	0,000
Public building α test	-21,853	234,093	26,010	-73,615	29,909	-0,840	80	0,403
Public building β test	-16,267	83,062	9229	-34,633	2100	-1763	80	0,082
Public building γ test	-11,791	51,531	5726	-23,185	-0,397	-2059	80	0,043
Public building δ test	-1589	145,885	16,209	-33,847	30,669	-0,098	80	0,922
Public building ϵ test	0,900	169,939	18,882	-36,676	38,477	0,048	80	0,962

approval period. This may indicate a willingness on behalf of the municipalities to devote more financial resources to long-term projects, thus effectively reducing their current operating costs.

5. Discussions and conclusions

The authors state that their discussions and conclusions are based on the following assumption: “the municipalities that voluntarily joined the CoM initiatives committed themselves to planning strategic actions for energy efficiency within the SEAP”. It is reasonable to think that the significant variations between the average investment expenditure pre- and post-SEAP are linked to the strategic actions formally planned in the SEAP for each sector declared. In addition, the financial resources available to municipalities are limited, so it seems illogical and irrational that one can make significant investments in the sectors covered by SEAP actions.

Based on this purpose, the first assessment of investments related to public energy efficiency measures can be considered an overall positive impact of the CoM initiative on small municipalities (Domorenok et al., 2020).

The sector that has benefited most in terms of financial allocation is the education sector. A possible reason for this is the fact that public buildings in the small municipalities of Basilicata are either municipal or scholastic. Thus, municipal governance is oriented towards selecting efficiency interventions, mainly in school buildings. The public lighting and public building sectors also have benefited from participation in the CoM initiative, albeit to a lesser extent than the education sector. In this case, the increase in investment expenditure can be observed when the object of analysis is the investment ratio.

The trend of financial data in the public sector is the fundamental variable for observing the arrival of resources in the territory. However, it only captures the behaviour of entities with a certain delay (Ferretti et al., 2021). Since the financial crisis of 2009, public investment has been progressively shrinking. According to (Ferretti et al., 2021), decentralised authorities are responsible for 56 % of public gross fixed capital formation, a higher percentage than in many European countries. To cope with the crisis, local authorities have had to review their spending, preferring to reduce investment rather than provide services to citizens (Ferretti et al., 2017). In 2018, LG investment spending showed signs of recovery, but the trend reversal is still weak. This may provide an explanation for the limited allocation of financial resources of municipalities to investment expenditure in recent years. In this context, the National Recovery and Resilience Plans (NRRP) represent a financial push in a municipality's national, regional and local budget availability, boosting the stock of investment expenditure.

The increase in investment expenditure appears to be the potential benefit of joining CoM in terms of achieving financing opportunities for SEAP projects, contributing to achieving sustainability goals and promoting territorial and social development. The positive impact can be explained by observing the increase in investment expenditure by signatory municipalities in the post-adhesion period and because this confirms the economic advantage in terms of “better opportunity” in obtaining public funding, including European funding. According to (Malandrino et al., 2019), to improve the energy performance of the PA, effective detection systems must be implemented, and adequate data and information must be available to assess the results obtained to identify possible areas for improvement. In this scenario, the CoM initiative could be a valuable tool to provide useful information and guide energy efficiency actions.

The behaviour of municipalities appears to be consistent with Legitimacy and Stakeholder theory.

The many CoM 2020 municipalities in Basilicata clearly explain the need to gain legitimacy. The climate emergency and, consequently, energy efficiency are a must that municipalities, as all other LGs, can no longer ignore. CoM signatories show how municipalities increase their legitimacy by participating in a European initiative where a community

of similar organisations is employed for the same sustainability goal.

Under the stakeholder theory, municipalities include objectives considered to be relevant in their strategic sustainability plans by many stakeholder categories. Among them, there are citizens, employees, government Institutions, and regulatory and policy makers at the forefront involved in global warming.

Accountability and reporting are also crucial in Legitimacy and Stakeholder theory. The slight delay of the municipalities in providing the SE(C)APs and reporting could be due to the lack of resources (mainly human) able to do that.

Furthermore, as remarked by (Domorenok et al., 2020) the CoM initiative promoted investment policies in energy efficiency, supporting the weaknesses in terms of the small municipalities' technical capacity and implementing CO₂ reduction interventions oriented towards the EU 2050 targets. Considering the voluntary approach pursued by CoM, the increase in investments has a positive impact in terms of incentives to plan interventions for the reduction of energy consumption and support modelling a “green awareness” in the citizens through these interventions. Moreover, data on municipal budgets is a meaningful tool to improve the monitoring capacity for SE(C)AP implementation and could be considered as additional indicators to be included in the CoM Monitoring Reports.

From a planning perspective, SE(C)AP designs long-term period targets, offering the municipalities a way out to affirm the principles of strategic planning in a perspective oriented to the usefulness of the results. Furthermore, SE(C)AP could fill the weaknesses of strategic planning, performance measurement, and reporting according to performance indicators, targets, and milestones.

Via the municipal budget analysis, the study tries to provide an innovative approach to monitoring and assessing the strategic actions planned as a consequence of the CoM undersigning. The reasonable assumption is that strategic energy efficiency planning within the SEAP affects investment choices made in the fields of intervention indicated in the SEAP (Rivas, Urraca, & Bertoldi, 2022). These strategic decisions should reflect any statistically significant change in investment expenditure. In the absence of the Municipalities' Monitoring Reports, this new approach provides a means to evaluate and monitor the initial financial impacts of the SE(C)AP. Moreover, this study tries to fill a gap in previous literature because the financial profile of the topic is addressed not at a country level but at the disaggregated level of the individual municipality operating in the same area. Lastly, this study, unlike the previous ones (Rivas et al., 2021; Rivas, Urraca, Palermo, & Bertoldi, 2022), is not limited to providing a descriptive statistic of the expenditure potentially related to the targets planned in the SEAP but offers a comparison between the averages of the expenditure associated with the SEAP intervention areas, in an attempt to understand whether such strategic plans can reasonably match the relevant investment choices.

Limitations related to this research are: 1) the focus on the public investments related only to three categories (education, public lighting and public buildings); 2) the economic assessment focused on CoM municipalities; 3) the selection of a specific municipalities' population size (i.e. below 10,000 inhabitants); 4) the small size of the sample investigated.

Future developments of the research are the following. Firstly, the extension to other private and public sectors to achieve an “urban vision” (see also (Scorza & Santopietro, 2021)) of the SE(C)AP impact, it is also useful to investigate other intervention categories including private investments (i.e. the transport sector is one of the main SEAP sectors (Crocì et al., 2017; Kona et al., 2017), especially for those small municipalities with tourism specialisation (Santopietro, Scorza, & Murgante, 2022)). Secondly, in order to assess where the funding for SE (C)AP energy efficiency interventions comes from, the sources of investment (whether public or private) could be an additional monitoring element. Thirdly, the sample was extended to medium-large population-size municipalities (over 10,000 inhabitants). At least, CoM offers the

possibility to join a group of municipalities, and this is a further field of research useful to investigate forms of collaboration that could remove both financial obstacles through the subdivision of transaction costs and the exchange of know-how and best practices currently available (Malandrino et al., 2019).

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CRediT authorship contribution statement

Luigi Santopietro: Conceptualization, Data curation, Investigation, Writing – original draft, Writing – review & editing. **Silvia Solimene:** Conceptualization, Data curation, Investigation, Writing – original draft, Writing – review & editing. **Manuela Lucchese:** Conceptualization, Formal analysis, Methodology, Validation, Writing – review & editing. **Ferdinando Di Carlo:** Conceptualization, Formal analysis, Methodology, Validation, Writing – review & editing. **Francesco Scorza:** Conceptualization, Data curation, Formal analysis, Methodology, Validation, Writing – review & editing.

Declaration of competing interest

The authors report that they have no conflicts of interest to declare.

Data availability

Data will be made available on request.

References

- “Open Bilanci” database. n.d. <https://openbilanci.it/> (accessed September 19, 2023).
- Barton, A. (2005). Professional accounting standards and the public sector—A mismatch. *Abacus*, 41, 138–158. <https://doi.org/10.1111/j.1467-6281.2005.00173.x>
- Bernstein, S., & Hoffmann, M. (2018). The politics of decarbonization and the catalytic impact of subnational climate experiments. *Policy Sciences*, 51, 189–211. <https://doi.org/10.1007/s11077-018-9314-8>
- Bertoldi, P., Kona, A., Rivas, S., & Dallemand, J. F. (2018). Towards a global comprehensive and transparent framework for cities and local governments enabling an effective contribution to the Paris climate agreement. *Current Opinion in Environment Sustainability*, 30, 67–74. <https://doi.org/10.1016/j.cosust.2018.03.009>
- Bhattacharyya, A., & Cummings, L. (2015). Measuring corporate environmental performance - stakeholder engagement evaluation. *Business Strategy and the Environment*, 24, 309–325. <https://doi.org/10.1002/bse.1819>
- Biesbroek, G. R., Swart, R. J., & van der Knaap, W. G. M. (2009). The mitigation-adaptation dichotomy and the role of spatial planning. *Habitat International*, 33, 230–237. <https://doi.org/10.1016/j.habitatint.2008.10.001>
- Bisogno, M., Cuadrado-Ballesteros, B., Rossi, F. M., & Peña-Miguel, N. (2023). Sustainable development goals in public administrations: Enabling conditions in local governments. *International Review of Administrative Sciences*, Article 002085232211464. <https://doi.org/10.1177/00208523221146458>
- Bouckaert, G., Loretan, R., & Troupin, S. (2016). *Public administration and the sustainable development goals*.
- Buntin, J. (2009). Desert storm. *Governing*, 5, 31–36.
- Campbell, D. J. (2000). Legitimacy theory or managerial reality construction? Corporate social disclosure in Marks and Spencer Plc corporate reports, 1969–1997. In , 24. *Accounting Forum* (pp. 80–100). Taylor & Francis.
- Casella, G., & Berger, R. L. (2021). *Statistical inference*. Cengage Learning.
- Chen, J. C., & Roberts, R. W. (2010). Toward a More Coherent Understanding of the Organization–Society Relationship: A Theoretical Consideration for Social and Environmental Accounting Research. *Journal of Business Ethics*, 97, 651–665. <https://doi.org/10.1007/s10551-010-0531-0>
- Coleman, L. (2011). Losses from failure of stakeholder sensitive processes: Financial consequences for large US companies from breakdowns in product, environmental, and accounting standards. *Journal of Business Ethics*, 98, 247–258. <https://doi.org/10.1007/s10551-010-0544-8>
- Covenant of Mayors for Climate & Energy Office. (2023). *Quick Reference Guide - Joint Sustainable Energy & Climate Action Plan*.
- Croci, E., Lucchitta, B., Janssens-Maenhout, G., Martelli, S., & Molteni, T. (2017). Urban CO2 mitigation strategies under the covenant of mayors: An assessment of 124 European cities. *Journal of Cleaner Production*, 169, 161–177. <https://doi.org/10.1016/j.jclepro.2017.05.165>
- Deegan, C. (2002). Introduction: The legitimising effect of social and environmental disclosures—a theoretical foundation. *Accounting, Auditing & Accountability Journal*, 15, 282–311. <https://doi.org/10.1108/09513570210435852>
- Deegan, C. (2007). Organizational legitimacy as a motive for sustainability reporting. *Sustainability Accounting and Accountability*, Routledge, 127–149. <https://doi.org/10.4324/NOE0415384889.ch7>
- Deegan, C. (2011). *EBOOK: Financial Accounting Theory*. European Edition. McGraw Hill.
- Deegan, C. (2014). *An overview of legitimacy theory as applied within the social and environmental accounting literature*.
- Deegan, C., & Gordon, B. (1996). A study of the environmental disclosure practices of Australian corporations. *Accounting and Business Research*, 26, 187–199. <https://doi.org/10.1080/00014788.1996.9729510>
- Deegan, C., Rankin, M., & Tobin, J. (2002). An examination of the corporate social and environmental disclosures of BHP from 1983–1997. *Accounting, Auditing & Accountability Journal*, 15, 312–343. <https://doi.org/10.1108/09513570210435861>
- Domorenok, E. (2019). Voluntary instruments for ambitious objectives? The experience of the EU covenant of mayors. *Env Polit*, 28, 293–314. <https://doi.org/10.1080/09644016.2019.1549777>
- Domorenok, E., Acconcia, G., Bendlin, L., & Campillo, X. R. (2020). Experiments in eu climate governance: The unfulfilled potential of the covenant of mayors. *Glob Environ Polit*, 20, 122–142. https://doi.org/10.1162/glep_a_00563
- Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. *The Pacific Sociological Review*, 18, 122–136. <https://doi.org/10.2307/1388226>
- Etter, M., Colleoni, E., Illia, L., Meggiorin, K., & D'Eugenio, A. (2016). Measuring organizational legitimacy in social media: Assessing Citizens' judgments with sentiment analysis. *Business & Society*, 57, 60–97. <https://doi.org/10.1177/00076503166683926>
- European Commission. (2020). Climate & energy package | Climate Action. In , 2020. *Climate & Energy Package* (p. 2009). https://ec.europa.eu/clima/policies/strategies/2020_en. (Accessed 1 December 2020).
- Eyraud, L., Clements, B., & Wane, A. (2013). Green investment: Trends and determinants. *Energy Policy*, 60, 852–865. <https://doi.org/10.1016/j.enpol.2013.04.039>
- Ferrell, O. C., Thorne, D. M., & Ferrell, L. (2011). *Social responsibility and business, 4th edn, international edition* (4th ed.). Boston, MA: Cengage.
- Ferretti, C., Gori, G. F., & Lattarulo, P. (2017). *Finanza locale e investimenti negli anni della crisi*.
- Ferretti, C., Gori, G. F., & Lattarulo, P. (2021). *CAPITOLO 4 - Gli investimenti pubblici degli enti locali: dagli anni del rigore ai tentativi di rilancio. Analisi degli investimenti pubblici - Dati, indagine diretta ai Responsabili Unici del Provvedimento e casi di studio* (pp. 73–167).
- Fiorino, D. J. (2010). Sustainability as a conceptual focus for public administration. *Public Administration Review*, 70, s78–s88. <https://doi.org/10.1111/j.1540-6210.2010.02249.x>
- Franzese, M., & Iuliano, A. (2019). *Descriptive Statistics*.
- Freeman, E., & McVea, J. (2003). *A stakeholder approach to management: The state of the art*. Oxford: Handbook of Strategic Management, (Blackwell Publishing).
- Gaia, S., & Jones, M. J. (2020). Biodiversity reporting for governmental organisations. *Accounting, Auditing & Accountability Journal*, 33, 1–31. <https://doi.org/10.1108/AAAJ-05-2018-3472>
- Giacomini, D., Rocca, L., Carini, C., & Mazzoleni, M. (2018). Overcoming the barriers to the diffusion of sustainability reporting in Italian LGOs: Better stick or carrot? *Sustainability*, 10, 131. <https://doi.org/10.3390/su10010131>
- Gray, R., Kouhy, R., & Lavers, S. (1995). Corporate social and environmental reporting. *Accounting, Auditing & Accountability Journal*, 8, 47–77. <https://doi.org/10.1108/09513579510146996>
- Gray, R., Owen, D., & Adams, C. (1996). *Accounting & Accountability: Changes and challenges in corporate social and environmental reporting*. Prentice Hall.
- Guarini, E., Mori, E., & Zuffada, E. (2021). New development: Embedding the SDGs in city strategic planning and management. *Public Money & Management*, 41, 494–497. <https://doi.org/10.1080/09540962.2021.1885820>
- Guarini, E., Mori, E., & Zuffada, E. (2022). Localizing the sustainable development goals: A managerial perspective. *Journal of Public Budgeting, Accounting & Financial Management*, 34, 583–601. <https://doi.org/10.1108/JPBFAFM-02-2021-0031>
- Guthrie, J., & Parker, L. D. (1989). Corporate social reporting: A rebuttal of legitimacy theory. *Accounting and Business Research*, 19, 343–352. <https://doi.org/10.1080/00014788.1989.9728863>
- Guthrie, J., & Parker, L. D. (1990). Corporate social disclosure practice: A comparative international analysis. *Advances in Public Interest Accounting*, 3, 159–175.
- van der Heijden, J. (2019). Studying urban climate governance: Where to begin, what to look for, and how to make a meaningful contribution to scholarship and practice. *Earth System Governance*, 1, Article 100005. <https://doi.org/10.1016/j.esg.2019.100005>
- Hendriks, C. (2018). Municipal financing for sustainable development: A case of South Africa. *Local Economy: The Journal of the Local Economy Policy Unit*, 33, 757–774. <https://doi.org/10.1177/0269094218811799>
- Jenkins, H. (2004). Corporate social responsibility and the mining industry: Conflicts and constructs. *Corporate Social Responsibility and Environmental Management*, 11, 23–34. <https://doi.org/10.1002/csr.50>
- Jones, P., & Comfort, D. (2020). A commentary on the localisation of the sustainable development goals. *Journal of Public Affairs*, 20. <https://doi.org/10.1002/pa.1943>
- Kona, A., Melica, G., Bertoldi, P., Rivas, S., Koffi, B., Iancu, A., et al. (2017). *Covenant of mayors in figures: 8-year assessment*. Luxembourg: Publications Office of the European Union. <https://doi.org/10.2760/64731>
- Lai, A., & Stacchezzini, R. (2021). Organisational and professional challenges amid the evolution of sustainability reporting: A theoretical framework and an agenda for

- future research. *Meditari Accountancy Research*, 29, 405–429. <https://doi.org/10.1108/MEDAR-02-2021-1199>
- Laukkonen, J., Blanco, P. K., Lenhart, J., Keiner, M., Cavric, B., & Kinuthia-Njenga, C. (2009). Combining climate change adaptation and mitigation measures at the local level. *Habitat International*, 33, 287–292. <https://doi.org/10.1016/j.habitatint.2008.10.003>
- Lindblom, C. K. (1994). *The implications of organizational legitimacy for corporate social performance and disclosure*.
- Lokuwaduge, C. S. D. S., & Heenetigala, K. (2017). Integrating environmental, social and governance (ESG) disclosure for a sustainable development: An Australian study. *Business Strategy and the Environment*, 26, 438–450. <https://doi.org/10.1002/bse.1927>
- Madlener, R., & Sunak, Y. (2011). Impacts of urbanization on urban structures and energy demand: What can we learn for urban energy planning and urbanization management? *Sustainable Cities and Society*, 1, 45–53. <https://doi.org/10.1016/j.scs.2010.08.006>
- Malandrino, O., Sica, D., & Supino, S. (2019). The role of public Administration in Sustainable Urban Development: Evidence from Italy. *Smart Cities*, 2, 82–95. <https://doi.org/10.3390/smartcities2010006>
- Manes, R. F. (2015). Public sector accounting and auditing in Italy. In I. Brusca, E. Caperchione, S. Cohen, & F. M. Rossi (Eds.), *Public sector accounting and auditing in Europe* (pp. 125–141). London: Palgrave Macmillan UK. https://doi.org/10.1057/9781137461346_9
- Marcuccio, M., & Steccolini, I. (2009). Patterns of voluntary extended performance reporting in Italian local authorities. *International Journal of Public Sector Management*, 22, 146–167. <https://doi.org/10.1108/09513550910934547>
- Marques, L., Leitão, J., Carvalho, A., & Pereira, D. (2021). Public administration and values oriented to sustainability: A systematic approach to the literature. *Sustainability*, 13, 2566. <https://doi.org/10.3390/su13052566>
- Melica, G., Bertoldi, P., Kona, A., Iancu, A., Rivas, S., & Zancanella, P. (2018). Multilevel governance of sustainable energy policies: The role of regions and provinces to support the participation of small local authorities in the covenant of mayors. *Sustainable Cities and Society*, 39, 729–739. <https://doi.org/10.1016/j.scs.2018.01.013>
- Melica, G., Treville, A., Franco, C., Baldi, M., Monforti, F., Palermo, V., et al. (2022). Covenant of Mayors. In *2021 Assessment. Climate change mitigation and adaptation at local level*. <https://doi.org/10.2760/58412>
- Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *The Academy of Management Review*, 22, 853. <https://doi.org/10.2307/259247>
- Mussari, R., & Monfardini, P. (2010). Practices of social reporting in public sector and non-profit organizations. *Public Management Review*, 12, 487–492. <https://doi.org/10.1080/14719037.2010.496262>
- Navarro Galera, A., de los Ríos Berjillos, A., Ruiz Lozano, M., & Tirado Valencia, P. (2014). Transparency of sustainability information in local governments: English-speaking and Nordic cross-country analysis. *Journal of Cleaner Production*, 64, 495–504. <https://doi.org/10.1016/j.jclepro.2013.07.038>
- Newman, P., & Thornley, A. (2002). *Urban planning in Europe: International competition, national systems and planning projects*. Routledge.
- O'Donovan, G. (2002). Environmental disclosures in the annual report. *Accounting, Auditing & Accountability Journal*, 15, 344–371. <https://doi.org/10.1108/09513570210435870>
- del P Pablo-Romero, M., Sánchez-Braza, A., & Manuel González-Limón, J. (2015). Covenant of mayors: Reasons for being an environmentally and energy friendly municipality. *Review of Policy Research*, 32, 576–599. <https://doi.org/10.1111/ropr.12135>
- Palermo, V., Bertoldi, P., Apostolou, M., Kona, A., & Rivas, S. (2020). Assessment of climate change mitigation policies in 315 cities in the covenant of mayors initiative. *Sustainable Cities and Society*, 60, Article 102258. <https://doi.org/10.1016/j.scs.2020.102258>
- Patten, D. M. (1991). Exposure, legitimacy, and social disclosure. *Journal of Accounting and Public Policy*, 10, 297–308. [https://doi.org/10.1016/0278-4254\(91\)90003-3](https://doi.org/10.1016/0278-4254(91)90003-3)
- Pietrapertosa, F., Khokhlov, V., Salvia, M., & Cosmi, C. (2018). Climate change adaptation policies and plans: A survey in 11 south east European countries. *Renewable and Sustainable Energy Reviews*, 81, 3041–3050. <https://doi.org/10.1016/j.rser.2017.06.116>
- Pietrapertosa, F., Salvia, M., De Gregorio, H. S., D'Alonzo, V., Church, J. M., Geneletti, D., et al. (2019). Urban climate change mitigation and adaptation planning: Are Italian cities ready? *Cities*, 91, 93–105. <https://doi.org/10.1016/j.cities.2018.11.009>
- Pozzoli, M., & Ranucci, S. (2013). The process of implementing the accounting harmonisation in the Italian local governments: The case of Prato. *International Journal of Business Research and Development*, 2. <https://doi.org/10.24102/ijbrd.v2i3.335>
- Reckien, D., Flacke, J., Dawson, R. J., Heidrich, O., Olazabal, M., Foley, A., et al. (2014). Climate change response in Europe: what's the reality? Analysis of adaptation and mitigation plans from 200 urban areas in 11 countries. *Climatic Change*, 122, 331–340. <https://doi.org/10.1007/s10584-013-0989-8>
- Reckien, D., Flacke, J., Olazabal, M., & Heidrich, O. (2015). The influence of drivers and barriers on urban adaptation and mitigation plans—An empirical analysis of European cities. *PLoS One*, 10, Article e0135597. <https://doi.org/10.1371/journal.pone.0135597>
- Reckien, D., Salvia, M., Heidrich, O., Church, J. M., Pietrapertosa, F., De Gregorio-Hurtado, S., et al. (2018). How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. *Journal of Cleaner Production*, 191, 207–219. <https://doi.org/10.1016/j.jclepro.2018.03.220>
- Regione Basilicata. (1999). *Bollettino ufficiale della Regione Basilicata n. 47 del 20 agosto 1999. Potenza*.
- Rivas, S., Urraca, R., & Bertoldi, P. (2022). Covenant of mayors 2020 achievements: A two-speed climate action process. *Sustainability*, 14, 15081. <https://doi.org/10.3390/su142215081>
- Rivas, S., Urraca, R., Bertoldi, P., & Thiel, C. (2021). Towards the EU green Deal: Local key factors to achieve ambitious 2030 climate targets. *Journal of Cleaner Production*, 320, Article 128878. <https://doi.org/10.1016/j.jclepro.2021.128878>
- Rivas, S., Urraca, R., Palermo, V., & Bertoldi, P. (2022). Covenant of mayors 2020: Drivers and barriers for monitoring climate action plans. *Journal of Cleaner Production*, 332, Article 130029. <https://doi.org/10.1016/j.jclepro.2021.130029>
- Roberto, F., Maglio, R., & Rey, A. (2020). Accountability and sustainability reporting in the public sector. *Evidence from Italian Municipalities*, 19–34. https://doi.org/10.1007/978-981-15-6366-9_2
- Rocca, L., Giacomini, D., & Zola, P. (2021). Environmental disclosure and sentiment analysis: State of the art and opportunities for public-sector organisations. *Meditari Accountancy Research*, 29, 617–646. <https://doi.org/10.1108/MEDAR-09-2019-0563>
- Romano, B., Zullo, F., Marucci, A., & Fiorini, L. (2018). Vintage urban planning in Italy: Land management with the tools of the mid-twentieth century. *Sustainability (Switzerland)*, 10, 4125. <https://doi.org/10.3390/su10114125>
- Saha, D. (2009). Factors influencing local government sustainability efforts. *State & Local Government Review*, 41, 39–48.
- Saha, D., & Paterson, R. G. (2008). Local government efforts to promote the “three Es” of sustainable development. *Journal of Planning Education and Research*, 28, 21–37. <https://doi.org/10.1177/0739456X08321803>
- Santopietro, L., Palermo, V., Melica, G., & Scorza, F. (2024). *The Engagement of Small European Municipalities in Achieving the Climate Neutrality* (pp. 577–586). https://doi.org/10.1007/978-3-031-54096-7_50
- Santopietro, L., & Scorza, F. (2021). The Italian experience of the covenant of mayors: A territorial evaluation. *Sustainability (Switzerland)*, 13, 1–23. <https://doi.org/10.3390/su13031289>
- Santopietro, L., Scorza, F., & Murgante, B. (2022). Multiple components in GHG stock of transport sector: Technical improvements for SECAP baseline emissions inventory assessment. *TEMA Journal of Land Use, Mobility and Environment*, 15, 5–24. <https://doi.org/10.6092/1970-9870/8391>
- Santopietro, L., Scorza, F., & Rossi, A. (2021). *Small Municipalities Engaged in Sustainable and Climate Responsive Planning: Evidences from UE-CoM*, 615–620. https://doi.org/10.1007/978-3-030-87013-3_47
- Santopietro, L., Solimene, S., Di Carlo, F., Lucchese, M., & Scorza, F. (2023). *The Design of Local Actions Toward EU2050 Targets Performed on Municipal Budgets* (pp. 104–116). https://doi.org/10.1007/978-3-031-37123-3_9
- Santopietro, L., Solimene, S., Di Carlo, F., Lucchese, M., Scorza, F., & Murgante, B. (2022). *A First Financial Assessment of SEAP Public Energy Interventions Performance Through Municipal Budget* (pp. 54–64). https://doi.org/10.1007/978-3-031-10592-0_6
- Sarkar, A., & Singh, J. (2010). Financing energy efficiency in developing countries—Lessons learned and remaining challenges. *Energy Policy*, 38, 5560–5571. <https://doi.org/10.1016/j.enpol.2010.05.001>
- Scorza, F., & Santopietro, L. (2021). A systemic perspective for the sustainable energy and climate action plan (SECAP). *European Planning Studies*, 1–21. <https://doi.org/10.1080/09654313.2021.1954603>
- Scott, W. R. (1987). The adolescence of institutional theory. *Administrative Science Quarterly*, 32, 493. <https://doi.org/10.2307/2392880>
- Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *The Academy of Management Review*, 20, 571. <https://doi.org/10.2307/258788>
- Tozer, L. (2018). Urban climate change and sustainability planning: An analysis of sustainability and climate change discourses in local government plans in Canada. *Journal of Environmental Planning and Management*, 61, 176–194. <https://doi.org/10.1080/09640568.2017.1297699>
- Treville, A., de Los, F., Rios, C., Melica, G., Baldi, M., Clemente, M., & Bertoldi, P. (2021). GCoM - MyCovenant. In *Second release. European Commission (Joint Research Centre (JRC) [Dataset]*. 2022).
- UN Secretary-General. (1987). World commission on environment and development. Report of the world commission on environment and development : Note /by the Secretary-General. *Environmental Policy and Law*, 14, 4–7. [https://doi.org/10.1016/S0378-777X\(85\)80026-3](https://doi.org/10.1016/S0378-777X(85)80026-3)
- Wang, X., Liu, C., & Hawkins, C. V. (2017). Local government strategies for financing energy efficiency initiatives. *The American Review of Public Administration*, 47, 672–686. <https://doi.org/10.1177/0275074015619483>
- Zanon, B., & Verones, S. (2013). Climate change, urban energy and planning practices: Italian experiences of innovation in land management tools. *Land Use Policy*, 32, 343–355. <https://doi.org/10.1016/j.landusepol.2012.11.009>