Output-orientated data envelopment analysis for measuring recycling efficiency: an application at Italian regional level

Alessandro Crociata* and Nicola Mattoscio

Department of Economics, Quantitative, Philosophical, Educative Sciences, University "G. D'Annunzio" of Chieti-Pescara, Viale Pindaro 42, 65127 Pescara, Italy

Pro-environmental behaviours associated with reducing, reusing and recycling have become increasingly matters of public policy concern. However, the existing literature on waste management rarely considers the cultural factors associated with predictors and enablers of recycling behaviours, nor has it deeply explored the relation between cultural access and such behaviours. Mindful of the relationship between cultural participation and learning, the main objective of this paper is to examine which Italian regions are ranked among the most 'efficient' in recycling, taking into account the variable of cultural participation. Using a data envelopment analysis method applied to Italian regions for the period 2002–2007, we provide a measure of 'efficiency' that considers cultural consumptions (as input) and recycling (as output). Public data are drawn from two sources: the Italian Institute of Statistics database, 'Cultura in cifre', and the survey 'Noi Italia – Environment section'. The results from the empirical analysis rank efficient and non-efficient regions in terms of connection between pro-environmental behaviour and cultural participation. The results also indicate a benchmark for 'inefficient' regions. The findings add to the discussion of cultural considerations for designing and implementing preventative pro-environmental strategies, that seek to reduce environmental costs and public environmental expenditure by factoring in – rather than out – the importance, role and impact of cultural access and participation.

Keywords: recycling; cultural consumptions; pro-environmental behaviour; technical efficiency; data envelopment analysis

JEL Codes: Q53; C61; Z

Introduction

Environmental sustainability depends on waste management. However, waste management in urban to rural communities has become a major challenge for local and national authorities, particularly at the municipal level. National, regional and local political agendas of many economically developed nations have had to address how they enable communities to reach sustainable waste management targets, such as by increasing the level of recycling (UNCED 1992). Increasing concern regarding waste (typically, reduction, reuse and recycling) has been evident across these scales in European Union environmental policies since the 1970s, particularly following the Stockholm United Nations conference on the human environment in 1972.

---

*Corresponding author. Email: crociata@gmail.com

However, since the mid-1980s, waste management systems have varied in terms of progress and efficiency, and for this study, we note those in Italy have remained far behind other European countries.

Driven by various social, environmental and economic needs, as well as to implement European waste management policies, the Italian Government issued the legislative decree No. 22/1997 (the Ronchi Decree). As Fiorillo (2013) notes, since 1998, as a whole, Italy has experienced an increase in separate waste collection, with rates reaching 27.5% in 2007; up from 13% in 1999. However, some regions of Italy, particularly those in the south, have experienced waste management crises, attributable in part to a very low separate waste collection rate, amongst the wider factors that have led to such situations (see D'Alisa, Di Nola, and Giampietro 2012).

Notwithstanding the relevance that waste management issues have taken in the discourses on public management and policy, there is still open debate about the development and design of waste recycling practices, targets, public learning and strategy. In academic circles, the issue of how to better encourage and enable pro-environmental behaviours related to recycling has sparked a rich array of interdisciplinary research. Scholars of public pedagogy, for instance, call for participation and learning processes within the context of a complex array of environmental education (EE) and education for sustainable development (ESD) approaches and settings (e.g. Læssøe 2010; Van Poeck and Vandenabeele 2012). For some time now, an economics viewpoint might suggest putting incentives under the spotlight, including monetary rewards (e.g. Curlee 1986). Some environmental psychologists have focused upon the role of mobilising altruistic motivations (e.g. De Young 1986), while certain sociologists have highlighted the significance of social pressures and environmental constraints (e.g. Burn and Oskamp 1986). Elsewhere, legal researchers have considered the effects of legal measures such as mandatory recycling laws (e.g. Lanza 1983), and engineers have compared the relative effects of alternative technologies and systems of recycling (e.g. Noll 1985).

Within all this, apart from the aforementioned social science-focused literature, most research on waste management has rarely considered cultural factors to any depth, tending to omit examination of the relations between cultural access and pro-environmental behaviours by focusing on individual, legal or technical problems and their possible solution. However, since an exploratory analysis provided by Crociata, Lilla, and Sacco (2012), there has been a broadening of focus, including to understanding the relationship between participation and learning in this area, from a range of perspectives. In this, cultural access, such as by attending a public performance or exhibition, has been considered as providing a specific situational context for exploring the relationships between values, activities, development, sense of crisis and multiple forms of cultural and historic representation of contemporary concerns.

As Krasny, Lundholm, and Plummer (2010) point out, learning processes for environmental education and sustainability should not be seen as isolated (e.g. in schools and for schools only), but rather as a complex and multifaceted part of a larger system of interacting social structures and activities. For example, when the significant determinants of recycling are examined (see Tang, Chen, and Luo 2011; for a review), education (across the range of formal, informal and non-formal modes) clearly has a role to play, but the 'jury is still out' on how this relates to, for example, the cultural and social capital of the participants, be they the 'educated' or the 'educators' in a variety of contexts and roles. We argue that scale and scope are

CEER 1015494
14 February 2015
Initial
CE: SG   QA: KM
Coll: QC:

Environmental Education Research   3

important here: is research largely conducted with a unit of analysis that focuses on individuals, households, the state – or some other differentiator or integrating factor? For example, Miafodzyeva and Brandt (2013) have provided a meta-analysis of results from previous studies of different variables influencing household-level recycling behaviours. They evaluated trends in research outputs in the period 1990–2010, classifying variables affecting recycling behaviours into four groups: sociopsychological, technical organisational, individual socio demographic and study specific. The strongest predictors of householders' recycling behaviour were identified as: convenience, moral norms, information and environmental concern – each of which, we note, has strong cultural connotations.

The picture that emerges from such studies and considerations leads us to recognise that:

- Predictors of waste behaviour include a large array of diverse variables, capturing and expressing the influence of a variety of factors of interest to social and education research;
- Even though households are generally aware of recycling, such awareness does not necessarily derive from formal education (such as schooling) or inflect back into actual recycling practice;
- Further research is needed to identify reliable 'recycling behaviour profiles', including a deeper exploration of the role of underlying psychological, cultural and social attitudes to recycling.

In view of the previous discussion, we believe that there is a strong case to develop richer understandings of the cultural cognitive determinants of household-level recycling behaviours. In particular, in this paper we examine the role of a factor that seems to have been entirely overlooked so far, and is, to our knowledge, considered here for the first time in the literature on waste recycling: namely, cultural capital (Throsby, 1999, 2005) at the level of household and how that aggregates at a regional level.

Cultural capital, as Throsby argues, comes in both tangible and intangible forms. The stock of tangible cultural capital assets consists of many different artifacts, such as historical buildings and locations with cultural significance (so-called cultural heritage), as well as objects such as artworks (paintings, sculptures, etc.), books, music, video and multimedia and so on. Intangible cultural capital includes ideas, practices, beliefs, traditions and values, which carry special significance and identity value for groups and communities. Our underlying supposition is that cultural participation functions as a platform for education processes, social regeneration, networking and cohesion within and beyond the household (e.g. Everingham 2003). More generally, culture fosters awareness of a multitude of socially relevant issues, and consequently might motivate individuals and households with an array of images, strategies, models, stories and considerations involved in activities related to taking more responsibility for the pro-environmental dimension of daily, weekly and longer term practices, behaviours and habits.

Investigating the peculiarities of cultural processes, Hutter (1996) claims that culture plays a preeminent role in shaping a collective identity within a community, and might thereby solidify social ties and contribute to the binding and enforcement of social norms (Antoci, Sacco, and Vanin 2007). The cultural processes that citizens-as-learners engage with are not only processes of schooling but could include a

broader form of educational practice, as in the case of 'citizenship-as-practice' learning (delineated by Van Poeck and Vandenabeele 2012). Such a culturally informed
view of education might encourage and enable us to emancipate ourselves, in much
the same way that social and civic participation may do so too. Moreover, as participatory forms of ESD foreground people's enlightenment and empowerment (Læssøe
2010), participatory forms of cultural access and consumption may empower people
as active citizens in sociocultural processes focused on fostering more sustainable
forms of development, rather than replicating unsustainable forms. Moreover, as
Flowers et al. (2014) suggest, art, culture and EE seems to be 'a natural fit'. In that
sense, culture represents an universally applicable tool that could help researchers
and practitioners environmental attitudes and awarness. For example, drawings have
been used to facilitate children's understanding of ecological processes and adult's
mental models of environment (Moseley 2010). Another study (Murray, Goodhew,
and Murray 2014), evaluating the impact of the training on 67 s year undergraduate
design and engineering students, provided a quantitative analysis of the students' values and worldview, with design students appearing more receptive than those studying engineering. If ESD is about empowering people for change a more cultural and
creative content learning (as design) seem to be more conducive to achieve a personally engaging with sustainability. Finally Song (2012), explores how an ecological
artist help student critical thinking on environmental issues, increasing students
engagement in the learning process. Culture, by means of ecological art, provides
both aesthetic and cognitively engaging experience for people, provoking a cognitive
and social response. It works as a platform through wich social and communal interaction helps a community identify and resolve nature issue collaboratively. These
findings in literature represent a strong and rigorous connections culture, EE and
ESD programmes showing how culture and education are linked and how cultural
economics studies could be beneficial for environmental education outcomes.

Proceeding from these assumptions, namely that culture fosters and shapes individual and household-level awareness about and in pro-environmental behaviours
and therefore recycling habits, the aim of this article is to consider their aggregation,
by examining how Italian regions might rank in terms their 'efficiency', with a cultural participation perspective considered as part of the analysis. As Læssøe (2010)
suggests, participatory ESD approaches require the focus of analysis to shift towards
a stronger account of historical and societal context and effects, requiring researchers
to pay close attention to the sensitivities of change over the years including similarities and differences between regions, by means of concrete analyses of any given
situation and context, particularly through comparative approaches. We welcome this
shift, and find a deep resonance with the twin roots of cultural analysis in its focus
on questions of 'time' and 'space'. Culture, categorised both in terms of product and
process (Lavanga 2003; Russo and van der Borg 2005), is intrinsically linked to spatial context or, in a more social sense, to a community and its history (Santagata
2004). From this perspective, cultural assets are the fruit of the marriage between
information and community knowledge, circumscribed by geographic and social
space, and vivified by the personal experiences and agendas of the individuals that
inhabit and inscribe them as much as a challenge or reconstitute them.

As Throsby (2005) notes, in the knowledge society, collective learning emphasises the importance of localised knowledge, particularly as a facet of 'territorial
competitiveness'. The importance of this factor is reinforced if we accept the fact
that some cultural-economic systems (of exchange, production and consumption)

have a strong territorial role, meaning that they distinguish and drive geographic and social spaces and processes in diverse ways (e.g. global financial services hubs, as with the metonymic and cultural connotations of 'Wall Street' and the 'City' of London). Arguing from the position that cultural systems have a spatial dimension requires that we consider how the relations that spring up from their circumscribed, privileged and selective relationships will also have their territorial aspects. This suggests that a given system can be meaningfully defined as a contained matrix of relations between individuals in terms of space, with a range of fixed and permeable boundaries. Moreover, the learning of the actors and agencies involved can also be described spatially (both in geographic and social terms). From this perspective, every agential action can be characterised by a specific interlacing and intersection of relations in space among the diverse places of exchange, production and consumption of cultural assets (Throsby 2001).

Thus, from a perspective sensitive to the transactions and materiality of 'cultural capital', such spatialised dimensions of culture represent a point of unique access for analysing the processes and agents, as well as barriers and enablers, of sustainable development. As foreshadowed above, in order to look at a different societal context for an 'educated public' and 'educating the public', we carry out an 'efficiency analysis' drawing on data envelopment analysis (DEA) methods. In this study, we focus only on the technical component of the 'efficiency' of the Italian regions in recycling, according to a determinate level of cultural consumption. In particular, we provide a calculation for 'efficiency', considering publicly available knowledge of cultural consumptions as input, and the level of recycling as output. Our results produce a ranking of the efficiency of the various regions, and, as might be expected, they show a clear level of heterogeneity among regions.

The remainder of the article is organised as follows. First, an elaboration of the theoretical considerations for the study, then an overview of the DEA methodology followed by the data and results, and finally, a concluding discussion, with notes on limitations of the study and recommendations for future research.

Towards a focus on cultural goods and cultural consumption

Cultural goods as a concept has a high degree of semantic difficulty, being a sort of evanescent parameter for economists. Nevertheless, there is growing interest in combining economic theory and analysis with culture matters, and for the purposes of this study, we briefly show how the work of David Throsby is crucial for understanding our particular approach.

In the volume, 'Economics and Culture', David Throsby (2001, ed. it. 25) suggests three defining criteria for cultural goods: (i) cultural goods need a form of creativity in the production process; (ii) they concern symbolic meaning making and communication; (iii) they could be, potentially, an object attracting intellectual property rights. Cultural economics is a particular branch of study that has grown up within economic theory, focusing attention on the economic features connecting the creation, production, distribution and consumption of cultural goods. Of particular concern th'en is their materiality, and the features (including the effects) of their transaction.

The first contributions by economists on this topic seem to be somewhat intuitive, sometimes a personal interest, even possibly a pure *divertissmant* (Mattoscio 2006). For example, Adam Smith, in 'An Inquiry into the Nature and Causes of the

Wealth of Nations', argues that live performing arts are able to erase melancholy
from the majority of people (quoted in Euromeridiana 2004, 3), while Alfred
Marshall, in commenting on a paradox often debated in cultural economics, notes
that in consuming industrial goods, beyond a certain level individual satisfaction
decreases, while in consuming music the principle is the opposite: the more you
consume the more you appreciate (quoted in Euromeridiana 2004, 7).

Conventionally, the formal birth of cultural economics as a focus of academic
inquiry is dated to the publication of Baumol and Bowen's research (1966), on theo-
ries regarding the financial weakness of the culture industries, especially the live
performing arts sector. The justification for the public financing of this particular
cultural sector includes that cultural goods are also 'merit goods' in a semantic
sense. In this way, these goods satisfy socially important needs (such as health and
education), and so justify a 'moral paternalism' and hence an interference with con-
sumer preferences, including the disruption of the wider and increasingly pervasive
principle of 'consumer sovereignty'. More recently, emphasis has been placed on
researching culture and cultural goods as part of the complex phenomena of the
knowledge economy, considering cultural goods as part of social development mod-
els, and the need to develop multidimensional analytical models that examine the
links between cultural goods and their consumption, including the role of education
in influencing both aspects (Mattoscio e Furia 2010).

To illustrate, in Italy, D'Angelo et al. (2010) have analysed attendance at the per-
forming arts during the period 2000–2008, showing that changes in income per
capita, quality of theatrical production, and level of education, produce a significant
increase in consumption. These positive effects are partially offset by a moderate
ticket price effect. Their study shows that the higher the education level, the more
the habit of consuming cultural goods grows. Moreover, higher cultural consump-
tions encourage human capital development.

In this, it is commonly assumed that the demand for cultural goods usually origi-
nates from a limited group of individuals sharing a number of homogeneous demo-
graphic and economic features, and that low income and poorly educated people are
excluded from culture consumption, thereby risking an incomplete exploitation of
the expansion opportunities emerging in cultural markets (Trimarchi 2002). Thro-
sby's (1994) analysis of cultural consumption interprets a 'taste for the arts' as a
threefold relation, involving: (i) present satisfaction, (ii) accumulation of knowledge
and (iii) accumulation of knowledge and experience affecting future consumption.
This means that the consuming process, as also possibly an educative process,
depends in part on the amount of information gathered by the individuals through
cultural participation, whatever their demographic or social circumstance. Equally,
the accumulation of perceptive and cognitive data gives rise to, formally, a sort of
'progressive learning' that allows for greater levels of appreciation of the cultural
goods consumed, including the nature and quality Marshall intuitively argued, and
hence satisfaction alongside dissatisfaction with the current level and range of
consumption. McCain (1995) argues that this process is a form of iterative 'learn-
ing-by-consuming' that influences consumer tastes, and can be heavily structured by
class and other demographics that shape the logics and practices of consumption.
For McCain, over time, a combination of aspirational and deconstructive dimensions
reduces the 'risk' associated with consuming immaterial goods, leading to a
specialisation and differentiation process, as 'taste' is cultivated and demonstrated in
particular clusters of behaviours, interests and practices.

Whatever the merits and shortcomings of these arguments, the common ground here is a clear convergence on the fact that present cultural goods consumption is highly indexed to patterns of previous consumption in the acquiring of taste (Gorman 1967; Stigler and Beker 1977). For Pine and Gilmore (~~2010~~), this patterning and associated habituation are treated as key features of the 'sedimentation of experience', linking cultural consumption back to the category of experience goods. Connected to this, Bourdieu (1979) elaborates that cultural consumption is sustained by relational and well positioned goods (or status goods), and this allows a distinguishing of who is knowing and ready to select and carry out a particular consumption action (an attitudinal set that echoes Veblen's [1899] commentary on 'showy consumptions' in theorising wealth and class).

A sociological approach to this discourse can also draw in such concepts as social shortage (Hirsch 1976), to show how from the emergency of new needs is linked to the expressive dimension of wellbeing (Zamagni 2005), in that a society may no longer be dominated by a heavy shortage in the material order and refocus to its 'immaterial' aspects. In such contexts, the consumption of cultural goods is interpreted as a bridging expression of two different motivational guides: 'The first one corresponds to the desire to approach the other in order to define a relation, to which a positive value is associated. In contast, the positional guideline corresponds to the desire to earn a better position than the other on some social scale' (Zamagni 2005, 156).

Within our research, the very sense of a cultural experience is one that questions existing conventions and meanings, inquires about one's place in the world and in the society and reframes one's knowledge and belief systems with new coordinates. Through this approach, the topic of the plasticity of preferences induced by an experience and by cultural consumption lead us back to questions of a mental model (Johnson-Laird 1993) as a key feature of the efficient cognitive representation of the main features of such experience. Focusing on the cognitive perspective, preferences are formed according to a high degree of cultural specificity, which means 'the individuals that grow within various cultures will learn different rules in order to elaborate information of the world that encircles them' (Lloyd 1972, 16).

The recent literature provides us with several hints as to why and how a local through to national level culture acts as a powerful driver and medium for interpreting and enacting sustainable development. Sacco and Crociata (2013) present a conceptual framework for the design of culture-driven development strategies, and for the evaluation of the multidimensional effects of culture. More generally, cultural participation functions as a platform for social regeneration, networking and cohesion (e.g. Everingham 2003). Beyond its commodity dimension, cultural experience plays the role of a mental precursor to all forms of consumption and of identity building processes, thereby producing new, distinctive forms of human and social and cultural capital (Jenkins 2008), causing spillovers into diverse fields such as learning outcomes, innovation, welfare, social cohesion and so on.

Culture from this perspective, then, is a resource that activates mental processes for the construction of identity. This consideration is also associated with the increase of cognitive and cultural determinants of pro-environmental behaviour, inviting us to consider that cultural consumption and recycling habits require deeper investigation in order to understand their relations. A close look at the literature suggests that hardly any research has been carried out that evaluates the relationship between cultural access and sustainable waste management. Given the preceding

8   *A. Crociata and N. Mattoscio*

considerations, we pose whether cultural access works as an effective predictor of recycling activities, noting it has been rarely considered before in the literatures of cultural economics or ecological economics, when it comes to participation aspects.

Secondly, within the literature on DEA, in terms of scale of application (see Liu et al. 2013 for a review), this paper represents a novelty for applying this methodology. Even within the specific literature on environmental efficiency evaluation, we find no scholarship applying DEA methodology to waste management (see Song et al, 2012). While Charles and Zegarra (2014) have measured regional competitiveness by means of developing a methodology based on DEA, no attempts (to our knowledge) have been carried out to study regional efficiency levels and variability in terms of waste management. As for Italy's waste management studies, Paci and Becagli (2009) have evaluated regional levels of activity and performance, but have only looked at regional provision and planning and some structural features of firms operating in the waste management sector. D'Alisa, Di Nola, and Giampietro (2012) limited their analysis only to the Campania region focusing on the issue of urban metabolism, while Fiorillo (2013) has analysed the determinants of household recycling in Italy with particular emphasis on social behaviours, but not at the regional scale.

Data envelopment analysis

DEA is a non-parametric method used in the analysis of systems and operations for the estimation of 'production frontiers'. It provides operations researchers (amongst others) with an empirical measure of the 'productive efficiency' of 'decision making units' (or DMUs), and it has been used to understand such 'efficiencies' in microeconomic, public and private utility and non-governmental organisations and settings.

Non-parametric approaches have the benefit of not assuming a particular functional form for the inputs and outputs of a process that together, constitute the 'frontier' for production (e.g. in understanding how efficient an electricity supply utilities provider is, the inputs to consider would include staff hours, losses, capital (lines and transformers only) and goods and services, while the output variables include number of customers, energy delivered, length of lines, etc.). Instead of explicitly specifying the form of the frontier, a non-parametric method estimates it based on the sample data: the measured values of the inputs and the outputs are used to form a set of production possibilities, and the frontier of this set is used as a benchmark for measures of efficiency. DEA, therefore, can be used to measure productive efficiency for DMUs with relatively deterministic borders, using the techniques of linear programming to envelop the input–output vectors observed as closely as possible. Thus, one of the main advantage of DEA is comparison in the face of complexity about inputs and outputs (e.g. policy and historic processes), and the possibility of simultaneously considering, comparing and modelling a wide range of non-transparent input and output processes, for the purposes of non-arbitrary comparison.

As noted above, to measure the efficiency of DMUs, a benchmark must be derived. In principle, this is represented by the frontier representing the whole of production, also called the 'efficiency frontier'. The radial distance of an observed DMU from this frontier provides a measure of relative efficiency. In other words, relative efficiency is measurable by means of the DEA through reference to a subset of DMU efficient 'best practices', with which any other DMU is comparable.

The versatility of the DEA can thus be summarised through reference to the following advantages:

- First, it is an extreme point method which compares each DMU with a best DMU.
- Second, it does not require any underlying assumption of a functional form relating to inputs and outputs.
- Third, it provides the possibility of incorporating the existence of multiple inputs and outputs.
- Fourth, it works well with a small variable, sample and population size, as well as larger ones.

As Golany and Roll (1989) note, DEA can be applied to: identifying sources of inefficiency, ranking DMUs, evaluating management and the effectiveness of programs or policies and creating a quantitative basis for reallocating resources. Since Charnes et al. (1978) seminal paper, numerous DEA models have been used to assess the 'efficiency' of public and not-for-profit organisations, e.g. hospitals (Kuntz, Scholtes, and Vera 2007; Kuntz and Vera 2007), police forces (Thanassoulis 1995; Sun 2002; Aristovnik, Seljak, and Mencinger 2012), districts appeals courts (Marselli and Vannini 2004), the inclusion of disabled people in the labour market (Agovino and Rapposelli 2011), the banking sector (Kensyn and Degirmen, 2013), social efficiency and quality of life scenarios (Mariano e Rebelatto 2013), and regional competitiveness (Charles and Zegarra 2014). According to a recent survey of DEA applications (Liu et al. 2013), the areas of application seeing the highest growth are energy, environment and finance.

DEA has basically three options regarding the orientation of its models: input orientation, output orientation and input–output orientation. In this work, the use of the input orientation or doubly oriented model is considered unfavourable because our main assumption is that aspects of culture (as input) foster pro-environmental behaviours. As one of the objectives of sustainable waste management is to increase regional recycling activities (outputs in the model), the DEA model with output orientation was chosen. In this way, we evaluate the technical output efficiency by implementing the Charnes, Cooper and Rhodes model (CCR). This model draws on the techniques of linear programming as used in operations research, and for this study is applied in a 'output oriented' way, because it estimates the maximum feasible expansion of the output of the units within the set of production possibilities, assumed to contain all input–output correspondences. Each of the n DMUs ($j = 1, \ldots, n$) to be evaluated consumes varying amounts of m different inputs to produce s different outputs. The relative efficiency of the currently evaluated DMU j_0 is obtained from the following calculation:

$$h_0 = \max \sigma_0$$

s.t.

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{ij_0} \quad \forall i$$

10   *A. Crociata and N. Mattoscio*

$$\sigma_0 y_{rj_0} - \sum_{j=1}^{n} \lambda_j y_{rj} \leq 0 \quad \forall r$$

$$\lambda_j \geq 0, \quad \lambda_j \geq 0$$

Here y_{rj} is the amount of the *r*-th output to DMU *j*, x_{ij} is the amount of the *i*-th input to DMU *j*, and λ_j are the weights of DMU *j*. The value of σ_0 obtained is termed the technical output efficiency of DMU j_0, and it is bounded between 0 and 1: a technically efficient unit will have a score of unity, while inefficient ones will have a score less than unity.

The study and its findings

As an exploratory study, we evaluated data for the 20 Italian regions during 2003–2007, with respect to levels of recycling and the cultural participation of Italians. In this section, we describe more accurately the variables used in the DEA.

Italy forms the wider unit for understanding the particular motivation for this study, within which we note, Campania and its capital, Naples, have become icons of waste mismanagement in Europe. Hundreds of articles in international newspapers and thousands of websites and blogs have diseminated news of this socio-ecological disaster (see D'Alisa, Di Nola, and Giampietro 2012 for a critical review). Moreover, we chose regions as the bounded geographical unit of analysis because waste management and landfill policies are implemented at a decentralised, municipal and localised level (Mazzanti, Montini, and Nicolli 2009). Secondly, Italy, with its often problematic economic, institutional and environmental heterogeneity regarding regional outcomes, allows an interesting analysis of regional effects and differences for a decentralised, federalised setting. (A more nuanced analysis could be conducted with household level data, urban to rural data, and so on).

The data[1] have been selected from two different sources, both of them obtained from the Italian national institute of statistics (ISTAT). Output data have been obtained from the survey 'Noi Italia – Sezione Ambiente', while input data has been extracted from the database, 'Cultura in cifre'. The former survey identifies the kg of recycling per capita, provided by Italian institute of environmental research and prevention. The acquisition of information on production and collection of municipal waste was based on the preparation and submission of appropriate questionnaires to public entities that collect information on the management of municipal waste. In particular, the information has been requested from the regional and provincial agencies for environmental protection. The latter survey collects data on cultural participation, these information was collected by ISTAT on census data provided by the Italian cultural ministry.[2]

Before proceeding with the DEA analysis, we note a simpler correlation analysis shows the link between cultural consumptions (CC) and recycling behaviours (RB), using data selected from the aforementioned sources. The selection variables are not arbitrary proxies; in line with Throsby, and flowing from the results of the analysis of Crociata, Lilla, and Sacco (2012), they focus on: CC as the average of 'consumption' of books, newspapers, cinema, museums/exhibitions and non-classical music and RB, as the kg of recycling per capita. As shown in Table 1, there is a significant

CEER 1015494
14 February 2015

Initial

CE: SG   QA: KM
Coll: QC:

Environmental Education Research   11

Table 1.   Correlation analysis between cultural consumption and recycling.

Year	Corr_CC and RB
2003	0.7579*
2004	0.7872*
2005	0.8314*
2006	0.9024*
2007	0.8859*

relationship between the data on cultural consumption and recycling during the
period analyzed (5% significance threshold).   5

To perform the DEA, at the level of private cultural consumption, we have con-
sidered the cumulative variable for each type of consumption. This captures the
continuing effect of cultural consumption in relation to pro-environmental behaviour,
but also requires us to recognise the need to filter off occasional effects (e.g. events
that distort patterns). This methodological choice finds its roots in the literature of   10
cultural economics (see Mattoscio and Furia 2010; for a critical review, and Crociata
2010; for its multidimensional features). According to Stigler and Becker (1977),
the focus on trend data for cultural consumptions is to identify how they work as
'additive goods'; that is to say, preference for this type of goods is not given, but
tends to increase and shift over time, in line with growing levels of cultural capital.   15
In other words, additive goods activate a dynamic process of the cultivation of taste,
in which tastes change by the experience of consumption, such that as McCain
(1995) argues, cultural consumptions activate a 'learning by consuming' process.
Even as events are important to this, a focus on events alone and their possible dis-
torting effects, moves attention away from longer term factors or processes. More-   20
over, access to cultural consumption largely depends on an individual's regular
background of experiences (Pine and Gilmore 2011), skills (Wright 1975) and capa-
bilities (Sen 2000), most notably concerning prior 'everyday' experiences of cultural
access and familiarity with the appropriation and interpretation of cultural codes,
which in turns depends on the allocation of one's cognitive surplus across time and   25
space, rather than simply to momentary events (Shirky 2010). For this reason, we
consider the accumulation of these experiences and learning as stronger evidence of
a form and development of cultural capital.

Applying these assumptions, we now identify proxies for the cumulative values
of cultural consumption for these times and places, noting that while these are avail-   30
able in the databases, alternatives might be considered for other forms of cultural
analysis, particularly for other places and periods:

No. of DMUs = 20
No. of output items = 1
Output (1) = kg recycling per capita
No. of input items = 5
Input (1) = cum_books
Input (2) = cum_newspaper
Input (3) = cum_cinema
Input(4) = cum_museum/exibition
Input(5) = cum_non classical music

12   *A. Crociata and N. Mattoscio*

Analysis of results

The results obtained for the output-orientated DEA efficiency scores applying the CCR model are now presented.

As shown in Table 2, only three regions, Trentino-Alto Adige, Veneto and Emilia-Romagna, are technically 'efficient'. We note that only the northern part of Italy shows regions that are efficient while the central and southern parts of the country show no region within the 'top performers'.

Comparing these results with ISTAT data on cultural consumption, we note Trentino-Alto Adige, Veneto and Emilia-Romagna are among the regions with the greatest amount of cultural consumption. Moreover, these results confirm the analysis of Paci and Becagli (2009) that identifies Trentino-Alto Adige and Veneto as among the most 'sustainable' regions in Italy, with particular reference to their high separate waste collection rates.

The map represented in Figure 1 shows a clearer pattern to the regional rankings. The emerging picture of efficiency reveals a predominance of northern regions as most efficient, followed by central regions and lastly, southern ones. These results graphically illustrate substantial differences between the Italian regions. The findings echo the prevailing 'two Italys' pattern; that is, that the country is divided into two clearly separate parts. In this study, northern regions are very close to technical efficiency while those in the south have the lowest performance ratings. This finding is confirmed in the literature, where for some regions, mostly in the North, it can be shown that recycling is part of a complex integrated system consisting of the collection, treatment and disposal of waste. In other regions, especially regions and islands in the South, there is very little separate waste collection, and incinerating seems to

Table 2.   DEA efficiency scores by Italian regions, 2007.

| DMU	Score	Rank	Reference set (lambda)			
Piemonte	0.9658	4	Veneto	0.7174	Emilia-Romagna	0.2320
Valle d'Aosta	0.9381	7	Veneto	0.5693	Emilia-Romagna	0.3509
Lombardia	0.9402	6	Veneto	0.9581	–	–
Trentino-Alto Adige	1.0000	1	Trentino-Alto Adige	1.0000	–	–
Veneto	1.0000	1	Veneto	1.0000		
Friuli-Venezia Giulia	0.7496	9	Veneto	0.9922	Emilia-Romagna	0.0145
Liguria	0.5594	13	Emilia-Romagna	0.8259	–	–
Emilia-Romagna	1.0000	1	Emilia-Romagna	1.0000	–	–
Toscana	0.9581	5	Veneto	0.3628	Emilia-Romagna	0.5434
Umbria	0.7837	8	Emilia-Romagna	0.8199	–	–
Marche	0.5804	11	Veneto	0.0655	Emilia-Romagna	0.7509
Lazio	0.3219	17	Veneto	0.0684	Emilia-Romagna	0.8405
Abruzzo	0.5597	12	Emilia-Romagna	0.7038	–	–
Molise	0.1345	20	Emilia-Romagna	0.5719	–	–
Campania	0.4842	14	Emilia-Romagna	0.5477	–	–
Puglia	0.3465	16	Emilia-Romagna	0.5410	–	–
Basilicata	0.2235	19	Veneto	0.1065	Emilia-Romagna	0.4923
Calabria	0.3532	15	Emilia-Romagna	0.4873	–	–
Sicilia	0.2443	18	Emilia-Romagna	0.5364	–	–
Sardegna	0.6979	10	Veneto	0.3722	Emilia-Romagna	0.4501
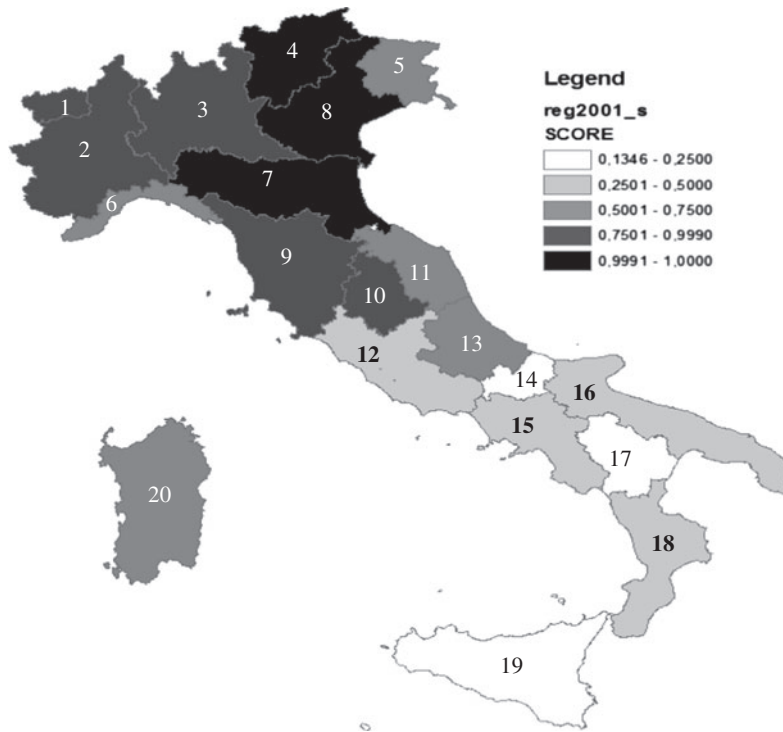
Figure 1.   DEA efficiency scores by Italian regions, 2007.
Note: 1. Valle d'Aosta; 2. Piemonte; 3. Lombardia; 4. Trentino-Alto Adige; 5. Friuli Venezia Giulia; 6. Liguria; 7. Emilia Romagna; 8.Veneto; 9. Toscana; 10. Umbria; 11. Marche; 12. Lazio; 13. Abruzzo; 14. Molise; 15. Campania; 16. Puglia; 17. Basilicata; 18. Calabria; 19. Sicilia; 20. Sardegna.

be the only real alternative to landfill (Paci and Becagli 2009). According to Fiorillo (2013), we must also consider that there is high geographical heterogeneity in these practices, with Northern Italy rapidly evolving towards high level of recycling (42% in 2007), and Southern Italy dramatically mired in low separate collection (11.6% in 2007). This finding is also confirmed in cultural economics literature, where regions in the North allocate public expenditure to the cultural sector (in 2007) more than the South ones (Stratta 2009). Bodo (2009) shows a statistical evidence of the persisting gap in cultural development between Southern Italy and Northern and Central Italy. According to the study, in fact, whereas 35% of the Italian population belongs to the South, most of the cultural development indicators of this area are swinging between only 27 and 11% of the total. Starting from financial indicators, where available statistics show an incidence of the Mezzogiorno around 21% on State expenditure for the performing arts and on local expenditure, and an even lower incidence on earned income from household expenditure, evidence is given of the negative effects of such under financing on cultural supply and demand.

It is also possible to identify poorly performing regions alongside their relatively more efficient peers through a focus on DMUs. According to the DEA results, the 'Reference set' (Table 3) displays the frequency with which efficient regions appear against inefficient ones. Emilia-Romagna is the region appearing most frequently in

CEER 1015494
14 February 2015
Initial
CE: SG   QA: KM
Coll: QC:

14   *A. Crociata and N. Mattoscio*

Table 3. DEA efficiency scores by Italian regions, 2003–2007.

DMU	2007 Score	2007 Rank	2006 Score	2006 Rank	2005 Score	2005 Rank	2004 Score	2004 Rank	2003 Score	2003 Rank
Piemonte	0.965875	4	0.951624	6	0.881996	6	0.816387	6	0.723525	7
Valle d'Aosta	0.938122	7	0.878005	7	0.830028	7	0.810195	7	0.853077	6
Lombardia	0.940273	6	0.979762	5	0.961323	4	0.980139	4	1.000000	1
Trentino-Alto Adige	1.000000	1	1.000000	1	1.000000	1	1.000000	1	0.986567	4
Veneto	1.000000	1	1.000000	1	1.000000	1	1.000000	1	1.000000	1
Friuli-Venezia Giulia	0.749678	9	0.672641	9	0.652995	9	0.614472	9	0.679536	8
Liguria	0.559421	13	0.533544	12	0.503161	12	0.522653	10	0.580420	10
Emilia-Romagna	1.000000	1	0.994444	4	0.949178	5	0.926647	5	0.917761	5
Toscana	0.958138	5	1.000000	1	1.000000	1	1.000000	1	1.000000	1
Umbria	0.783755	8	0.843685	8	0.751388	8	0.621432	8	0.607218	9
Marche	0.580443	11	0.578183	10	0.557362	10	0.489560	11	0.485699	11
Lazio	0.321963	17	0.329465	17	0.311419	16	0.257417	16	0.251331	17
Abruzzo	0.559761	12	0.551018	11	0.509292	11	0.457192	12	0.385200	14
Molise	0.134554	20	0.150628	20	0.159873	20	0.098615	20	0.109359	20
Campania	0.484281	14	0.442946	14	0.412822	13	0.402949	13	0.328854	15
Puglia	0.346498	16	0.360083	15	0.317831	15	0.282793	15	0.415448	12
Basilicata	0.223508	19	0.226334	19	0.188173	19	0.180814	18	0.209966	18
Calabria	0.353259	15	0.330585	16	0.357574	14	0.387234	14	0.393518	13
Sicilia	0.244363	18	0.287960	18	0.238663	18	0.220638	17	0.258673	16
Sardegna	0.697989	10	0.533203	13	0.283144	17	0.164828	19	0.120645	19

CEER 1015494
14 February 2015

Initial

CE: SG   QA: KM
Coll: QC:

Environmental Education Research   15

the reference sets. By looking at DEA results during the period 2003–2007, we can observe the dynamics in the performance of regions, which delineates three further groupings of regions. The first is represented by regions that improved their performance (Piemonte, Trentino-Alto Adige, Emilia-Romagna, Abruzzo and Sardegna). The second is represented by regions that worsened their performance (Lombardia, Liguria, Toscana, Puglia, Calabria and Sicilia). The third is represented by regions that remain more or less constant in their performance (Veneto, Friuli-Venezia Giulia, Valle d'Aosta, Umbria, Marche, Lazio, Molise, Campania and Basilicata). For this period, it is also interesting to note that Veneto and Trentino-Alto Adige (except for 2003) are always in the top performing regions, while Emilia-Romagna only became one of those in 2007.

Conclusion

More than a decade ago, scholars denounced the missed opportunity of using waste reduction to drive and demonstrate a shift towards sustainable development (de Jong and Wolsink 1997); indeed, in spite of mandatory legal measures and prevention policies, waste generation continues to rise (Ekvall 2005) and widespread sustainable household recycling habits are still far from being achieved. Compared to previous studies, to our knowledge, the linkages between cultural consumption and recycling is rarely considered in the literature, but it has some firm logical ground once the role of cultural access is considered in fostering pro-environmental behaviours. In particular, regional levels of participation in various forms of cultural experiences provide citizens with opportunities to engage in mind-opening interactions, that may encourage the development of knowledge-oriented dispositions, intellectual curiosity, and better awareness about the relatedness of everyday choices, including long-term social and environmental outcomes. In this way, drawing on ideas associated with cultural capital and how it might be illustrated through proxy measures, we have been able to consider the relationship between participation and activity, and how cultural consumptions represent a specific interacting and learning context that also shifts attention away from schooling as the primary focus of an 'education for sustainable development'.

To summarise the findings, we have evaluated the performance of Italian regions with respect to the nexus between cultural consumption and pro-environmental behaviour by means of a non-parametric approach to DMU efficiency measurement, as examined by DEA techniques. To this end, we have obtained measures of technical efficiency applying the notion of production frontiers. The results of the empirical analysis have highlighted a ranking of efficient and non-efficient regions in terms of the connection between environment-related behaviours and cultural participation. The results provided by the first DEA model show that out of the 20 units analyzed, only three (Emilia-Romagna, Veneto and Trentino-Alto Adige) can be judged 'efficient'.

These results are important because they illustrate substantial differences across the Italian regions. The results show a benchmark for each inefficient region, with Emilia-Romagna offering a marker for significant change (also useful for subsequent benchmarking considerations, e.g. for data 2007 onwards). Looking at the period 2003–2007, Italian regions can be divided into three groups, and within those two regions remain as 'top performers' (Veneto and Trentino-Alto Adige).

By proceeding from the assumption that cultural capital enables and motivates individuals to take more collective responsibility for their pro-environmental behaviours, shaping up to a collective identity within households and communities, solidifying social ties and contributing to the enforcement of social norms, we have been able to use cultural capital considerations as a means to providing a ranking of regions, using efficiency to consider to examine the relationship between cultural participation and recycling. However, we also acknowledge this study has several limitations. We note, primarily it is an exploratory correlational analysis of the topic under consideration, and for this reason, there are no other studies with which to compare the results, at this or other scales of comparison, including confounding factors and alternative output variables that may similar patterns (e.g. higher levels of cultural consumption considered in terms of events may require more travel). Also, the time horizon of the data could be expanded so a more sophisticated DEA model could be used. (This limit is actually the next step for future research, which will also include the use of other situational variables, such as education and income.) For example, it could also be important to consider the role that fiscal incentives, such as monetary rewards, can play on pro-environmental behaviours (Frey and Jegen 2001), but this too might be broadened to consider more closely their cultural dimensions, be that in terms of cultural capital, taste, motivation or cultural consumptions. Finally, moving beyond relatively crude proxies for cultural consumption and pro-environmental behaviour must also be considered, i.e. towards a more sophisticated set of measures for DEA (and other techniques) for evaluating the performance of Italian regions as DMUs, on the theme of sustainable waste management and related aspects of pro-environmental behaviour formation, enaction, and so forth. Would also be useful to extend the analysis of regional performance including the presence and the role played by cultural institutions such as the ecomuseums.

The term ecomuseum (or widespread museum), indicates a region characterised by traditional living environments, natural and historical-artistic heritage particularly relevant and worthy of protection and enhancement. The historical, cultural and environmental heritage have become the subject of public interest in which the community can know the area that surrounds it. An ecomuseum, unlike a regular museum, is not surrounded by walls or limited in any other way, but it is proposed as an opportunity to discover and promote an area of particular interest to medium routes prepared, of teaching and research that use of the personal involvement of the population, the associations and cultural institutions. No coincidence that the regions with the best performance (as Veneto and Emilia Romagna) are those in which include more ecomuseums.

It remains that public environmental policies face many new challenges, including for sustainable waste management, and that although facing up to these issues has emerged as a public priority, there is a paucity of preventative strategies. Within this scenario, and given our findings, there is cause to consider that culture-related programmes could exert positive effects on waste management behaviours. Even if at an exploratory stage, our analysis illustrates a positive relationship between cultural participation and recycling, and thus it could be beneficial for designing and implementing preventative strategies that further consider the role and impact of cultural access, if not the non-obvious links between cultural and ecological economics.

In order to establish a long-term change in pro-environmental behaviour, we would also argue that politically define regions as a scale of analysis must be considered further, because of their legislative and regulatory functions, if new strategic

dimensions are to be better conceived, in public education, alongside the informal and historic dimensions to producing and sustaining an educated public, more typically targeted at individuals and households.

Finally, given the increasing importance of waste management for sustainable policy action, a future research step could be to inquire as to how society and ecosystem services are mediated and shaped by cultural consumptions, exploring the overlap of resilience, learning and cultural access. We note Krasny, Lundholm, and Plummer (2010) have attempted pioneering work on environmental education and resilience; in the same way, it could be fruitful to discuss how cultural participation as a learning platform could also become a gateway of information, to provide and critique knowledge and practices on socio-ecological adaptation, for example. In other words, if cultural and ecological resilience, like sustainability, are dependent on learning processes, as well as the social, cultural and economic situation and setting, there is also room to believe that learning theory, cultural economics and social-ecological resilience may contribute to ongoing discussions about the transferability of ideas within regions, and across disciplines.

AQ14

Notes

1. The data refer to 2003–2007 because there was no information in relation to recycling in other years; Fiorillo (2013) provided a clear picture of Italy's situation on the same years. Moreover, a recent study (Santana et al. 2014) applies the DEA methodology to a similar timeframe.
2. We do not consider education and income as inputs per se because our hypothesis is that that the higher the education and income levels, the more the habit of consuming cultural goods is in evidence. Moreover, this work tries to evaluate the regional performances considering the direct impact of culture on recycling.

References

Abraham, C., W. W. Cooper, and E. L. Rhodes. 1981. "Evaluating Program and Managerial Efficiency: An Application of Data Envelopment Analysis to Program Follow Through." *Management Science* 27: 668–697.

AQ15

Agovino, M., and A. Rapposelli. 2013. "Inclusion of Disabled People in the Italian Labour Market: An Efficiency Analysis of Law 68/1999 at Regional Level." Quality & Quantity 47: 1577–1588.

AQ16

Antoci, A., P. L. Sacco, and P. Vanin. 2007. "Social Capital Accumulation and the Evolution of Social Participation." *Journal of Socio-Economics* 36: 28–143.

Aristovnik, A., J. Seljak and J. Mencinger. 2012. "Relative Efficiency of Police Directorates in Slovenia: A Non-parametric Analysis." *Expert Systems with Applications*. http://dx.doi.org/10.1016/j.eswa.2012.08.027.

Baumol, W. J., and W. G. Bowen. 1966. *Performing Arts, the Economic Dilemma: A Study of Problems Common to Theater, Opera, Music, and Dance*. New York: Twentieth Century Fund.

Bodo, C. 2009. "Lo sviluppo culturale del Mezzogiorno. Il ritardo in cifre." *Economia Della Cultura* 2: 167–182.

AQ17

AQ18

Bourdieu, P. 1979. *La Distinction. Critique Sociale Du Jugement*. Paris: Minuit.

Burn, S. M., and S. Oskamp. 1986. "Increasing Community Recycling with Persuasive Communication and Public Commitment." *Journal of Applied Social Psychology* 26: 29–41.

Charles, V., and L. F. Zegarra. 2014. "Measuring Regional Competitiveness Through Data Envelopment Analysis: A Peruvian Case." *Expert Systems with Applications* 41: 5371–5381.

Crociata, A. 2010. "A Multidimensional Framework of Cultural Economics." *Global & Local Economic Review XIII* 1: 101–122.

18   *A. Crociata and N. Mattoscio*

Crociata, A., M. Lilla, and P. L. Sacco. 2012. *Recycling Waste. Does Culture Matter?* Milan: Mimeo, IULM University.

Curlee, R. T. 1986. *The Economic Feasibility of Recycling*. New York: Praeger.

D'Alisa, G., M. F. Di Nola, and M. Giampietro. 2012. "A Multi-Scale Analysis of Urban Waste Metabolism: Density of Waste Disposed in Campania." *Journal of Cleaner Production* 35: 59–70.

D'Angelo, F., D. Furia, A. Crociata, and A. Castagna. 2010. "Education and Culture: Evidence from Live Performing Arts in Italy." *Procedia: Social & Behavioral Sciences* 9: 1373–1378

De Young, R. 1986. "Some Psychological Aspects of Recycling: The Structure of Conservation – Satisfactions." *Environment and Behavior* 18: 435–449.

Ekvall, T. 2005. "Introduction to the Special Issue: 'Environmental Assessments and Waste Management'." *Journal of Cleaner Production* 13: 209–211.

Euromeridiana. 2004. *L'economia Della Cultura*, 2° quadrimestre.

Everingham, C. 2003. *Social Justice and the Politics of Community*. London: Ashgate.

Fiorillo, D. 2013. "Household Waste Recycling: National Survey Evidence from Italy." Journal of Environmental Planning and Management 56 (8): 1125–1151.

Flowers, A. A., J. P. Carroll, G. T. Greena, and L. R. Larson. 2014. "Using Art to Assess Environmental Education Outcomes." *Environmental Education Research*. doi:10.1080/13504622.2014.959473.

Frey, B. S., and R. Jegen. 2001. "Motivation Crowding Theory." *Journal of Economic Surveys* 15: 589–611.

Golany, B., and Y. Roll. 1989. "An Application Procedure for DEA." *Omega – The International Journal of Management* 17: 237–250.

Gorman, W. M. 1967. "Taste, Habits and Choices." *International Economic Review* 8: 9–33.

Hirsch, F. 1976. *Social Limits to Growth*. London: Routledge.

Hutter, M. 1996. "The Impact of Cultural Economics on Economic Theory." *Journal of Cultural Economics* 20: 263–268.

Jenkins, H. 2008. *Convergence Culture: Where Old and New Media Collide*. New York: New York University Press.

Johnson-Laird, P. 1993. *Human and Machine Thinking*. Hillsdale, NJ: Erlbaum.

de Jong, P., and M. Wolsink. 1997. "The Structure of the Dutch Waste Sector and Impediment for Waste Reduction." *Waste Management and Research* 15: 641–658.

Kensyn, B. Y., and S. Degirmen. 2013. "The Application of Data Envelopment Analysis Based Malmquist Total Factor Productivity Index: Empirical Evidence in Turkish Banking Sector." *Panoeconomicus* 2: 139–159.

Krasny, M. E., C. Lundholm, and R. Plummer. 2010. "Environmental Education, Resilience, and Learning: Reflection and Moving Forward." *Environmental Education Research, (Special Issue: Resilience in Social-Ecological Systems: The Roles of Learning and Education)* 16 (5–6): 463–474.

Kuntz, L., S. Scholtes, and A. Vera. 2007. "Incorporating Efficiency in Hospital-capacity Planning in Germany." *The European Journal of Health Economics* 8 (3): 213–223.

Kuntz, L., and A. Vera. 2007. "Modular Organization and Hospital Performance." *Health Services Management Research* 20 (1): 48–58.

Læssøe, J. 2010. "Education for Sustainable Development, Participation and Socio-cultural Change." *Environmental Education Research* 16 (1): 39–57.

Lanza, D. R. 1983. "Municipal Solid Waste Regulations: An Ineffective Solution to a National Problem." *Fordham Urban Law Journal* 10: 215–245.

Lavanga, M. 2003. "Cultural Economics and Its Multidisciplinary Approach." Proceedings of the Conference Research in Economics: Methodology, Coherence and Effectiveness, Graduate College Santa Chiara, Siena.

Liu, J. S., L. Y. Y. Lu, W.-M. Lu, and B. J. Y. Lin. 2013. "A Survey of DEA Applications." *Omega* 41: 893–902.

Lloyd, B. 1972. *Perception and Cognition*. Harmondsworth: Penguin.

Mariano, E. B., and D. A. Rebelatto. 2013. "Transformation of Wealth Produced into Quality of Life: Analysis of the Social Efficiency of Nation-states with the DEA's Triple Index Approach." *Journal of the Operational Research Society*. doi:10.1057/jors.2013.132.

CEER 1015494
14 February 2015

Initial

CE: SG   QA: KM
Coll: QC:

Environmental Education Research   19

AQ23
AQ24
Marselli, R., and M. Vannini. 2005. "L'efficienza tecnica dei distretti di corte d'appello italiani: aspetti metodologici, benchmarking e arretrato smaltibile". Working Paper CRENoS

Mattoscio, N., and D. Furia. 2010. "A Multidimensional Model Analysis in Cultural Economics: The Italian Case." *Tourism Economics* 16 (3): 565–583.

Mazzanti, M., A. Montini, and F. Nicolli. 2009. "The Dynamics of Landfill Diversion: Economic Drivers, Policy Factors and Spatial Issues." *Resources, Conservation and Recycling* 54: 53–61.

McCain, R. 1995. "Cultivation of Taste and Bounded Rationality: Some Computer Simulations." *Journal of Cultural Economics* 19: 1–15.

Miafodzyeva, S., and N. Brandt. 2013. "Recycling Behaviour Among Householders: Synthesizing Determinants via a Meta-analysis." *Waste and Biomass Valorization* 4 (2): 221–235.

Moseley, C., B. Desjean-Perrotta, and J. Utley. 2010. "The Draw-an-Environment Test Rubric (DAET-R): Exploring Pre-Service Teachers' Mental Models of the Environment." *Environmental Education Research* 16 (2): 189–208.

AQ25
Murray, P., J. Goodhew, and S. Murray. 2014. "The Heart of ESD: Personally Engaging Learners with Sustainability." *Environmental Education Research* 20 (5): 718–734.

Noll, K. 1985. *Recovery, Recycle and Reuse of Industrial Wastes*. Chelsea, MI: Lewis Publishers.

Paci, A., and C. Becagli. 2009. "Public Policies and Corporate Strategies for Successful Models in Waste Management." *Sinergie* 78: 79–95.

Pine, B.J., and J. H. Gilmore. 2011. *The Experience Economy*, Updated edition. Cambridge, MA: Harvard Business Review Press.

Russo, A. P., and J. van der Borg. 2005. *The Impacts of Culture on the Economic Development of Cities*. Rotterdam: Euricur Report.

Sacco, P. L., and A. Crociata. 2013. "A Conceptual Regulatory Framework for Design and Evaluation of Complex, Participative Cultural Planning Strategies." *International Journal of Urban and Regional Research* 37 (5): 1688–1706.

Santana, N. B., D. A. do Nascimento Rebelatto, A. E. Périco, and E. B. Mariano. 2014. "Sustainable Development in the BRICS Countries: An Efficiency Analysis by Data Envelopment." *International Journal of Sustainable Development & World Ecology* 21 (3): 259–272.

Sen, A. 2000. *Development as Freedom*. New York: Anchor Books.

Shirky, C. 2010. *Cognitive Surplus. Creativity and Generosity in a Connected Age*. New York: Penguin Press.

Song, Y. I. K. 2012. "Crossroads of Public Art, Nature and Environmental Education." *Environmental Education Research* 18 (6): 797–813.

Stigler, G. J., and G. S. Becker. 1977. "De gustibus *non est* disputandum." *American Economic Review* 67 (2): 76–90.

AQ26
AQ27
Stratta, B. 2009. "Spesa pubblica per la cultura nelle regioni italiane: dinamiche e recenti modelli." *Economia Della Cultura* 2: 148–165.

Sun, S. 2002. "Measuring the Relative Efficiency of Police Precincts Using Data Envelopment Analysis." *Socio-Economic Planning Sciences* 36 (1): 51–71.

Tang, Z., X. Chen, and J. Luo. 2011. "Determining Socio-psychological Drivers for Rural Household Recycling Behavior in Developing Countries: A Case Study from Wugan, Hunan, China." *Environment and Behavior* 43 (6): 848–877.

Thanassoulis, E. 1995. "Assessing Police Forces in England and Wales Using Data Envelopment Analysis." *European Journal of Operational Research* 87 (3): 641–657.

Throsby, D. 1994. "The Production and Consumption of the Arts; A View of Cultural Economics." *Journal of Economic Literature* 32: 1–29.

Throsby, D. 1999. "Cultural Capital." *Journal of Cultural Economics* 23: 3–12.

Throsby, D. 2001. *Economics and Culture*. Cambridge: Cambridge University Press.

Throsby, D. 2005. *On the Sustainability of Cultural Capital*. Economics Department, Macquarie University.

AQ28
Trimarchi, M. 2002. "Dentro lo specchio: economia e politica della domanda di cultura". *Economia della cultura* 2: 157–170.

AQ29
UNCED. 1992. *Agenda 21: Action Plan for the Next Century United Nations Conference on Environment and Development*. Rio De Janeiro.

20   *A. Crociata and N. Mattoscio*

Van Poeck, K., and J. Vandenabeele. 2012. "Learning from Sustainable Development: Education in the Light of Public Issues." *Environmental Education Research* 18 (4): 541–552.

Veblen, T. 1922. *The Theory of the Leisure Class. An Economic Study of Institutions*. London: George Allen Unwin. (First published, 1899).

Wright, D. F. 1975. "Musical Meaning and Its Social Determinants." *Sociology* 9: 419–435.

Zamagni, S. 2005. *L'economia Civile E I Beni Relazionali*, in *Le Nuove Economie* edited by Viale R. Milano: Edizione del Sole 24 Ore.