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# Public Spending and Sustainable Development: A Pay by Result Model for the Public Administration

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## Resumen

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Este trabajo define un modelo teórico útil para apoyar a la administración pública (AP) en la identificación de estrategias financieras orientadas a la sostenibilidad ambiental y social. En concreto, el modelo guía los decisores públicos en la asignación del gasto, según tres perspectivas específicas: el posicionamiento que la AP asume respecto a indicadores de desarrollo sostenible, la maximización del impacto multidimensional, el uso de los recursos públicos en una lógica de public-private partnership (PPP).

**Palabras clave:** administración pública, desarrollo sostenible, indicadores de impacto, modelo teórico.

**Keywords:** public administration, sustainable development, impact indicators, theoretical model.

## Expanded abstract

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Sustainable development policies are a hot topic on the policy makers' agenda; their implementation requires the definition of strategies, frameworks for measuring impacts, and economic models oriented towards sustainable finance, which are currently being investigated by national and international researchers and institutions. This work defines a theoretical model useful to support the public administration (PA) in identifying financial strategies and architectures aimed at environmental and social sustainability. Specifically, the model guides public decision makers in orienting public expenditure in favor of sustainable development processes, inspired by three specific perspectives: the positioning strategy that the PA assumes with respect to various sustainable development indicators, the maximization of impact in terms of multidimensional well-being, the efficiency in the use of public resources thanks to public-private schemes. The model proposed in this work is flexible and can be declined on the different levels of the PA, from a central level to a local one, and calibrated on different frameworks for measuring environmental and social sustainability.

The work contributes to advancing the literature regarding sustainable finance by laying the foundations for a modeling that is not limited to supporting the analysis of the positioning of the PA with respect to sustainability objectives, but connects the positioning itself to the public spending trend and to its more efficient management, in a partnership context with the private sector.



## 1. Introduction

Sustainable development policies are currently a top priority for policy makers' agenda; their implementation requires the definition of strategies, frameworks for measuring impacts, and economic models that are oriented towards sustainable finance<sup>1</sup>. The young, and still limited, literature exploring the relationship between public policies, economic choices, and environmental and social sustainability has yet to advance, especially for integrated accounting systems, i.e., systems combining economic decisions with decisions related to sustainability, and financial models inspired to foster partnerships with private investors and an efficient use of public resources.

On the other hand, governments and the public administration (hereinafter: "PA") have become fully aware of their role in the process of reaching environmental and social sustainability objectives. This role is carried out, not only at central administrations level, but also along the whole chain of the territorial public administration. To this end, central and local administrations have recently begun to develop tools to evaluate, monitor, and implement their policies in order to comply with Sustainable Development Goals (hereinafter: "SDGs") set by the United Nations in the 2030 Agenda. This is even more urgent for countries like Italy, which counts more than 8,000 municipalities providing social and environmental impact services<sup>2</sup>.

Under this framework, our work proposes a theoretical model aimed to support the PA in identifying strategies for environmental and social sustainability and in supporting financial choices that make the public budget economically sustainable. Specifically, the model guides public decision makers' choice in the allocation of expenditure, orienting it towards investments in line with positioning objectives aligned with the SDGs framework, and defines economic variables useful for implementing forms of partnership with private investors according to a pay by result (PbR) mechanism.

The model relies on three different strands of literature: public planning for sustainable development, the use of multidimensional and accountability indicators for the impact assessment of public policies, and public private partnership (hereinafter: PPP) inspired by a PbR logic typical of sustainable finance and more specifically of impact finance.

This work advances the literature on sustainable finance by laying foundations for a model which defines the PA positioning analysis, with respect to sustainability goals, and connects it to the public spending in the context of public-private partnerships. The rest of this work is

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<sup>1</sup> The paper is conceived as part of the research project "Sustainable Finance and Local Administrations: from theory to action", co-financed by SNA - National School of Administration within the framework of the research program "Projects for a new Public Administration - Collection of ideas to guide change in public administrations "(2020-2021). [www.sna.gov.it](http://www.sna.gov.it)

<sup>2</sup> In Italy, this process is supported both by the Alliance for Sustainable Development and the "Fair and Sustainable Wellbeing" (Benessere Equo e Sostenibile, hereinafter: "BES") framework. The former is an organization monitoring the SDGs progress for the country. The latter is a multi-dimensional index composed by a series of indicators grouped into 12 domains particularly relevant for Italy. Thus, BES complements the SDGs for monitoring sustainability in Italy. Furthermore, the "National Strategy for Sustainable Development" has given further impetus to the PA alignment with sustainability objectives, even if this path seems to entail, net of a few virtuous examples, greater slowness (Bova, 2019; Collevicchio, 2019).



structured as follows: section 2 contextualizes the reference literature; section 3 clarifies the proposed model; section 4 concludes and summarizes some key takeaways.

## 2. Theoretical background that inspired the model

The literature analyzing the relationship between public policies and environmental and social sustainability is relatively recent and is limited to some specific dimensions. As highlighted by La Torre et al. (2022)<sup>3</sup>, the majority of these studies has been published since 2017, and can be gathered into four main areas: public planning for sustainable development, integrated accounting systems for sustainability, impact measurement public policies, and sustainable finance and public-private partnership tools.

In general, the processes of integrating sustainability into the strategic planning of the PA represent single case attempts, rather than robust conceptual systematization (Tommasetti et al., 2020). Several authors note, for example, the lack of a systemic approach that limits, among other things, the ability to conduct integrated analyses across sectors (Allen et al., 2018) and planning levels - i.e. local, regional, and national (Zolin et al., 2020). Other studies complain about the absence of paths and tools aimed at defining priorities among actions (Cherp et al., 2004). In this direction, several scholars suggest promoting a bottom-up approach to define and evaluate sustainable development policies. This approach would enhance the ability to restore awareness in the link between resources and results, helping policy makers identify the most suitable policies for a given place.

Literature on "planning and accounting of public expenditure" points out that the PA, especially local authorities, allocate financial commitments for social purposes based on a traditional budget item classification; in addition, decisions are based on historical social expenditures, rather than on future social objectives, thus decreasing the effectiveness of sustainability policies (Tafuro et al., 2019; Sisto et al., 2020).

The broader strand of literature investigates "impact measurement frameworks applied in the public sector". Due to the absence of universal reporting standards, some tools tend to overlap each other, increasing the effort to comply on current regulation, and making the comparison between inter- and intra-territorial entities more difficult (Hege & Brimont, 2018; Biondi & Bracci, 2018). For this reason, there is a widespread practice captured by literature of considering the SDGs as a reference framework. Moreover, most countries use the SDGs indicators as a measurement and monitoring framework for public policies; consequently, a large body of literature deals with monitoring the progress of certain countries according to the SDGs and 2030 targets. However, in Europe, some countries, like Italy and Poland, have developed a series of indicators to measure territorial sustainability (Bellantuono, Lagrasta, Pontrandolfo & Scozzi, 2021; Raszkowski & Bartniczack, 2019). This allows to compare local

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<sup>3</sup> To be published in an international journal as "Sustainable finance in public administration in Europe: a Systematic Literature Review"



results within the countries, even though a domestic framework creates an obstacle to international comparison.

From a PA perspective, the financial dynamics supporting sustainable growth are linked with the need to find private sources that can amplify the impact of increasingly reduced public financial resources. Moreover, the strong disparities in financial autonomy between central PAs and local administrations are reflected in a different capacity of the administrative territorial units to fulfill their responsibilities to ensure sustainable territorial development (Suditu et al., 2014).

In this perspective, the last field retrieved from academic literature concerns "impact finance models". These models are also known as "Pay by Result" (PbR) mechanisms, and include social impact bonds (OECD, 2016), and recent forms of public-private partnerships (PPPs). The partnerships' objective is to attract private funds and highly specialized skills to reduce the economic and managerial financial burden that the PA should bear for certain investments (McHugh et al., 2013; Sinclair et al., 2014; Nicholls & Tomkinson, 2015). However, the main feature of impact finance tools in general, and PbR tools in particular, is that they attract traditional investors together with "patient" investors, that is, investors who are willing to link their economic return with the level of social or environmental impact reached, and this return is likely to be the market value (OECD, 2016; Gustafsson-Wright et al., 2015). This makes PbR and social impact bonds (SIBs) contracts different from traditional partnerships, precisely because of the intrinsic motivations of their agents that might have positive and negative consequences for adverse selection issues (Gerhart and Fang, 2015). The use of these financial instruments for public utility services involves risks and opportunities that still need to be explored (Warner, 2013; Edmiston and Nicholls, 2018; Fraser et al., 2018). Most of the studies on PbR tools are qualitative, and are mainly case studies (Broccardo et al., 2020). A few papers analyze PbR models from a business models perspective (La Torre et al., 2019) useful for partnerships (Rizziello et al., 2020). In this perspective, an interesting work is proposed by Becchetti et al. (2021): the authors identify the necessary and sufficient conditions for the PA to use a SIB.

What we have summarised so far suggests a few solutions to effectively integrate sustainability factors into public policies. The above-mentioned literature highlights the need for models allowing to inspire public spending choices, not only for positioning analyses, with respect to sustainability indicators, but also for targeting specific objective values. The positioning analysis, and the definition of medium and long-term targets, must also serve as a first step before financial choices; this calls for a renewed budget policy, which cannot be separated from new integrated accounting models, able to combine accounting and impact metrics. Finally, the increasingly reduced quantity of public resources available should prompt the PA to consider new forms of partnership with private individuals, especially PbR-type models.

Our analysis contributes to the existing literature by offering the PA a theoretical model that can be applied according to different target needs and perspectives. In fact, our model (i) is conceived to be implemented both at the local level and at central administration level, and to



be applied transversally to all the PA sectors; (ii) connects the traditional accounting, i.e., an economic-financial characteristic, to the accounting of environmental and social sustainability, reclassifying the budget of the PA according to the sustainability framework; (iii) adopts the framework of the SDGs, but can be adapted to any measurement framework, where significant historical series of the related indicators exist; (iv) estimates the economic variables useful for defining PPPs using PbR models.

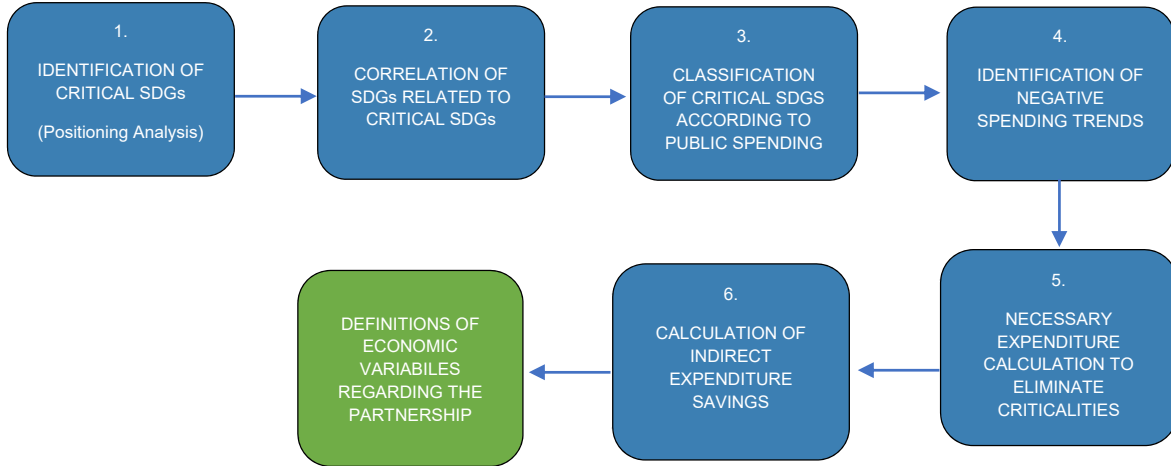
### 3. The model

Our theoretical model relies on the SDGs as a sustainability framework; depending on the context, however, the model can be calibrated using different multidimensional well-being and sustainable development frameworks, i.e., at international and national level, and can be applied to the different levels of the PA, i.e., regions, metropolitan cities, and central administrations.

The model follows a building block approach based on 7 components: the first two develop a positioning analysis by identifying sustainability indicators defined as “critical” with respect to a given benchmark; more specifically, we identify critical indicators (component 1) and indicators related to the critical ones (component 2); in this analysis, SDGs indicators are our reference framework. Components 3, 4, 5 refer to the reference PA budget structure, and classify expenditure items according to the sustainability indicators (component 3), derive the expenditure trends (component 4), and set the gap expenditure necessary to make critical indicators and expenditures no longer critical and achieve a benchmark positioning (component 5). Components 6 and 7 define the economic variables for a partnership with private investors using a PbR logic; these variables refer to the indirect spending savings achieved by the PA, due to investments aimed at improving critical sustainability indicators (component 6), and to the level of economic return ensured by private capital, given the public budget constraint and the cost savings arising from the generated impact (Figure 1).



**Figure 1.** The model building block approach



Source: authors elaboration

### 3.1. Positioning analysis and identification of critical SDGs

The positioning analysis identifies critical SDGs in three phases. The first identifies, for each indicator  $i$  of the SDG  $j$  at time  $t$ ,  $I_{ijt}$ , three indices:

- the level of performance of the last available year  $T$ ,  $I_{ijT}$ ;
- the percentage change between the levels of the last two years,

$$\text{DELTA1}I_{ijT} = (I_{ijT} - I_{ijT-1}) / I_{ijT-1};$$

- the percentage change between the levels of the last year and five years before,

$$\text{DELTA5}I_{ijT} = (I_{ijT} - I_{ijT-5}) / I_{ijT-5}.$$

The second phase compares these indices with reference benchmarks; depending on the objectives of the analysis and the context, the benchmark can be represented by the average of the three indices at municipal or metropolitan city (respectively,  $\text{MC}I_{jT}$ ,  $\text{MCDELTA1}I_{jT}$  and  $\text{MCDELTA5}I_{jT}$ ), regional (respectively,  $\text{REG}I_{jT}$ ,  $\text{REGDELTA1}I_{jT}$  and  $\text{REGDELTA5}I_{jT}$ ), or national (respectively,  $\text{ITA}I_{jT}$ ,  $\text{ITADELTA1}I_{jT}$  and  $\text{ITADELTA5}I_{jT}$ ) level.

In the third phase, the critical SDGs are identified through quantitative and qualitative assessments. In this analysis, our quantitative criterion defines a critical goal as that with its indicators  $I_{ijT}$  such that all the indices ( $I_{ijT}$ ,  $\text{DELTA1}I_{ijT}$  and  $\text{DELTA5}I_{ijT}$ ) are lower than their respective benchmark averages; we will call this percentage  $D_j\%$ .

For the sake of simplicity, in this paper we take national averages as our benchmark, even though the model might be applied to any local PA perspectives. Similarly, the 50% threshold for  $D_j\%$  to be critical has been arbitrarily set, and can be qualitatively assessed, as well as modified based on the available dataset or political priorities of the PA.



After our positioning analysis, we are now able to classify the SDGs into two categories: critical and non-critical goals. The set of critical goals (CRIT<sub>j</sub>) will therefore be composed of those SDG<sub>j</sub> for which all three positioning indices are lower than their respective average benchmarks: in our case, national averages.

More formally, we can identify critical SDGs as follows:

CRIT<sub>j</sub> = SDG<sub>j</sub> if

$$I_{iDjT} < \mathbf{MCI}_{iDjT}$$

$$\mathbf{DELTA1}_{iDjT} < \mathbf{CMDELTA1}_{iDjT}$$

$$\mathbf{DELTA5}_{iDjT} < \mathbf{CMDELTA5}_{iDjT}$$

for at least half of  $i$  belonging to SDG<sub>j</sub>.

Then, CRIT represents the set of critical goals CRIT<sub>j</sub>, that is, the  $j$ s that satisfy the three positioning constraints. Note that some indicators may be expressed differently; that is, some indicators increase as the indicator itself improves (i.e., life expectancy), while others decrease (i.e., number of road accidents). In this case, the evaluator should adjust the interpretation of the signs accordingly.

### 3.2. Correlations among SDGs

The model considers the possible correlation among SDGs in order to capture the effect that an intervention on a critical SDG has on other SDGs. Consider, for example, SDG 13 "Climate actions" and SDG 8 "Decent work and economic growth"; we can assume (and empirically test) that an improvement in one of these SDGs may also have positive effects on other SDGs, such as, for example, SDG 3 "Good health and well-being".

We therefore assume that this interaction among goals can be written using the following linear model:

$$SDGi = \sum_{j \neq i} b_{ij} SDGj + c_i$$

where  $b_{ij}$  are the parameters capturing the link between SDGs  $i$  and  $j$ , and  $c_i$  is a constant term. Each goal  $i$  can be expressed as the sum of other goals  $j$  plus a fixed parameter characteristic of that goal. The terms  $b_{ij}$  represent correlation among goals and can be estimated through an econometric model using minimum least squares or fixed or variable effects models, depending on available data. Once the parameters  $b_{ij}$  are estimated, we define a strong link between SDG<sub>i</sub> and SDG<sub>j</sub> if  $b_{ij}$  is statistically significant at 5% (i.e., p-value < 0.05), and we assume  $b_{ij} = 0$  otherwise.

This econometric analysis may follow a simpler correlation analysis among goals for the sake of including only relevant goals. This step could be particularly useful if the number of observations is not enough to obtain sufficiently robust results and to avoid an incorrectly





specified model. Even in this case, to obtain consistent and reliable results, a qualitative assessment by the evaluator in the choice of variables and the model is essential.

### 3.3. Relationship between expenditure and SDGs

After having identified critical goals and their correlated goals, we analyse the SDG-oriented budget of the PA and identify the critical expenditure items.

First, we classify all expenses items according to the SDGs. Then, we identify the items that show negative trends over time, which could potentially explain the critical positioning in terms of SDGs, and which represent areas of potential further improvement for the PA budget and critical SDGs.

Similarly to what we have done with the SDG positioning analysis, this analysis also consists of four steps. The first links budget spending programs and SDGs; for our purpose, we assume an expense item  $m_{it}$  for each SDG $_i$  in year  $t$ . More precisely, we assume that  $m_{it}$  expenditure and sustainable development indicators are linked through the following linear relationship:

$$SDG_i = \alpha_i m_{it-1} + k_i, \text{ with } \alpha_i > 0$$

where sustainable development goal SDG $_i$  is a function of a fixed value  $k_i$  and a variable value proportional to a parameter  $\alpha_i$ . The term  $k_i$  is equivalent to the value that would be obtained if the PA did not invest any expenditure for that budget program associated to SDG $_i$ ; for this reason, we assume negative  $k_i$ , meaning that we always need a positive expense to obtain a positive target value. The coefficient  $\alpha_i$ , on the other hand, captures the effect that a monetary investment (for example, 1 euro) has on the value of the goal.

This model can be used to analyse historical data of the targeted PA budget, with expenditure items that refer to each goal, to determine the values of  $k_i$  and  $\alpha_i$ . Also, for the budget analysis, the correlation between expenditure and goals can be estimated through an econometric model using the minimum least squares model or fixed or variable effects models, depending on the available data. Once the  $\alpha_i$  parameters have been estimated, we define a strong link between SDG $_i$  and its expenditure, if  $\alpha_i$  is statistically significant at 5% (i.e., p-value < 0.05).

In the second step, we analyze the change in the expenditure between the two last years (i.e.,  $DELTA1m_{iT} = m_{iT} - m_{iT-1}$ ), or the expenditure of five years earlier ( $DELTA5m_{iT} = m_{iT} - m_{iT-5}$ ).

In the third step, we compute the benchmark averages changes in expenditure for the last two years; in our model, these are the national averages (respectively,  $DELTA1M_{iT}$  and  $DELTA5M_{iT}$ ). As for the previous steps, a qualitative assessment is also necessary for this step. For example, in some contexts it may be appropriate to assume a longer period of distance, such as 8 or 10 years, to better reflect the adjustment time each indicator needs.

In the fourth and last step, we define the critical spending items as those in which both short- and long-term variations are lower than their respective national averages, i.e.,  $DELTA1m_{jT} <$



$\Delta 1M_{jT}$  and  $\Delta 5m_{jT} < \Delta 5M_{jT}$ . As in previous steps, a qualitative evaluation is necessary to assess a criterion that qualifies expenditure trends as critical.

### 3.4. Choosing expenditure items to improve

The public administration has now all the information to assess expenditure items and making choices to correct the most critical ones, in order to improve its positioning with respect to the critical SDGs. The model has identified the critical SDGs, those related to them, and the SDGs with expense items displaying negative trends.

More formally, critical goals to be improved, and expenditure items to be changed, next year are defined as follows:

$$\begin{aligned} \text{INT\_SDG}_{it} &= \text{SDG}_{it} \text{ if} \\ &\text{SDG}_{it} \in \text{CRIT}_j \text{ or } b_{ji} \neq 0 \text{ for some } j \neq i, \\ &\Delta 1m_{jT} < \Delta 1M_{jT} \\ &\Delta 5m_{jT} < \Delta 5M_{jT} \\ &= 0 \text{ otherwise} \end{aligned}$$

Assuming the total budget of the administration at time  $t$ ,  $M_t$ , as the sum of the individual expenditure items for each goal  $i$ ,  $m_{it}$ , we obtain that the initial budget is  $M_0 = \sum_i m_{i0}$ . Therefore, having identified the SDGs to improve in period  $t$ , the expenditure relating to those SDGs can be increased in the following period, i.e.,  $t + 1$ , as follows:

$$m_{it+1} > m_{it} \text{ if } \text{INT\_SDG}_{it} \neq 0.$$

Intuitively, the expenditure referring to the SDGs that need improving must be greater at time  $t + 1$  than at time  $t$ .

### 3.5. Indirect improvement of related SDGs

The decision to increase expenditure on some specific budget items has two implications. First, there is a potential improvement in the positioning analysis which is directly connected to the expense items. Thanks to the relationship between expenditure and SDGs objectives described above, this direct  $\Delta \text{SDG}_i$  improvement can be written as

$$\Delta \text{SDG}_i = \alpha_i (m_{it+1} - m_{it}) > 0$$

Second, there is an "indirect" positioning improvement arising from the SDGs that are not linked to the improved expenditures, but that are still correlated with directly improved SDGs. More formally, we have:

$$\text{SDG}_{j,t+1} \geq \text{SDG}_{j,t} \text{ if } b_{ij} \neq 0 \text{ and } i \text{ is in CD and } j \neq i,$$

that is,  $\text{SDG}_j$ , different from the critical  $\text{SDG}_i$  and linked to  $i$  through  $b_{ij}$ , increases from period  $t$  to period  $t + 1$ . We denote this increase as:

$$\Delta \text{SDG}_{ji} = b_{ij} \alpha_i (m_{it+1} - m_{it}) > 0$$



### 3.6. Savings in public spending created by the impact on the SDGs

With the increase in expenditure related to the critical SDGs, the PA can, therefore, obtain a direct improvement in positioning on the goals themselves, and an indirect improvement in positioning compared to other SDGs related to critical ones. This indirect increase, if any, is an unsolicited increase, which, in theory, the administration can disregard; in accounting terms, this waiver can translate into a reduction in the items of expenditure related to the SDGs indirectly impacted by the improvement of critical SDGs, obtaining cost savings. In summary, the administration will be able to achieve savings on some items of expenditure without penalizing its positioning on related SDGs.

For each goal  $j$  correlated with goal  $i$  through interactions between objectives described above, the amount of expenditure that the administration can save is equivalent to the indirect increase obtained on goal  $j$ , thanks to the increase in expenditure on goal  $i$ ,  $DELTA_{SDGji}$ .

The total savings that the administration can obtain will therefore be given by the difference between the amount of expenditure increased, or invested, on the items of expenditure related to the critical SDGs

$$X = \sum_i (m_{it+1} - m_{it}) \text{ if } CRIT_i \neq 0$$

and the amount of expenditure saved on the items of expenditure attributable to the SDGs related to the critical ones

$$Y = \sum_{(i, j)} \alpha_j^{-1} DELTA_{SDGji}$$

where  $\alpha_j^{-1}$  is the inverse of the coefficient that relates goal  $j$  and monetary expenditure, as described above.

Note that, from a financial perspective, the amount of expenditure invested  $X$  refers to a certain increase in expenditure and accounted for in the period of the intervention, while the amount of saved expenditure  $Y$  refers to future expected savings as a result of the investment.

Based on these hypotheses, the administration either chooses to invest  $X$  at time  $t$  to obtain savings  $Y$  at time  $t+1$  with probability  $s$ , or no gain (with probability  $s - 1$ ). This last scenario can happen if the increase in expenditure does not generate a positive impact on the administration's SDG positioning in relation to critical SDGs.

### 3.7. The Pay by Result logic and the financing of expenditure

The potential cost savings calculated by the model can be used to implement a partnership with private investors using a PbR approach. These investors are willing to finance the increase in public spending, taking part of the indirect expenditure savings achieved by the administration as their expected gain. According to this mechanism, which characterizes impact bonds, the private investor pays for the investment to improve the SDGs positioning of the PA,



and gets back part of the indirect expense savings as payoff. As this payoff represents expected gains, the private investor also needs to be guaranteed by the government of a minimum gain in case the investment does not return the expected profits.

Following Becchetti et al. (2021), in our model we formalize the PbR scheme assuming that the private investor and the local administration agree upon a contract  $(g, f)$  as long as the expected outcome  $Y$  is greater than the initial investment  $X$ , where  $g$  is the guaranteed amount paid back to the investor in case of failure, and  $f$  is the share of profits the investor gains in case of success.

The administration, therefore, will assess whether such a partnership is convenient and financially sustainable.

More specifically, following Becchetti et al. (2021), the administration solves the following constrained maximization problem:

$$\begin{aligned} \max_{g, f} & s (1-g) (Y-X) - (1-s) fX \\ \text{s.t.} & sg (Y-X) + (1-s) (fX-X) \leq h \quad (C1) \\ & sg (Y-X) + (1-s) (fX-X) \geq X (a_0 + a_1\sigma^2 (g, f)) \quad (C2) \end{aligned}$$

where  $a_0 + a_1\sigma^2 (g, f)$  represents the efficient investment frontier (i.e., how much the investment would have made if committed elsewhere, on average) and  $h$  represents the risk attitude of the administration. The two constraints C1 and C2 represent, respectively, the participation requirements of the PA, which is assumed to be sufficiently risk averse, and of the private investor, who is assumed to gain at least as much as it would gain with another investment. This latter condition is a conservative condition, as it does not consider patient investors, altruistic investors who may be willing to give up some of their profits for the social or environmental benefit of the project. On this point, the coefficient  $h$  can also represent the time preferences of the administration - more exposed to moral hazard in the short-term, more prudent in the long-term. Moreover, the  $h$  term can capture other elements that affect the administration choice, such as bureaucratic friction, that jeopardize the ability to implement investment projects efficiently and at limited costs.

Solving the maximisation problem, the optimal solution of the PbR partnership described above can be written as

$$(g^*, f^*) = ((a_0 X) / (Y-X), ((X+Xa_0) / X))$$

which exists if and only if  $0 \leq (1+a_0) X \leq Y$  (Becchetti et al., 2021).

This condition must be read in two directions. On the one hand, the quantity  $(1+a_0)X$  must be positive in order to guarantee greater earnings to the private investor; on the other hand, the same amount must be less than the expected gain in case of success, to minimize the losses of the administration compared to the case in which they had not activated the partnership.



## 4. Discussion

The proposed model is a useful tool available to the PA that wants to systematically direct its policies towards environmental and social sustainability objectives. The model integrates the positioning analysis with respect to the sustainability framework with the budget analysis of the PA, in an integrated accounting perspective, and defines the economic variables for partnerships with impact-oriented private investors.

In the proposed version, the model adopts the SDGs sustainability framework. However, as clarified, the model can be extended to any framework, with both an international and a domestic focus. The perspective of the PA that is adopted will determine the choice of the framework; from an application point of view, it should be noted that the availability of a long and detailed historical series of SDGs data for the PA - both with respect to the targeted administration and the reference benchmark - represents a necessary condition for the significance of the analysis.

The same observation also applies to the accounting data that can be obtained from the PA's financial statements; in this case, not only the availability of the data is relevant, but also their correct classification, based on the chosen framework of indicators.

Consequently, to make the proposed model more extensible and relevant, the PA needs to implement an integrated accounting system, both from a financial and non-financial perspective - which is oriented to one or more measurement frameworks.

Since the quality of the data is essential, it is advisable to promote a uniform system of indicators as reference for different levels - central, regional, and provincial - of the PA; this, of course, should be combined with the specific local needs or challenges each PA may face with. In this direction, our model relies on both internationally recognized indicators, such as SDGs, and domestic indicators used at national level.

The model also requires a constant update of the data, as this will make estimates on correlations among goals and budget items more accurate.

A further observation concerns the qualitative assessment of the model. In each step, we highlighted that the expert analysts and the policy maker needs to qualitatively assess what quantitative methods define and produce. The qualitative intervention allows the model to be calibrated according to the context, considering specific features of the territory and the environmental, social, and economic setting. For this reason, it is extremely important to enhance the transparency of each criterion and to ground the analysis on multiple parameters; this would better inform external evaluators about how the political and financial decisions has been made.

## 5. Conclusion



Increasing pressure on social and environmental responsibility stimulates national governments and local administrations to constantly monitor their policies, to implement, with innovative methods, policies that are sustainable from an environmental, social, economic, and financial perspective. In this process, the PA may practically cope with many challenges, and local PA often lack specific guidelines tailored for local settings.

This study proposes a theoretical model that the PA can apply to position its policies based on sustainability frameworks, and more specifically on the SDGs. The model allows PAs, not only to make economic choices oriented towards sustainability on the basis of a positioning analysis, but also to identify the optimal conditions for using a partnership with private investors, according to the PbR mechanism, typical adopted in the field of impact finance.

The application of the model calls all the PAs, such as those at municipalities, regional, and central level, to gather a series of economic and sustainability data within an integrated accounting schemes. According to this perspective, our model can act as a useful stimulus for PA experiments, also to enhance consistent data collection along the territorial chain of the PA, to efficiently assess policies through the lens of sustainability criteria.

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