# Pro-Environmental Determinants of Waste Separation

Subjects: Economics

Contributor: Iacopo Odoardi , Chiara Burlina , Alessandro Crociata

Sustainable practices should include proper incentives and involve a large part of the population to achieve a significant environmental impact. Human capital is considered one of the factors that affect pro-environmental behaviours: more educated people tend to be more aware of waste management processes. Another factor is social capital, as far as the feeling of belonging to a society might involve people in adopting sustainable practices.

human capital waste separation waste management social capital

## 1. Introduction

Waste separation practices are increasingly common worldwide [1][2], and the goal of waste separation is considered an integral part of sustainable processes included in the policies of many countries [3]. Well-known macroeconomic phenomena, such as the growing world population, its progressive urbanisation, and problems related to the search for a virtuous economy, highlight the necessary contribution of waste management in improving life well-being up to the processes of sustainable development [4][5].

Thanks to appropriate waste management, it is possible to observe a plethora of economic and environmental benefits, while being aware of the different costs for consumers who are involved in the separation processes [6]. The need to bear these costs implies that the necessary attention to waste separation is not automatic and requires the collaboration and adaptation of various agents involved in the cycle [7][8]. Moreover, there is a need for updated technologies to correctly process the increasing amount of produced waste [9]. Among these, it is worth mentioning the conversion of waste to energy [10], sanitary landfills, thermal treatment, and biological treatment methods [11]. All these technologies require high investments and people with high-skill capabilities to operate according to the circular economy paradigm of reuse and recovery [12]. However, education is not only important for the practitioner of a waste management process, but it turns out to be a fundamental factor as it stimulates the overall population to be fully involved and aware of the importance of correct waste management [13]. Another aspect to consider is the role of social capital (SC), as far as the diffusion of norms concerning reciprocity and trust help to promote pro-environmental behaviours and good practices related to waste management [14][15][16]. Such behaviours would be triggered when a society offers the opportunity to develop relations between its members, who should be mobilised for greater participation and also tested on recycling practices. Therefore, societies where education, embedded in the accumulation of human capital (HC), is accompanied by higher levels of SC, are those that might develop better waste management practices and sustainable development initiatives [17].

## 2. The Effect of Education on Pro-Environmental Behaviours

Education is considered a fundamental aspect of initiatives and development strategies for encouraging pro-environmental practices and those related to waste management [18]. The socioeconomic literature considers various types of education with respect to their role in fostering the aforementioned behaviours, and the researchers observe at least two main types, i.e., specific training (e.g., on the relevance of environmental sustainability issues) and general training (e.g., achieving a high level of education that also contributes to environmental awareness).

More specifically, the first one (which is not treated in this article) is related to specific education programs that concern awareness of the natural environment, the waste cycle, and the importance of individual contributions to waste management, often starting from the first school levels [19][20].

The second strand of literature concerns more the general role of education. This broader definition constitutes the theoretical basis of the article. In this sense, education contributes to understanding and developing the necessary knowledge of environmental aspects. In particular, advanced education should act on the awareness of the importance of waste separation and recycling, and this should positively influence recycling attitudes and environmental behaviours (see the literature review by Aini et al. [21]). The influence of education on waste activities and environmental conduct is tested in specific surveys, in addition to social norms, perceived controls, and moral obligations [22]. Educated individuals are more conscious of sustainable development and tend to modify their behaviours to protect the environment [23]. This aspect is fundamental because it affects the involvement of consumer households in recycling processes and is strengthened by specific (public) interventions that highlight the seriousness of the problem of waste growth [24].

The role of education has been verified in recent studies, since educated people are a key point at which institutions are aiming for the future of sustainability [25]. For example, Ahmed and Wang [13] found a direct relationship between education and the improvement of the environment through the effective contribution of HC in reducing the ecological footprint in India, as similarly observed by Zafar et al. [26] for the US, which considered HC useful for a sustainable economic turnaround. Ponce et al. [27] found that HC plays a positive role in environmental behaviours and preserving the environment in Ecuador. The HC stimulus toward environmental quality finds confirmation in cross-country analysis and over long time periods, as verified by Ahmed et al. [28] for the G7 countries during 1971–2014.

## 3. SC and Pro-Environmental Behaviours

In addition to the awareness of environmental issues and general knowledge, SC is a major source for inducing pro-environmental and green protection behaviours [29]. De facto, SC would act as a kind of guarantee for the members of a community (e.g., investing in collective activities, such as the management of common resources), knowing that others would tend to act similarly [30].

Among the many prosocial behaviours, internal social motivators can induce triggering effects, as well as a social influence (from family, friends, and neighbours), and these are linked, for example, to recycling behaviours [31]. In fact, social interaction (or “social pressure”), when environmental compliance standards exist, can contribute to normalising them, leading to further practices related to sustainability [32]. In this sense, SC can be considered a resource of the society that makes itself more sustainable and environmentally resilient when other resources (such as public ones) are weak [33].

Many contributions in the literature endorse the role of SC. Collins et al. [34] observe that those who give to charity or who undertake charitable work show a much greater tendency to recycle. Fiorillo and Senatore [35] found a positive relationship between prosocial behaviours, waste concern, and propensity for recycling in the time preceding environmental policies, rewards, or sanctions. Torgler and García-Valiñas [36] found that SC and trust generally indicate high environmental preferences; nevertheless, these preferences can vary over time (e.g., willingness to pay specific taxes) and among areas of a country. Fiorillo [37] demonstrates that social behaviours (e.g., membership in non-profit associations, talking politics, and church attendance) strongly predict the tendency to recycle always or often. Hua et al. [38] observe that trust plays a major role in encouraging, guiding, and controlling behaviours related to recycling among the members of social communities. Owen and Videras [39] demonstrate a strong cross-country valid relationship between civic cooperation (limiting free-riding behaviours) and pro-environment attitudes and intentions to pay higher taxes to protect the environment.

In observing the particular effect of social attitude, SC is not a constant source of sustainable behaviours [40]. For this reason, it is important to identify which among the social behaviours effectively play a role in waste management practices. Zhou et al. [41] have recently shown that the mechanisms by which this occurs are to be sought from the influence of social networks, social trusts, and social participation in promoting waste-separation actions. SC can effectively do so by providing knowledge on pro-environmental behaviours “by providing opportunities for individuals’ social learning and strengthening the reputation effect to encourage residents’ waste-separation behaviours” [41] (pp. 13–14). De facto, SC acts with the presence of in-group norms and interpersonal trust, when present in social networks, and these sort of “social norms” affect precisely pro-environmental behaviours intentions, among which waste sorting, which in turn reward individuals and groups [42].

## 4. Waste Separation in Italy

The study of waste management in Italy has taken on relevance since policymakers and public opinion began to increasingly consider the problem of excessive waste production during the 1990s, suggesting growing attention toward recycling. In this context, the awareness of Italians grew with the first practices of waste separation at the household level [43][44]. The model of waste management in Italy concerns different levels of peripheral administrations, which also apply EU directives, with the aim, e.g., of generating less waste, obtaining materials for reuse, and, indeed, reducing pollution [45]. Administrations, such as municipalities, do not always carry out virtuous practices, and the Italian problem of excessive landfilling is known, compared to other high-income European countries [46].

The first period of “change in behaviours” related to waste management was on a voluntary basis, without incentives or punishments. In this context, facilitations in recycling waste were decisive, as well as the greater propensity of subjects already active in the social field or capable of prosocial behaviors [37]. Since then, the Italian model has changed, and an increasing number of Italians are committed to producing less waste, differentiating more, and obtaining more services (door-to-door waste collection), even in small municipalities [47]. Italy has implemented numerous other measures (reducing landfilling and emissions, improving waste management and wastewater treatment) aimed at sustainability and the development of the circular economy in recent years, accompanied by efforts for environmental protection and by combating environmental crime [48].

However, these good practices are not present in all areas. Evident gaps between the wealthy Center-North and the relatively “poor” South are also present in waste management, in the provision of related infrastructures, and in the levels of waste separation [49][50]. The delay in the development of waste management in the southern regions “*is certainly due to several environmental, social, technological and financial constraints affecting waste management (e.g., poor collection service capacity, a lack of disposal infrastructures, scarcity of waste valorisation investments)*” [51]. Substantial differences in economic development must be considered, even if the role of high income seems to have a virtuous effect only for the richest provinces, shifting the focus to the need to implement other policies that limit the creation of waste at the source [52]. Agovino et al. [53], by studying homogeneous groups of municipalities, observed that the role of institutions is preponderant in addressing separate collection practices, but the best results occur when they work in coordination with citizens, and despite the confirmation of North–South dualism, some positive cases are also present in the South.

## References


1. Baud, I.; Grafakos, S.; Hordijk, M.; Post, J. Quality of life and alliances in solid waste management: Contributions to urban sustainable development. Cities 2001, 18, 3–12.
2. Karani, P.; Jewasikiewitz, S.M. Waste management and sustainable development in South Africa. Environ. Dev. Sustain. 2007, 9, 163–185.
3. World Bank. What a Waste—A global Review of Solid Waste Management; Urban Development Series—Knowledge Papers No. 15; World Bank: Washington, DC, USA, 2007.
4. World Bank. What a Waste 2.0—A Global Snapshot of Solid Waste Management to 2050; Urban Development Series; World Bank: Washington, DC, USA, 2018.
5. Guo, Y.; Wei, R.; Zhang, X.; Chai, F.; Zhao, Y.; Zhou, T. Positive Impacts of the Overall-Process Management Measures on Promoting Municipal Solid Waste Classification: A Case Study of Chongqing, China. Sustainability 2022, 14, 14250.
6. Stanisavljevic, N.; Brunner, P.H. The user—Beneficiary or victim of modern waste management systems? Waste Manag. Res. 2020, 38, 597–598.

7. Finnveden, G.; Björklund, A.; Reich, M.C.; Eriksson, O.; Sörbom, A. Flexible and robust strategies for waste management in Sweden. Waste Manag. 2007, 27, S1–S8.
8. Kemp, R.; Loorbach, D.; Rotmans, J. Transition management as a model for managing processes of co-evolution towards sustainable development. Int. J. Sustain. Dev. World Ecol. 2007, 14, 78–91.
9. Nanda, S.; Berruti, F. Municipal solid waste management and landfilling technologies: A review. Environ. Chem. Lett. 2021, 19, 1433–1456.
10. Münster, M.; Meibom, P. Optimization of use of waste in the future energy system. Energy 2011, 36, 1612–1622.
11. Iqbal, A.; Liu, X.; Chen, G.H. Municipal solid waste: Review of best practices in application of life cycle assessment and sustainable management techniques. Sci. Total Environ. 2020, 729, 138622.
12. Hoang, A.T.; Varbanov, P.S.; Nižetić, S.; Sirohi, R.; Pandey, A.; Luque, R.; Ng, K.H. Perspective review on Municipal Solid Waste-to-energy route: Characteristics, management strategy, and role in circular economy. J. Clean. Prod. 2022, 359, 131897.
13. Ahmed, Z.; Wang, Z. Investigating the impact of human capital on the ecological footprint in India: An empirical analysis. Environ. Sci. Pollut. Res. 2019, 26, 26782–26796.
14. He, K.; Zhang, J.; Feng, J.; Hu, T.; Zhang, L. The Impact of Social Capital on farmers' Willingness to Reuse Agricultural Waste for Sustainable Development. Sustain. Dev. 2016, 24, 101–108.
15. Putnam, R. Making Democracy Work: Civic Traditions in Modern Italy; Princeton University Press: Princeton, NJ, USA, 1993.
16. Shi, J.; Lu, C.; Wei, Z. Effects of Social Capital on Pro-Environmental Behaviours in Chinese Residents. Sustainability 2022, 14, 13855.
17. Dale, A.; Newman, L. Social capital: A necessary and sufficient condition for sustainable community development? Community Dev. J. 2010, 45, 5–21.
18. Zorpas, A.A. Strategy development in the framework of waste management. Sci. Total Environ. 2020, 716, 137088.
19. Mostowfi, S.; Mamaghani, N.K.; Khorramar, M. Designing Playful Learning by Using Educational Board Game for Children in the Age Range of 7–12: (A Case Study: Recycling and Waste Separation Education Board Game). Int. J. Environ. Sci. Educ. 2016, 11, 5453–5476.
20. Hoang, T.T.P.; Kato, T. Measuring the effect of environmental education for sustainable development at elementary schools: A case study in Da Nang city, Vietnam. Sustain. Environ. Res. 2016, 26, 274–286.

21. Aini, M.S.; Fakhru'l-Razi, A.; Lad, S.M.; Hashim, A.H. Practices, attitudes and motives for domestic waste recycling. Int. J. Sustain. Dev. World Ecol. 2002, 9, 232–238.
22. Pakpour, A.H.; Zeidi, I.M.; Emamjomeh, M.M.; Asefzadeh, S.; Pearson, H. Household waste behaviours among a community sample in Iran: An application of the theory of planned behaviours. Waste Manag. 2014, 34, 980–986.
23. Tsai, T.-h. The impact of social capital on regional waste recycling. Sustain. Dev. 2008, 16, 44–55.
24. Simmons, D.A.; Widmar, R. Participation in household solid waste reduction activities: The need for public education. J. Environ. Syst. 1990, 19, 323–330.
25. El Hajj, M.C.; Chlouk, G.; Moussa, R.A. Seeds of sustainability in Lebanese universities: An empirical study. In Modernizing Academic Teaching and Research in Business and Economics; Marx Gómez, J., Aboujaoude, M., Feghali, K., Mahmoud, T., Eds.; Springer: Cham, Germany, 2017; pp. 1–23.
26. Zafar, M.W.; Zaidi, S.A.H.; Khan, N.R.; Mirza, F.M.; Hou, F.; Kirmani, S.A.A. The impact of natural resources, human capital, and foreign direct investment on the ecological footprint: The case of the United States. Resour. Policy 2019, 63, 101428.
27. Ponce, P.; Alvarado, R.; Ponce, K.; Alvarado, R.; Granda, D.; Yaguana, K. Green returns of labor income and human capital: Empirical evidence of the environmental behaviours households in developing countries. Ecol. Econ. 2019, 160, 105–113.
28. Ahmed, Z.; Zafar, M.W.; Ali, S. Danish Linking urbanization, human capital, and the ecological footprint in G7 countries: An empirical analysis. Sustain. Cities Soc. 2020, 55, 102064.
29. Aprile, M.C.; Fiorillo, D. Water conservation behaviours environmental concerns: Evidence from a representative sample of Italian individuals. J. Clean. Prod. 2017, 159, 119–129.
30. Pretty, J. Social capital and the collective management of resources. Science 2003, 302, 1912–1914.
31. Hornik, J.; Cherian, J.; Madansky, M.; Narayana, C. Determinants of recycling behaviours: A synthesis of research results. J. Socio-Econ. 1995, 24, 105–127.
32. Thomas, C.; Sharp, V. Understanding the normalisation of recycling behaviours and its implications for other pro-environmental behaviours: A review of social norms and recycling. Resour. Conserv. Recycl. 2013, 79, 11–20.
33. Bridger, J.C.; Luloff, A.E. Building the sustainable community: Is social capital the answer? Sociol. Inq. 2001, 71, 458–472.
34. Collins, A.; O'Doherty, R.; Snell, M.C. Household participation in waste recycling: Some national survey evidence from Scotland. J. Environ. Plan. Manag. 2006, 49, 121–140.

35. Fiorillo, D.; Senatore, L. Pro-social behaviours, waste concern and recycling behaviours in Italy at the end of the 1990s. Environ. Econ. Policy Stud. 2020, 22, 127–151.
36. Torgler, B.; García-Valiñas, M.A. The determinants of individuals' attitudes towards preventing environmental damage. Ecol. Econ. 2007, 63, 536–552.
37. Fiorillo, D. Household waste recycling: National survey evidence from Italy. J. Environ. Plan. Manag. 2013, 56, 1125–1151.
38. Hua, Y.; Dong, F.; Goodman, J. How to leverage the role of social capital in pro-environmental behaviours: A case study of residents' express waste recycling behaviours China. J. Clean. Prod. 2021, 280, 124376.
39. Owen, A.L.; Videras, J. Civic cooperation, pro-environment attitudes, and behaviours intentions. Ecol. Econ. 2006, 58, 814–829.
40. Craig, A.; Hutton, C.W.; Sheffield, J. Social Capital Typologies and Sustainable Development: Spatial Patterns in the Central and Southern Regions of Malawi. Sustainability 2022, 14, 9374.
41. Zhou, Y.; Song, H.; Huang, X.; Chen, H.; Wei, W. How Does Social Capital Affect Residents' Waste-Separation Behaviours? Evidence from China. Int. J. Environ. Res. Public Health 2022, 19, 3469.
42. Cao, J.; Qiu, H.; Morrison, A.M.; Wei, W. The Role of Social Capital in Predicting Tourists' Waste Sorting Intentions in Rural Destinations: Extending the Theory of Planned Behaviours. Int. J. Environ. Res. Public Health 2022, 19, 12789.
43. Aprile, M.C.; Fiorillo, D. Intrinsic incentives in household waste recycling: The case of Italy in the year 1998. J. Clean. Prod. 2019, 227, 98–110.
44. Giacomini, D.; Sancino, A.; Simonetto, A. The introduction of mandatory inter-municipal cooperation in small municipalities: Preliminary lessons from Italy. Int. J. Public Sect. Manag. 2018, 31, 331–346.
45. Pivetti, M.; Melotti, G.; Vespa, M.; Cappabianca, F.; Troilo, F.; Placentino, M.P. Predicting recycling in Southern Italy: An exploratory study. Resour. Conserv. Recycl. 2020, 156, 104727.
46. Mazzanti, M.; Zoboli, R. Waste generation, waste disposal and policy effectiveness: Evidence on decoupling from the European Union. Resour. Conserv. Recycl. 2008, 52, 1221–1234.
47. ISTAT. Senso Civico: Atteggiamenti e Comportamenti dei Cittadini Nella Vita Quotidiana—Anni 2016–2018; Istituto Nazionale di Statistica: Rome, Italy, 2019.
48. European Commission. The Environmental Implementation Review 2019—Country Report—Italy; European Union: Brussels, Belgium, 2019.

49. Agovino, M.; Ferrara, M.; Garofalo, A. An exploratory analysis on waste management in Italy: A focus on waste disposal in landfill. Land Use Policy 2016, 57, 669–681.
50. Cantoni, R. The waste crisis in Campania, South Italy: A historical perspective on an epidemiological controversy. Endeavour 2016, 40, 102–113.
51. Sisto, R.; Sica, E.; Lombardi, M.; Prosperi, M. Organic fraction of municipal solid waste valorisation in southern Italy: The stakeholder'' contribution to a long-term strategy definition. J. Clean. Prod. 2017, 168, 302–310.
52. Mazzanti, M.; Montini, A.; Zoboli, R. Municipal waste generation and socioeconomic drivers: Evidence from comparing Northern and Southern Italy. J. Environ. Dev. 2008, 17, 51–69.
53. Agovino, M.; Cerciello, M.; Musella, G. The good and the bad: Identifying homogeneous groups of municipalities in terms of separate waste collection determinants in Italy. Ecol. Indic. 2019, 98, 297–309.