A Model to Support the Investment Decisions Through Social Impact Bonds as Effective Financial Instruments for the Enhancement of Social Welfare Policies

Francesco Tajani[1], Pierluigi Morano[2], Debora Anelli[1(✉)], and Carmelo Maria Torre[2]

[1] Department of Architecture and Design, "La Sapienza" University of Rome, 00196 Rome, Italy
{francesco.tajani, debora.anelli}@uniromal.it
[2] Department of Sciences of Civil Engineering and Architecture, Polytechnic University of Bari, 70125 Bari, Italy
{pierluigi.morano, carmelomaria.torre}@poliba.it

Abstract. Despite the widespread opinion that the traditional finance is exclusively interested in the monetary return, in the last ten years this sector has been affected by a contamination of the public principles related to the social impacts. The global development and the spread of "win-win" financial instruments such as the Social Impact Bonds (SIBs) outlines a growing interest in making an investment that aims at generating benefits for all the subjects involved, always guaranteeing a monetary return to the private investor. The complexity of identifying the social impact sectors to be preferred, in a context characterized by different social needs, represents a critical issue in the SIBs investment. This research defines a model that can constitute a decision support tool for the public and private subjects in the preliminary phases concerning the resource allocation for a social program. The proposed algorithm allows to define a temporal priority of the social impact sectors that are simultaneously able to maximize the conveniences for all the subjects involved. Through the model, the public and private subjects will be able to determine the best allocation of financial resources according to the real social needs, contributing to an effective spread of SIBs both in Italy and abroad.

Keywords: Social impact bond · Social investments · Public-private partnership · Operational research · Decision support tools

1 Introduction

In the context of Sustainable and Responsible Investment (SRI), a sustainable finance approach born after the 2007 financial crisis, named the Social Impact Investments (SII), represents a new generation of impact investing. Defined as a wide range of investments based on the assumption that private capital can intentionally contribute to positive social impacts and, at the same time, financial returns, the SII stand out for the

© Springer Nature Switzerland AG 2020
O. Gervasi et al. (Eds.): ICCSA 2020, LNCS 12251, pp. 941–951, 2020.
https://doi.org/10.1007/978-3-030-58808-3_67

proactive intention with which the investor pursues the social purpose, together with the financial return, differently from the profit-only approach of traditional finance tools. In particular, the SII consist of a transaction between a private investor and a social enterprise, aimed at beneficiaries in difficulty. Therefore, the characteristics of the SII can be summarized as follow:

- *intentionality*, that is, the willing of the investor to generate a positive impact through the investment;
- *expectations of financial return*s, differentiating themselves from donations for which investors do not expect a monetary return;
- *flexibility of the expected rate of return*, which may be below the average market level or align with the average or higher yield;
- *measurability of the impact* generated through assessment techniques that can translate impacts into monetary terms;
- *breadth of investment instruments*, through the use of different asset classes, ranging from debt to pure equity, with different yield and risk profiles.

On the demand side, the SII promote the growth process of social enterprises, the ability to propose suitable responses to the complexity of new social needs and, at the same time, an economic and financial feasibility of intervention models. On the supply side, the SII stimulate the growth of a new generation of responsible investors, helping to spread the outcome-oriented approach that forms the theoretical basis on which the different social investment instruments are based.

The social investors, called *Impact First*, are solidarity organizations whose priority is to achieve the established social or environmental purpose, to the detriment of financial returns (e.g. charitable organizations, venture capital and venture philanthropy funds). It often happens that they find themselves working together with *Financial First* investors, who are influenced mainly by the financial return they can obtain, constituting the so called *Layered Structures*, which allows the Financial First to obtain the expected returns at market rates and Impact First to be able to make the most of their investment capital, thus achieving a more significant impact than that obtained if they had independently operated. The most common motivations for private investors to carry out impact investing concern *i)* the willingness of organizations to be responsible investors (85%), *ii)* the dedication to their missions (84%), *iii)* the search for efficient modalities to achieve their impact investment objectives (71%). A further important factor for the impact investing is represented by the respect of the United Nations sustainable development goals set in the 2030 Agenda for Sustainable Development or in the climate agreement held in Paris in 2015 [7].

There is ample evidence that the growth of the social sector stimulates the growth of the economic sector; social development closely linked to the government's practices for public welfare whose austerity policies, caused by the 2007 financial crisis, have imposed a constraint on the budget of public finances [8]. The constraint on public expenditure on welfare is probably a powerful driver of the diffusion of the SII tools, therefore, the public-private partnership acquires an important role [1–3, 17]. The involvement of private financial resources for public purposes has shown its effectiveness in numerous initiatives [19, 20, 22]. In doing so, for the financial private world the welfare deficit appears as a new market, while for the policy maker's point of view

the public-private partnership is a way to address the lack of public money, in order to provide the necessary resources for supporting the weaker of the community.

The Governments have been keen to support alternative service delivery as a way to shrink public sector costs and responsibilities [5] and they have begun experimenting with tools to encourage alternative service funding through innovations such as social impact bonds (SIBs). The SIBs are a financial tool used to encourage private, philanthropic or public investors to provide upfront capital to support project-oriented service delivery by private sector social investors.

2 Aim

Taking into account the framework outlined, in this research a decision support model that allows to define investment priorities among different social impact sectors has been developed, by borrowing the principles and theory of Operational Research. The model adopts the branch and bound algorithm for identifying the priority investment alternatives in the different social impact sectors considered. Each investment alternative is distinguished by several weighted criteria that define its main characteristics and represent the aspects that the social investor and the Public Administration should take into account for the adoption of the SIBs.

The model will serve the social investor and the Public Administration to carry out a screening of the types of social impact sectors in which to invest primarily for the activation of a social program using the Social Impact Bonds. The adoption of the proposed model must provide a simple and immediate support to the decisions to be taken in the preliminary phase of identifying the social issues to be addressed. The model should also support decisions to be taken for both small scale and large scale social issues.

The rest of the paper is organized as follows. In Sect. 3 the current diffusion of the SIBs has been outlined. In Sect. 4 the algorithm of the model proposed has been defined: the variables, the objective function and the constraints to be considered for the implementation of the model have been specified. In Sect. 5 the potentialities and the limitations of the proposed model have been discussed.

3 The Social Impact Bonds

Starting from 2010, the empirical literature that focuses on aspects of the SIBs implementation is growing. This consists of reports commissioned by governments and consultancies seeking to highlight the practical advantages and disadvantages to be learned from SIBs adoption [4, 18, 21]. These reports are almost exclusively qualitative and highlight many of the practical challenges involved in initiating SIBs such as high transaction costs, complexity in contractual negotiations, uncertainty relating to the risk and the return deriving from the (entrepreneurial and managerial) capacity of social enterprises to provide services related to the results of the program, difficulty in evaluating and quantifying the expected results, limitation of the budgets that can be spent by the local public administration funds. A part of this literature focuses instead

on the motivations that could lead the actors to decide not to pursue a SIB, mainly identified in a lack of sharing of the interests of the subjects involved [6, 13, 16].

The SIB's strategic ambiguity has advantages for both their proponents and critics, and they are lauded for their potential:

- to foster innovation [10];
- to "scale-up" evidence-based programs [12];
- to enable flexible and personalized services tailored to service users [9];
- to improve productivity and value for money or promote more measurement and accountability both for privates and public sector [11].

Thus, there are interesting questions emerging about whether the SIBs challenge or reinforce existing governance logics for actors, institutions and networks involved in experimenting with this new commissioning tool. Developing a SIB at the local level frequently involves the development of new relationships between the actors and the subjects that provide services in the social sector in response to existing and emerging policy problems. This, in turn, may strain (or conversely, it may strengthen) existing relationships and system governance.

Since the launch of the first SIB in 2010 in England, there has been a significant spread of the phenomenon with 137 cases implemented worldwide for a total number of beneficiaries amounting to 1,711,130 (Table 1).

Table 1. Number of SIBs implemented by geographical area, capital raised and number of beneficiaries (source: own elaboration based on https://sibdatabase.socialfinance.org.uk/).

	Number of launched sibs	Capital raised	Number of beneficiaries
United Kingdom	47	£ 44,7 M	54,233
United States	26	$ 219 M	659,482
Australia	10	AUD 57,2 M	8,280
Netherlands	11	€ 11,5 M	2,850
Canada	4	C$ 4,30 M	7,201
France	5	€ 1,95 M	14,030
Israel	3	€ 22,4 M	4,050
Portugal	4	€ 1,72 M	611
Japan	3	–	–
India	3	$ 14,8 M	918,000
South Africa	1	$ 0.540 M	1,000
Finland	2	€ 10,7 M	4,300
Colombia	1	$ 0.750 M	511
Belgium	2	€ 0.230 M	450
Uganda	1	$ 2,40 M	13,830
Cameroon	1	$ 250 M	18,000
Germany	3	€ 0.300 M	148
New Zeland	2	NZ$ 7,50 M	2,700
South Korea	2	₩ 110 M	100

(*continued*)

Table 1. (*continued*)

	Number of launched sibs	Capital raised	Number of beneficiaries
Sweden	1	SEK 10,0 M	60
Switzerland	1	CHF 0.720 M	120
Argentina	1	AR$ 40,0 M	1,000
Congo	1	$ 27,0 M	0
Austria	1	€ 0.800 M	75
Peru	1	$ 0.110 M	99
Total	**–**	**–**	**1,711,130**

What is shown in Table 1 highlights the adoption of SIBs in different geographical areas of the world whose entire, characterized by a series of social needs expressed by local populations, allows to define the extent of the impact generated and consequently the system of needs expressed by populations. Generally, there are seven main macro-categories that represent the social sectors of interest of SIBs: *i)* Child and family welfare; *ii)* Criminal Justice; *iii)* Education; *iv)* Environment; *v)* Health; *vi)* Homelessness; *vii)* Workforce development. The typology of needs expressed, and the importance attributed to a certain sector through the social programs launched by local governments is highlighted by the distribution of the SIBs in each country according to the respective social impact sector (Table 2).

Table 2. Number of SIBs implemented in each social impact sector (own elaboration based on data from: https://sibdatabase.socialfinance.org.uk/)

Country	Social issue						
	Child and family welfare	Criminal justice	Education	Environment	Health	Homelessness	Workforce development
United Kingdom	6	1	1	–	8	16	15
United States	6	8	2	1	3	4	2
Australia	4	1	–	–	1	3	1
Netherlands	–	1	–	1	1	–	8
Canada	1	–	1	–	1	–	1
France	–	–	1	–	–	–	4
Israel	–	–	1	–	1	–	1
Portugal	1	–	1	–	–	–	2
Japan	–	–	–	–	3	–	–
India	–	–	2	–	1	–	–
South Africa	1	–	–	–	–	–	–

(*continued*)

Table 2. (*continued*)

Country	Social issue						
	Child and family welfare	Criminal justice	Education	Environment	Health	Homelessness	Workforce development
Finland	–	–	–	–	–	–	2
Colombia	–	–	–	–	–	–	1
Belgium	–	–	–	–	–	–	2
Uganda	–	–	–	1	–	–	–
Cameroon	–	–	–	–	1	–	–
Germany	–	–	2	–	–	–	1
New Zeland	–	1	–	–	1	–	–
South Korea	–	–	1	–	–	–	1
Sweden	–	–	1	–	–	–	–
Switzerland	–	–	–	–	–	–	1
Argentina	–	–	–	–	–	–	1
Congo	–	–	–	–	1	–	–
Austria	1	–	–	–	–	–	–
Peru	–	–	–	–	–	–	1
Subtotals	**20**	**12**	**13**	**3**	**22**	**23**	**44**

The data show a high number of interventions (44) in the Workforce development sector for almost all countries, whereas it is evident that the number of Environment initiatives is limited (3). The interventions included in the social environmental impact sector are not very frequent because they are considered complex due to the vast territorial scale in which they are carried out and the multiple aspects and subjects involved (such as the construction of a water and sewage system for the most poor cities or reforestation projects). This condition is also confirmed by the number of funds that decide to invest pursuing an environmental focus or a social focus. From the data present in the ImpactBase database (source: www.impactbase.org/) it appears in fact that, until 2017, there is a greater number of funds involved in social initiatives rather than environmental ones, also due to the target return respectively obtainable (Fig. 1).

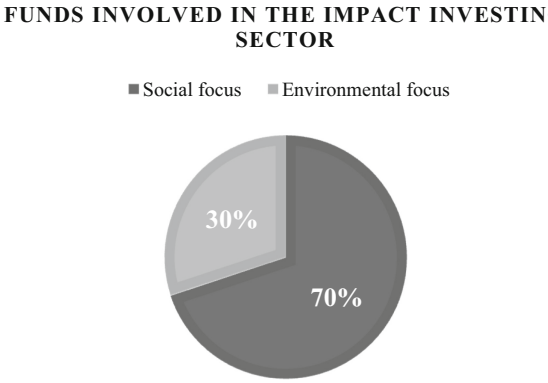


Fig. 1. Percentage of funds involved in initiatives with a social and environmental focus (source: www.impactbase.org/)

Moreover, England holds the record for the largest number of SIBs implemented (47), especially in the Homelessness (16) and Workforce development sectors (15), evidence in accordance with the reasons that led to the birth of SIBs. Except for the United States, Netherlands and Australia where the most widespread SIBs concern the sectors of Workforce Development, Criminal Justice and Child and family welfare, in the remaining geographical contexts the SIB have not had a development comparable to the previous ones. The subdivision of the projects implemented through the adoption of SIBs into macro categories of intervention is necessary to understand the relevance of the social issues felt by local governments, which as a result, carry out appropriate intervention.

4 The Model

The proposed model is based on the principles and theory of the Operational Research, a methodology of considerable flexibility and efficiency that is frequently used in the field of project evaluation and feasibility territorial investments [19, 20] for the resolution of a goal programming problem. The generic problem of goal programming can be traced back to the determination of the excellent use of scarce resources usable in alternative modalities. For the specific field of interest, the goal programming problem is characterized as follows:

- resources available in limited quantity are represented by the different social impact sectors;
- the alternative uses correspond the various weighted criteria, identifying the important aspects considered by the subjects involved (social investors, Public Administrations etc.);
- the constraints that translate into mathematical terms the temporal priority of social impact sectors taking into account the weighted criteria identified;

- the objective functions that reflect the goals pursued by the subjects involved in the social initiative, in terms of maximization (or minimization) of the respective expected outputs.

In this research, the proposed model applies the branch and bound algorithm [14, 15]. Based on a partition and branching mechanism of the sets of solutions and the calculation of a limit value of the objective function, the branch and bound algorithm proceeds for a partial exploration of the feasible solutions. In this case, clarified that, increasing the number of the n social impact sectors and the number of the m weighted criteria, the combinations to be examined become so numerous that the enumeration of the total number of solutions could be impossible, the branch and bound algorithm decomposes the domain solutions into subsets whose intersection is null and whose union coincides with the starter set. The best combination is sought in the subsets obtained through a strategy that aims to verify whether the partition should be further subdivided or may be excluded from further analysis.

The implementation of the branch and bound algorithm provides the introduction of a binary variable k_i, associated to the i-th (i = 1, …, n) social impact sectors. Therefore, k_i represents the branching variable, which assumes a value "1" if the i-th social impact sector satisfies the objective function, and a value "0" otherwise.

With the aim of defining a temporal priority order of the investment sectors according to the different weighted criteria, it is evident that the first selection of the i-th investment sector - which is therefore the first in order of realization - excludes the other $n-1$ sectors. This will be followed by $n - 2$ elaborations, aimed at identifying, in each of them, the i-th investment sector which, in terms of capacity to satisfy the intended objective function, follows that generated in the previous processing. Therefore, the first constraint of the model can be defined through Eq. (1), in order to ensure that the branching variable k_i takes the value "1" for only one of the j social impact sectors, with j = n, n − 1, …, 2 repeating this process:

$$\sum_{i=1}^{j} k_i = 1 \qquad j = n,\, n-1, \ldots, 2 \tag{1}$$

The second constraint concerns the definition, for each l-th selection criterion, of the capacity (G_l) of the investment sectors to satisfy the considered constraint. By indicating with v_{il} the score of the i-th investment sector in satisfying the l-th selection criterion, the second constraint of the model is expressed by Eq. (2):

$$\sum\nolimits_{i=1}^{j} k_i \cdot v_{il} = G_l \begin{cases} j = n, n-1, \ldots, 2 \\ l = 1, \ldots, m \end{cases} \tag{2}$$

The objective function of the proposed model pursues the maximization (or the minimization) of the outputs expected by the subjects involved in the process, i.e. the sum of the capacities (G_l) of the social impact sectors to satisfy the weighted criteria considered. Taking into account that the weight attributed to each criterion of the social impact sectors could be different, thus indicating with p_l the weight attributed to the l-th selection criterion, the objective function will be expressed by Eq. (3):

$$\max/\min\left(\sum_{l=1}^{m} p_l \cdot G_l\right) \tag{3}$$

In Table 3 the algorithm of the proposed model has been reported, whereas in Table 4 the meaning of each term of the algorithm has been explained.

Table 3. Algorithm of the proposed model

Variable	k_i
Objective function	Max/min $(\sum_{l=1}^{m} p_l \cdot G_l)$
Constraints	$\sum_{i=1}^{j} k_i = 1 \quad j = n, n-1, \ldots, 2$
	$\sum_{i=1}^{j} k_i \cdot v_{il} = G_l \begin{cases} j = n, n-1, \ldots, 2 \\ l = 1, \ldots, m \end{cases}$

Table 4. Variable and exogenous parameters of the proposed model

k_i	Binary variable associated to the i-th social impact sectors
v_{il}	Score attributed to the i-th investment sector in meeting the l-th criterion
G_l	Capacity of all social impact sectors to suit the l-th criterion
p_l	Weight attributed to the l-th criterion

In the present research the branch and bound algorithm will thus be able to provide the outputs, in order of temporal priority, of social impact sectors as outputs based on the values assumed by the return function of the model. In this way, the public subject and the social investor will be able to determine the best allocation of financial resources according to the real social needs and the expected financial returns.

5 Conclusions

In recent years, traditional financial instruments have been weak in investments aimed at solving complex social problems. New innovative models have also emerged in the SRI field to respond to the growing social and environmental challenges. The SII represent one of the most interesting SRI fields due to the willing to generate value in terms of both a measurable positive social impact and a financial return. The development and global spread of "win – win" financial instruments such as SIB are proof of a growing interest in the realization of an investment that aims at generating benefits for all the subjects involved. Taking into account the frequent low effectiveness of numerous social welfare policies and the reduction of financial resources available to the public sector, the investments in SIB can constitute a useful tool for governments. Private sector investments in SIB would not only be able to help public social

programs, but they could also provide such programs to a scale that would include a larger amount of beneficiaries.

However, the spread and the development of SIBs did not occur with the same force in all the countries. The complexity connected to the identification of the social impact sector in which investing in a territorial context characterized by a plurality of different social needs is one of the critical points highlighted in the literature for the development of the SIBs. The proposed operational research model has been defined to overcome this critical issue and to contribute to the spread of SIBs both in Italy and abroad.

Future developments of the present research may concern the verification of the validity and the reliability of the proposed model through the application to a real situation that can characterize, for example, a municipal area. Moreover, the definition of specific criteria that allow to represent the variety of aspects that the decision makers, according to their objectives and roles, evaluate for the activation of a social program, will allow to highlight how the process of identifying the social impact sector in which investing is closely related to a plurality of factors and requires an accurate assessment.

Aknowledgements. The authors declare that the contents of the paper are based on data and information developed within the "Innonets" Project founded by the Interreg Greece-Italy Program and are aimed at promoting the Project itself. For more information see http://interreginnonets.eu/en.

References

1. Barreca, A., Curto, R., Rolando, D.: Assessing social and territorial vulnerability on real estate submarkets. Buildings **7**(4), 94 (2017)
2. Del Giudice, V., De Paola, P., Forte, F.: Valuation of historical, cultural and environmental resources, between traditional approaches and future perspectives. In: Mondini, G., Fattinnanzi, E., Oppio, A., Bottero, M., Stanghellini, S. (eds.) SIEV 2016. GET, pp. 177–186. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-78271-3_14
3. De Paola, P., Del Giudice, V., Massimo, D.E., Forte, F., Musolino, M., Malerba, A.: Isovalore maps for the spatial analysis of real estate market: a case study for a central urban area of reggio Calabria, Italy. In: Calabrò, F., Della Spina, L., Bevilacqua, C. (eds.) ISHT 2018. SIST, vol. 100, pp. 402–410. Springer, Cham (2019). https://doi.org/10.1007/978-3-319-92099-3_46
4. Disley, E., Giacomantonio, C., Kruithof, K., Sim, M.: The payment by results Social Impact Bond pilot at HMP Peterborough: final process evaluation report. Ann. Rev. Policy Des. **7** (1), 1–20 (2019)
5. Evans, B., Richmond, T., Shields, J.: Structuring neoliberal governance: the nonprofit sector, emerging new modes of control and the marketization of service delivery. Policy Soc. **24**(1), 73–97 (2005)
6. Giacomantonio, C.: Grant-maximizing but not money-making: a simple decision-tree analysis for social impact bonds. J. Soc. Entrepreneurship **8**(1), 47–66 (2017)
7. Global Impact Investing Network. https://theiin.org/asets/GIIN_2019%20Annual%20Impact%20Investor%20Survey_webfile.pdf.Accessed 21 Nov 2019

8. Morano, P., Tajani, F., Di Liddo, F., Anelli, D.: A feasibility analysis of the refurbishment investments in the Italian residential market. Sustainability **12**(6), 2503 (2020)
9. Jackson, E.T.: Evaluating social impact bonds: questions, challenges, innovations, and possibilities in measuring outcomes in impact investing. Commun. Dev. **44**(5), 608–616 (2013)
10. Leventhal, R.: Effecting Progress: Using Social Impact Bonds to Finance Social Services. N. Y. Univ. J. Law Bus. **9**, 511 (2012)
11. Liebman, J.B.: Social Impact Bonds: A Promising New Financing Model to Accelerate Social Innovation and Improve Government Performance. Center for American Progress, Boston, vol. 9 (2011)
12. Maier, F., Meyer, M.: Social impact bonds and the perils of aligned interests. Adm. Sci. **7**(3), 24 (2017)
13. McKay, K.: Evaluating social impact bonds as a new re-entry financing mechanism: a case study on re-entry programming in Maryland, Department of Legislative Services Office of Policy Analysis Annapolis (2013)
14. Nemhauser, G.L., Wolsey, L.A.: Integer and Combinatorial Optimization. Wiley, New York (1988)
15. Parker, R.G., Rardin, R.L.: Discrete Optimization. Elsevier, New York (2014)
16. Pauly, M., Swanson. A.: Social Impact Bonds in Nonprofit Health Care: New Product or New Package?. National Bureau of Economic Research (2013)
17. Pontrandolfi, P., Scorza, F.: sustainable urban regeneration policy making: inclusive participation practice. In: Gervasi, O., et al. (eds.) ICCSA 2016. LNCS, vol. 9788, pp. 552–560. Springer, Cham (2016). https://doi.org/10.1007/978-3-319-42111-7_44
18. Rudd, T., Nicoletti, E., Misner, K., Bonsu, J.: Financing Promising Evidence-Based Programs: Early Lessons from the New York City Social Impact Bond. MDRC, New York (2013)
19. Tajani, F., Morano, P.: Evaluation of vacant and redundant public properties and risk control: A model for the definition of the optimal mix of eligible functions. J. Property Invest. Financ. **35**(1), 75–100 (2017)
20. Tajani, F., Morano, P.: Risk management and goal programming for feasible territorial investments. In: Mondini, G., Fattinnanzi, E., Oppio, A., Bottero, M., Stanghellini, S. (eds.) SIEV 2016. GET, pp. 123–132. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-78271-3_10
21. Tan, S., et al.: An evaluation of Social Impact Bonds in Health and Social Care: Interim Report. Policy Innovation Research Unit (2015)
22. Viglianisi, A., Rugolo, A., Calabrò, J., Della Spina, L.: Villa san giovanni transport hub: a public-private partnership opportunity. In: Calabrò, F., Della Spina, L., Bevilacqua, C. (eds.) ISHT 2018. SIST, vol. 101, pp. 211–221. Springer, Cham (2019). https://doi.org/10.1007/978-3-319-92102-0_23