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## Among ‘Bananas’ and ‘Backyards’: A Statistical Analysis of the Effect of Risk and Scientific Literacy on the Attitude towards a Waste Co-incinerator in Italy

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**Abstract:** This paper, based on a social impact research and the possible NIMBY-effect of the Turin, Italy, co-incinerator, deals with risk perception, scientific literacy and their influence on the attitude towards high-tech and controversial industrial plants. The paper argues that plant and infrastructure settlements having a substantial ecological impact represent a highly sophisticated and diverse social phenomenon in which risk plays an important but not unique role. Taking into account some important concomitant variables (such as trust, mass media use, political culture in decision-making processes), it is first of all shown that risk is not a mono-dimensional concept, as assumed by the psychometric tradition, and that two dimensions of the concept are to be found. The *collective* dimension has a positive monotonic association with a critical attitude towards the co-incinerator, whereas the *individual* dimension has an unexpectedly negative correlation, which will be explained in further detail. It also demonstrates that scientific literacy has no statistical significance for attitude in our model, confirming the well-known limits of the so called ‘knowledge deficit’ model.

**Keywords:** *NIMBY, BANANA, risk, incinerators, urban waste, scientific literacy, knowledge deficit, trust.*

### Introduction

This paper is derived from a still-on-going research program started in 2007 on the social impact of the co-incinerator presently under construction in the

Gerbido area of Turin, Piedmont, Italy. Basically, it deals with risk perception and people’s scientific literacy, and on their influence on the attitude towards high-tech and controversial industrial plants, an increasingly relevant theme,

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and not only within the social science field.

Over the last two decades, many studies have focused their attention on the phenomenon of local opposition to ‘useful but unwanted’ plant and infrastructure programs in many parts of the world, such as in Canada and the United States (Rasmussen, 1992; Seeliger, 1994; McGurty, 1997; Fischel, 2001; Blake, 2004; Saha and Mohai, 2005), France (Lafaye and Thévenot, 1993; Lolive, 1997; Trom, 1999; Catherin, 2000; Rootes 2003), Germany (Weidner, 1998; Rootes, 2003), Greece (Rootes, 2003), Great Britain (Welsh, 1993; Rootes, 2003), Spain (Muñoz, Durán and García, 1999; Rootes, 2003), Sweden (Rootes, 2003) and Japan (Lesbirel, 1998).

Looking at the Italian context then, mass media attention and public opinion have been drawn to projects such as the nuclear waste storage plant for Scanzano Ionico, the High Speed Train (TAV) in the Val di Susa area, the Dal Molin American Airport base near Vicenza and, most of all, the waste management catastrophe in Naples. These concerns, with limited scrutiny by the Italian media, are new and relatively rare in Italy when compared to similar events occurring over decades in North America and Northern Europe [Bobbio e Zeppetella 1999: 186], but they are not unique.

According to the NIMBY Forum Association’s 6<sup>th</sup> Survey (year 2011)<sup>1</sup>, public opinion in Italy is currently protesting against 320 infrastructure and plant programs. The expression ‘NIMBY syndrome’ has been applied to what is considered to be self-serving and to local interests that motivate this opposition. NIMBY (acronym of

Not In My Backyard) ‘is a malevolent label reflecting the viewpoint of the stakeholders of the project. In fact, it suggests that opposition groups are animated by the self-centeredness of those who do not want a particular (*industrial*) plant near their house, but also who would not do anything if such plant was to be built near someone else’s house’ (Bobbio and Zeppetella, 1999: 186). The variant called LULU (Locally Unwanted Land Use) is actually more neutral (Schively, 2007), whereas the acronym BANANA (Build Absolutely Nothing Anywhere Near Anybody) is probably more suitable to describe a relatively new and interesting protest and opposition trend exceeding local community interests, refusing technologies or programs aside from where they will be settled.

No matter what label is used, experts and other institutional entities (local politicians, industrial lobbyists and mass media) often mischaracterize this public opposition as an unjustifiable and irrational fear of techno-scientific products and a lack of civic culture. According to them, if citizens were more literate on technical and scientific issues, they would inevitably conclude that experts are right and that their skewed risk perception is not plausible.

Using the case study of the Turin co-incinerator project, this paper explores the concept of *risk*, showing its multidimensional scope, and then segues into a statistical analysis of the possible correlation between risk dimensions and scientific knowledge on the one side, and attitudes towards local infrastructure programs on the other side. As shown later (see par. 1), several independent variables were

included in the models used to control some important effects influencing risk perception and scientific knowledge.

### Theoretical Framework

Over the last decades, local opposition to the so-called 'mega-building' programs has become one of the most discussed issues in many public agendas. More research was generated by public attention as new environmental conflicts sprang up throughout many countries.

In the social science domain, the main studies can be identified and divided into four groups:

1) social movements and urban conflicts studies (Lolive, 1997; della Porta, Kriesi and Rucht, 1999; Lahusen, 1999; Lewicki, Gray and Elliot, 2003; Rootes, 2003; della Porta and Diani, 2004; della Porta, 2006; della Porta and Piazza, 2008);

2) works on public deliberation and citizens juries (Weidner, 1998; Bobbio and Zeppetella, 1999; Bobbio, 2002; Lewanski, 2006);

3) traditional analysis of geography, urbanism and territory (Segre and Dansero, 1996; Lewicki, Gray and Elliot, 2003; Elliott, 2007; Bobbio and Dansero, 2008);

4) psycho-social school of risk perception analysis (Slovic, Lichtenstein and Fischhoff, 1979, 1985; Slovic 1992, 2000).

Works focusing on communication and culture variables are unexpectedly missing, and these variables will form the singular perspective presented in this paper. It hypothesizes that the phenomenon of social opposition to industrial or infrastructure projects

arises from social forces closely linked to cultural and communicational interests, namely: risk perception, trust, mass media exposure, scientific literacy (at least, science communication and education) and political culture in decision-making strategies.

The concept of risk, especially as applied to the environment, presents many difficulties. The discussion is vast, complex and continuously evolving, particularly when considering its relatively new appearance within sociological thought. Research paths are numerous and showed the impossibility of enclosing a problem with relatively indefinable borders within a consolidated and unitary plan (Renn, 1992; De Marchi, Pellizzoni and Ungaro, 2001; Lewicki, Gray and Elliot, 2003).

It is well-known that risk study from the social science point of view started with the observation that the rationalistic paradigm was insufficient for the task. The economic field gave birth to this paradigm, which then grew into the medical science area and more specifically into epidemiology. In this regard, Luhmann (1991: 13) writes: 'If we enquire into the rationalist perception of the problem, we get a simple and convincing answer: losses are to be avoided as far as possible. Since this maxim alone restrict the scope of action too much, one does have to permit, and that means 'to risk', actions that can, in principle, cause avoidable loss, provided that the estimate of the possible degree of loss appears acceptable'. This concept leads to the development of a technical approach to risk<sup>2</sup>, which 'aims at anticipating potential losses, and calculating the expected frequency and distribution.

It then uses this information to avoid such losses, minimize them or subdivide their costs among subjects and various institutions' (Bucchi, 1999: 13 – translation mine). Various research contributions to the social science field oppose the rationalist view, which does not consider the human (and therefore social) component as one of the salient variables related to risk definition. The psychometric tradition helps us to introduce the theme of *perception*, while the works of Beck (1986), Giddens (1990) and Luhmann (1991), whose approaches on risk study are of an extreme importance and variety, provide the bases for an analysis of the role played by *trust* in political institutions, *expertise* and the *mass media*.

Despite their will to call the tradition of the so-called 'hard sciences' into question, most of the key works on risk perception and risk communication – such as those carried out by Slovic and his followers over the last 30 years (Slovic, Lichtenstein and Fischhoff, 1979, 1985; Slovic, 1992, 2000) – still do not critically analyse two implicit and rather problematic aspects: 1) risk can be treated as a unidimensional concept; 2) a positive association between risk and attitude towards hazards always exists. The point is (as taught by the psychometric approach) to determine which psychological factors could influence the perception mechanism and possibly modify the slope of the line describing geometrically the link between attitude and perception. The main deductive statement from psychometric studies on risk is that if someone were to have a high risk perception about something (commonly, a hazard), that

person would probably have a negative attitude towards it, and vice versa. Although not asserting such a causal link to be false, this paper argues that it is not to be considered always true *ex ante*, as long as risk is held to be a one-dimensional concept; both assumptions need to be proved and the NIMBY-BANANA phenomena are probably one of today's best research fields for empirically updating scientific knowledge on risk analysis.

#### *Risk and Attitudes: What Else?*

The critical analysis of the second hypothesis (the one dealing with the causal effect between risk and attitude) entails relativizing risk as it relates to a series of concomitant factors which could significantly influence the attitude towards a hazard, as explained by many studies<sup>3</sup>. In addition, the examination of some of the intervening variables is useful in advancing alternative hypothesis on the first traditional psychometric assumptions, namely the discounted idea of the mono-dimensionality of the risk concept in the human sciences field (this topic will be discussed later).

The main reference for both points is set by the European school of sociology, which places the study on risk within the overall change of contemporary society, set forth by Beck as a new and 'reflexive modernity' (1986: 14 and the whole chapter VII) and by others, such as Giddens (1990: 149), as the late 'radicalised modernity'. In addition to these important contributions, the German sociologist Niklas Luhmann focuses on risk from the viewpoint of cultural and communicative processes.

He argues that risk is a product of modernity, where decisions have to be taken in time and knowledge-limited contexts. Therefore, risk is related to the decline of 'hope in rationality' (Luhmann, 1991: 44).

Speaking of decision-making allows us to introduce a strongly linked aspect of risk, that is trust towards governmental institution and techno-scientific expertise involved in the NIMBY-BANANA phenomena. Despite their being characterized by 'expectations which can be frustrated or cast down' (Giddens, 1990: 31), at a substantive level, there are two different types of trust. In institutional trust, the choice requirement takes a central position, that is, the fact that possible alternatives are taken into consideration, including the avoidance of running the risk of a delusion. On the other hand, science and technique offer a different type of trust, a confidence expressing faith in the 'correctness of abstract principles' (Giddens, 1990: 34). On the other side, mass media often portray techno-science as a set of dogmatic, universal and incontrovertible truths (Einsiedel, 1992). Likewise, scientists and technologists – the personification of abstract erudition – are invested with the mystical *aura* and prestige deriving from their disciplines. It is therefore likely that trust in particularly renowned and well-known exponents of the techno-scientific universe might condition the attitude towards a determined issue, especially when the individual cognitive horizon is affected by an intrinsic scarcity of information about complex themes (i.e. biotechnologies, bioethics, but also the installation of a nuclear plant

or co-incinerator for urban waste). That is why we have included the role of trust as it relates to techno-scientific expertise in this study. Besides, we have also included trust towards non-mainstream scientific informational sources which, however, have been closely followed in Italy, particularly over the last years. In the first instance, explicit reference was made to Umberto Veronesi, ex-Minister of Health and famous Milanese oncologist and man of science, who has frequently come out in favour of co-incinerators both in the press and on television. In the second instance, explicit reference is made to comedian Beppe Grillo, who is the author of the most widely read and influential Italian blog, where he often writes about and advocates opinions fiercely adverse to waste incineration and the official position taken by traditional science.

Coming back to trust in political institutions, not all of them are at the same emotive distance from citizens. In particular, it is not difficult to imagine that local governance actors (regions, provinces and municipalities) may be interested in having closer relationships with the 'receivers' of their policies, in order for citizens to develop a greater sense of trusting familiarity (Sciolla, 2004: 191)<sup>4</sup>. Greater proficiency and familiarity in the relationships with local institutions can lead to the perception that a significant influence can be exerted on local policies<sup>5</sup>. The reverse of the medal is the fact that local institutions may feel the effects of the socio-economic and cultural context in which they act and express themselves (*ibidem*), and the theme of large public projects represents an interesting subject for examination.

One can therefore presume that the attitude of a citizen towards a ‘megabuilding’ project might in some manner be influenced by his judgement of the local institutions presenting such project. Also this control variable was placed in the regression model, in order to avoid distorting the observation.

Moving on with the examination of the theoretical frame at the very heart of this work, a *leitmotif* in social research on risk can be found, that is, the role played by mass media in the gap between ‘perceived’ risk and so-called ‘real’ risk. Empirical studies have profusely demonstrated that public opinion bases its own risk evaluation not on statistical predictions, but on qualitative characteristics depending on the public images of the risk source, because, as Luhmann observes, ‘one behaves according to his/her expectations for the pertinent reference group, or – either in conformity with or in breach of prevailing opinion in terms of one’s socialization’ (Luhmann, 1991: 3). Moreover, in environmental risk situations, mass media narrations are characterized by the proclivity to over-emphasize news, creating levels of communication that increase in intensity, marked by sensationalism and alarmism (Sandman, 1994; Fischhoff, 1995). All the above-mentioned elements can be applied to general tendencies at a global level, mostly in advanced democratic countries. However, a brief examination of the waste emergency in Naples and its media coverage is required to fully understand why and how the mass media variable has been included in this study. In 2008, during the last electoral campaign, the photographs of Naples under tons of urban waste

hit the headlines all over the world. Few weeks before national elections, the present Prime Minister used intense television and press coverage to promise that, thanks to the opening of new landfills and the construction of the Acerra co-incinerator, the emergency would have been solved within six months<sup>6</sup>. With the exception of a few isolated cases, messages from traditional media (and in particular, television) contributed greatly to spreading the idea that co-incinerators could be the key for resolving the waste disposal problem, while neglecting to point out possible alternatives to this technology<sup>7</sup>. These points, however, were widely discussed on the Internet<sup>8</sup>. So, the use of television alone as an information source prevented many citizens from having an overall view of the issue, and their perspective could differ greatly from the one of citizens who relied on mixed media or largely used new media. To prevent such differences from influencing the subject of our analysis, it seemed appropriate to keep the possible effect of the forms of media exposition under control.

The last two variables in the model are scientific literacy and type of political culture in the decision-making processes to solve public significant and controversial issues (a bureaucratic-dirigistic model versus a consensual-participating model). As we shall see, these two aspects are apparently not connected, but they actually share some important elements. In fact, both subjects share the idea that, besides blaming the Italian political establishment at the local level, there are at least two other elements into what we could call the ‘vocabulary of

motives<sup>9</sup> for NIMBY protests: namely, the lay public deficiency in techno-scientific knowledge and the lack of civic culture in local communities. Practically, considering scientific literacy means verifying empirically what has already been known in the literature of sociology of science and sociology of scientific knowledge as 'knowledge deficit' model (Hilgartner, 1990): people are averse to and suspicious of many technical and scientific products and fields of research because of ignorance. Had they been adequately 'educated', they would have acknowledged the position of the experts as the proper one, abandoning their fear and hostility. A somewhat subtle implication of knowledge deficit is that techno-scientific products are often publicly presented as good and useful and are never critically discussed. Consequently, a scientific literacy index seems appropriate as an additional control variable in this model studying risk and its impact on co-incinerator attitude. In addition, a specific model was developed to evaluate the net effect of scientific literacy, because, although we are fully aware of the significant limits of such a paternalistic and technocratic paradigm<sup>10</sup>, there are still no works focused on the NIMBY – BANANA phenomena.

Finally, as explained by the civic deficit 'motive', local opposition is an expression of an egoistic and clannish reaction on the part of the people impacted by unwanted installations. For those backing this thesis, freeing up a similar *impasse* would be a dirigisme-type cultural approach to decisions, which provides for public force reaction whenever any opposition party insists

strongly enough to put the project at risk<sup>11</sup>. In the light of what explained before, it is therefore plausible to expect that anyone openly approving the dirigistic cultural approach is more likely to develop a positive attitudes towards megabuilding projects, in contrast to those asking for alternative resolutions of disputes. This may happen because dirigistic public-decision makers always present their projects as useful and able *per se* to assure the development of the country. In order to prevent the explanatory model described in the next pages from suffering these influences, also the above-mentioned has been held under control.

#### *Risk: Is It A One-dimensional Concept?*

In addition to relativizing the influence of risk in relation to attitudes towards specific hazards, the theoretical framework traced so far allows us to pick up the first problematic nodes, that is the presumed unidimensionality of the risk concept. Unlike psychological paradigms, risk concerns not only the micro-social level. Various authors, such as Beck (1986), Giddens (1990), Luhmann (1991) and Douglas (1992), have clarified in their works that risk is a variable impacting also contemporary society at the systemic level, so much as to change its internal structures when compared to the past. It is not about the exclusion of one view in favour of the other, whereas it has to be noted that both co-exist and can have a mutual influence. In other words, individuals are so exposed to sources of risk that directly question the individual dimension of their

preferences, such as smoking, eating fat foods, drinking alcohol, leading a sedentary lifestyle, practising extreme sports, keeping undesirable company and so forth. However, they also have to face hazards that individuals cannot control directly, since their exposure to risk depends in great deal on systemic and - usually - political decisions<sup>12</sup>.

This study differs from the others because here the definition of risk source is not considered as an immutable event, but as an ever-evolving one, mainly through political power and media strategies. In other words, a single risk might be transformed into a collective issue (as in the case of social prescriptions on practices dealing with health and sexuality), while a general problem (initially experienced as more being remote) might become an urgent issue for individuals as well.

Coherently, the possible empirical evidence of a link between the attitude towards the Turin co-incinerator and the individual dimension of risk should most likely proceed in the opposite direction when compared to the observed relation for the collective dimension. In other words, an increase of the individual risk brings about a higher probability of developing a positive attitude towards the co-incinerator. As stated before, this could be the consequence of the fact that in the public debate which followed the waste emergency in Naples, co-incineration has been credited as the sole solution by the same sources which largely contributed to dramatically set the waste theme as an individual risk (and therefore, a close-by issue), and not as a collectively generic (and therefore, more distant) problem.

## Research Questions

The main goal of this work is to analyse the association between risk and scientific literacy, on the one side, and the attitudes towards major-building projects, on the other side, through a study of the co-incineration plant presently under construction in Turin. To this end, three hypotheses have been put to the test, given the statements presented in the theoretical framework:

Hypothesis 1 (H1): Risk is a multidimensional concept dealing with exposure to both individual (e.g. stemming from personal choices and lifestyles) and collective hazards (e.g. mega-building projects). At least two dimensions of the concept should be found.

Hypothesis 2 (H2): All intervening variables being equal, the impact of risk on the attitude towards the co-incineration plant changes because of the dimension under consideration. Given the part linked to collective hazards, a negative association between perceived risk and favourable attitude towards the project should be observed. On the contrary, in the case of individual hazards, such a relation should become positive.

Hypothesis 3 (H3): Despite the assumption of the knowledge deficit model, scientific literacy has low or no influence on the attitude towards the plant, as demonstrated by previous works in other research fields.

## Data and Methods

From the methodological point of view, this is a single-case study (Yin, 2003:

39). The Turin case has been selected because it is a 'revelatory case', providing for a full investigation on a phenomenon previously 'inaccessible to scientific investigation' (Yin, 2003: 42). Such statement can be supported by two main elements.

First of all, waste disposal projects such as co-incinerators, mechanical biological treatment plants and landfills have triggered the highest number of environmental conflicts in Italy<sup>13</sup> over the last few years. As a consequence, waste is one of the most suitable fields of investigation of the NIMBY – BANANA phenomena, *revealing* as they are presently developing in Italy. Moreover, socio-political stakeholders in the Turin area offered full cooperation to the research: no other examples of such close partnership between researchers and socio-political institutions can be currently found in NIMBY controversies in Italy.

Secondly, the main local political institutions (e.g., the Province of Turin and the seven municipalities directly involved in the co-incineration project<sup>14</sup>) have decided to economically support the research program, from the beginning of 2007 to at least the first year following the plant switch-on at the end of 2013. This will allow the research team to analyse some aspects of the study in a longitudinal perspective<sup>15</sup>.

Despite the use of several techniques in the program, only second wave data from the survey are presented here. The survey was carried out in late 2008 and consisted of computer-assisted telephone interviews with a sample of 1006 respondents taken from the MonVISO Project panel<sup>16</sup>. MonVISO is a longitudinal survey

specifically providing quantitative data on the social impact of the Turin co-incinerator project; the panel is a statistically representative sample of the South-West Turin Metropolitan area population aged 18 or older<sup>17</sup>; the first wave took place in 2007 and one release per year is planned.

Among the three hypotheses listed above, H1 has been tested using factorial analysis on a list containing 18 hazards. All people interviewed were asked to express their perceived level of risk according to a commonly used Likert type scale.

As for the two other hypothesis, the estimation method used in both cases is an ordinary binomial logistic regression considering, for individuals  $I$ , the odds of having a favourable attitude towards the co-incineration plant of Turin as:

$$\mathbf{h} \left( \frac{p_i}{1 - p_i} \right) = \alpha + \sum_{k=1}^k \beta_k X_k$$

where  $p_i$  is the hazard of the event,  $\alpha$  is the constant of the model,  $X_{ik}$  is the value of the  $k$  variable for individual  $i$  and  $\beta_k$  is the unknown parameter. The dependent variable is a categorical variable with an assumed value of 1 for a positive attitude towards the plant, or 0 for a negative attitude.

Two separate models were calculated to test H2, one measuring the net effect of the individual dimension of risk perception (F1), the other measuring the collective dimension (F2). In both cases, the variables in the theoretical framework are considered as control variables in the models.

In brief:

$$(H2a) \ln\left(\frac{p_i}{1-p_i}\right) = f(F1 | F2, T1, T2, T3, MM, DM, SL, SD)$$

$$(H2a) \ln\left(\frac{p_i}{1-p_i}\right) = f(F2 | F1, T1, T2, T3, MM, DM, SL, SD)$$

where T1-3 are categorical variables measuring respectively: 1) trust in local political administrations (municipality and province); 2) official expertise (i.e. Italian scientist and oncologist Umberto Veronesi); and 3) non-mainstream expertise (namely, following Italian opinion leader and blogger Beppe Grillo). MM is a dummy variable with value of 1 in the instance of individual 'traditionalism' in mass media practice for techno-scientific issues. DM is a categorical variable having a value of 1 for interviewees showing a preference for a governmental-dirigistic culture in political decision-making processes

and a value of 0 for those having a governance-deliberative sensibility. Scientific literacy (SL) is an additive index, varying in a range between  $\pm 7$ , obtained from a small test, in line with the international studies on the topic<sup>18</sup> [see, for an Italian example, Observa 2008 - 2011]. Some socio-demographic properties (such as age, sex and education) are also taken into account.

Finally, H3 has been tested with one model, using SL as *explanans* and all the other features presented above as control variables:

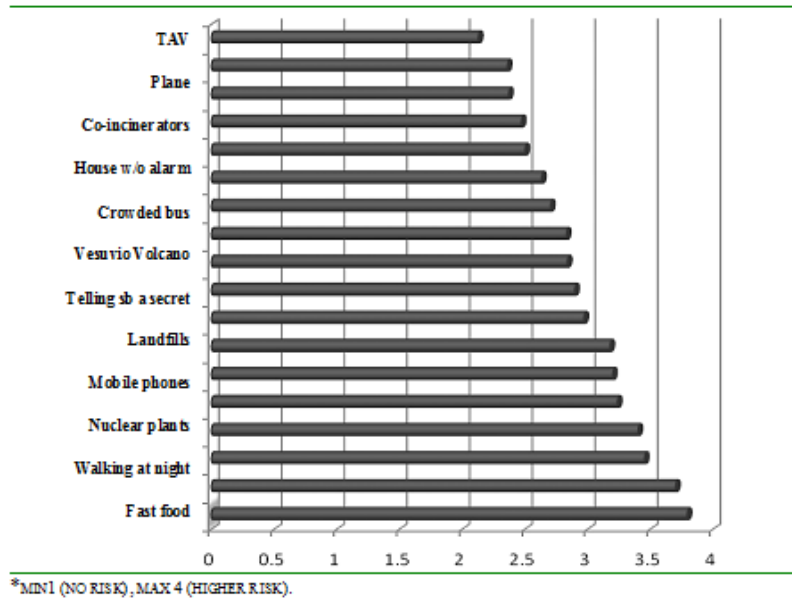
$$(H3) \ln\left(\frac{p_i}{1-p_i}\right) = f(F2 | F1, T1, T2, T3, MM, DM, SL, SD)$$

## Results

In line with risk studies, Figure 1 gives a battery of potential hazards ranked in increasing order on a scale from 0 (no perceived risk) to 4 (maximum perceived risk).

Factor analysis carried out on all the 18 items leads to a two-factor solution (Table 1). The first factor, called *individual risks* factor (F1), has a positive correlation to smoking, alcohol and sedentary lifestyle, and a

negative one to landfills, nuclear and co-incinerator plants, high-speed train and GMOs. Generally, this factor deals with lifestyles, personal preferences and individual exposure to (and control of) possible risk sources. The second factor (F2) is referred to as *collective risks* because of the positive correlation with all the hazards (industrial plants, high-speed trains et caetera) individuals cannot control directly since their risk exposure largely depends on systemic societal and political decisions.



**Figure 1.** Risk perception when facing a set of hazards (average evaluation\*)

Source: Author's data.

**Table 1** Factor analysis on the 18 risk items

Items	F1	F2
Alcohol	0.61214	0.08713
Car (travelling by)	0.67421	-0.47623
Co-incinerators	-0.27699	0.35097
Cigarettes	0.79527	0.30082
Crowded bus (travelling in a)	-0.00932	-0.45456
Deskbound life	0.25896	-0.02336
Fast food	-0.05392	-0.16819
GMOs	-0.19268	0.10445
House without alarm	0.12164	-0.31301
Landfills	-0.33621	0.22354
Mobile phones	-0.08798	-0.13069
Nuclear plants	-0.26499	0.48979
Plane (travelling by)	-0.13736	0.16237
Speculating on Stock Exchange	0.67327	-0.36789
TAV (Italian High-Speed Train)	-0.17581	0.44358
Telling somebody a secret	0.03093	-0.32442
Vesuvio Volcano	-0.17581	0.48979
Walking alone in the night	-0.04899	-0.34735
Variance Explained by each factor		
	Weighted	Unweighted
Individual Factor	3.52258	1.53661
Collective Factor	1.84120	1.29623

Source: Author's data.

Bivariate distribution (Table 2) seems to confirm the existence of a significant relationship between the attitude towards the co-incinerator and the two risk factors presented above<sup>19</sup>. Moreover, the examination of the relation between each factor and the

attitude shows that it is consistent with the assumptions made in the theoretical framework: a positive association between F1 and the attitude towards the project is observed, whereas such a relation becomes negative if using F2.

**Table 2.** Risk factors and attitude towards the co-incinerator cross tabulation (%), N=1006

F1 – Individual Risk Factor	Attitude	
	<i>Negative</i>	<i>Positive</i>
<i>Low</i>	45.7	54.3
<i>High</i>	21.2	78.8
Pearson's R = 0.166 ( $\alpha=0.000$ )		
F2 – Collective Risk Factor	Attitude	
	<i>Negative</i>	<i>Positive</i>
<i>Low</i>	14.8	85.2
<i>High</i>	26.5	73.5
Pearson's R = -0.122 ( $\alpha=0.000$ )		

Source: Author's data.

Of course, these results may be driven by many different elements and a compositional effect cannot be rejected at this point. For instance, assuming a technocratic perspective, one could assume that individual risk factor depends on hazards (e.g. sedentary lifestyles, bad eating behaviours, etc.), usually underestimated by less educated people who tends to show 'excessive, unmotivated or irrational' fear towards collective risk factors (Hansen, Holm, Frewer, Robinson and Sandøe, 2003: 111). Therefore, the outcomes shown in Table 2 can be explained through education in general, or scientific literacy in particular, rather than risk.

Hence, in order to shed more light on these relationships, multivariate

analysis techniques have to be applied. Table 3 shows the results for the association between the main independent variables and the favorable attitude towards the co-incinerator of Turin, as well as the effects of the control variables.

Model 1 and 2 clearly show that both dimensions of risk have a statistically significant effect on our dependent variable. Furthermore, as previously highlighted by the bivariate analysis, both associations go in reverse. Looking back to the theoretical framework of this study, it should be easier to understand why the two risk factors influence differently the attitude towards our object.

As stated above, the individual

**Table 3.** *Effects of risk (F1 and F2 model) and scientific literacy (SL model) on favourable attitude towards the co-incinerator of Turin and control variables*

	Individual risk factor (F1) model		Collective risk factor (F2) model		Scientific literacy (SL) model	
	$e^{\beta}$	SE	$e^{\beta}$	SE	$e^{\beta}$	SE
F1 (individual risk factor)	1.702***	0.117			1.803***	0.121
F2 (collective risk factor)			0.576***	0.143	0.548***	0.142
T1 (trust in local political administrations)	1.715*	0.193	1.861**	0.193	1.824*	0.197
T2 (trust in official expertise)	1.308*	0.092	1.349**	0.091	1.303++	0.093
T3 (trust in non-mainstream expertise)	0.695***	0.100	0.725**	0.101	0.737+	0.102
MM (traditionalism in mass media practice)	1.397*	0.133	1.457*	0.132	1.457+++	0.134
DM (government culture in decision making)	3.213***	0.161	3.151***	0.162	2.865***	0.164
SL (scientific literacy)	1.049	0.040	1.074	0.040	1.064	0.041
Age	1.006	0.036	1.000	0.036	0.996	0.037
Education	0.695	0.201	0.730	0.202	0.709	0.203
Sex (male)	1.686**	0.179	1.735*	0.179	1.643+++	0.182
Constant	2.207	0.892	2.305	0.881	2.884	0.902
N = 1006						

Note: +++  $p \leq 0.05$ ; ++  $p \leq 0.04$ ; +  $p \leq 0.03$ ; \*  $p \leq 0.02$ ; \*\*  $p \leq 0.01$ ; \*\*\*  $p \leq 0.001$ .

Source: Author's data.

dimension of risk concerns actions and practices that may not be perceived to be risky basically because they are the outcome of a voluntary choice, or because, even though they can recognize a risk, individuals believe to be fully in control of its exposure and to be able to decide if and when to stop. Actually, despite their dependence on individual will, social actors are not totally independent in the process of defining and redefining the preferences that lead them to the exposure to individual risks. Indeed, in the course of history, institutions of power have tried to control specific attitudes, actions, practices and objects by defining them as socially risky because of their being socially inappropriate<sup>20</sup>.

This takes us back to the theme of the trust in expertise, institutions and mass media, that is: the greater the trust in the source, the greater the possibility for these messages to be deemed credible. The first model in Table 3 shows that, all other relevant variables being held under control, a significant relationship between F1 and attitude towards the plant is still present, and it follows the opposite direction compared to what technocratic approaches used to indicate: with an increase in the individual risk component, a rise in the probability of developing a positive attitude towards hazards is observed. Summing up, empirical evidences are consistent with the hypothesis of evolution and change of risk source definition in time so that a single risk may be raised to a collective topic as well as a general issue (initially experienced as more remote) may also be transformed into an urgent concern for individuals. As explained before, that has happened in Italy with the waste issue, presented over the last years not only as a collective problem

but also as having a direct impact and a modifying power on the quality of life of Italian citizens.

Therefore, the positive association observed is the consequence of co-incineration being credited as the (sole) solution by the same sources which largely contributed to the establishment of the waste theme in the national public debate not just as a collective general problem, but as an individual risk and, therefore, a close-by issue, thus urging individuals to look for a solution.

Instead, collective risks normally make common citizens powerless. Such risks include terrorist attacks, nuclear power plant construction, wrong public politics, etc., impacting on society at the systemic level, and which are largely defined by local and/or national political institutions. Therefore, the impossibility of an independent decision and the absence of direct individual control immediately link the perception of collective risk to an expectation of trust in those charged to represent collective interests: the more positive the fiduciary expectation, the less evident the perception of this type of risk. The results of the analysis on the effect of this second dimension of risk on the attitude towards the Turin plant are reported in the second model of Table 3. Trust and other factors being equal, the relationship confirms what has been already observed by the psychometric approach, namely that elevated amounts of perceived risk result in preconditioning a more probable development of negative attitudes towards the hazard.

Finally, drawing our attention to model 3, no evidence of any significant effect of scientific literacy on attitude is found from the data in a multivariate design.

## Conclusion

After decades of research, social scientists have provided solid knowledge on the relationship between risk and a great variety of hazards. Despite the abundance of works on NIMBY/BANANA, researches focusing on the role of risk in these cases are few, while there is a lack of studies on the role of scientific literacy. Statistical models taking into account cultural and communicational dimensions (e.g. mass media exposure, trust, decision making strategies) as control variables are missing as well. In this paper, the attention gave to the co-incinerator of Turin, Italy, have brought some empirical evidence to the forefront. First, as hypothesized, factor analysis confirmed how reductive and misleading is to take risk as a monolithic, one-dimensional concept to explain people's attitude towards NIMBY or BANANA phenomena. Two dimensions for risk have been identified: 1) an 'individual risk' factor (briefly called F1), involving all the hazards depending on personal choices (lifestyles, alcohol drinking, smoking, etc.); and 2) a 'collective risk' factor, related to all the hazards that individuals cannot control directly, since the risk exposure largely depends on systemic societal and political decisions (industrial-infrastructure settlement projects, national-international politics, and so forth).

Secondly, binomial logistic regressions demonstrated that these two dimensions work in completely different ways: all other control variables being equal, F1 showed a solid positive association with a favourable attitude towards the co-incinerator of Turin, whereas F2 showed a clearly negative attitude.

Although this second link is definitely not surprising, given the psychometric studies on risk, the existence of a risk dimension increasing positive attitude towards a possible hazard represents a new element in the current debate on the topic.

Moreover, our analysis has also shown that the assumption of a lack of scientific knowledge origin for critical attitudes towards hazards is problematic for NIMBY cases as well as it has been already proved in other empirical fields. Indeed, no statistical evidence of a significant association between scientific literacy and attitude towards the co-incineration plant could have been found.

Summing up, the relevant number of statistically significant control variables in the three models may represent another validation of our starting assumption, that is, risk plays an important but not unique social role in people's attitude-building mechanism towards hazards. Though more studies are needed to confirm our findings, empirical evidence presented here may suggest to rethink risk analysis and its paths, giving up the evident limits that impact technocratic or paternalistic explanations. On the other hand, it would be more useful to fit present and commonly held concepts and categories of analysis to the relatively new NIMBY – BANANA cases and to examine more deeply other social variables such as trust, mass media use and political culture in decision-making strategies, because opposition to megabuilding projects is a highly sophisticated and still little known phenomenon in which Social Sciences have a great deal of field work to do.

## Notes

<sup>1</sup> <http://www.nimbyforum.it>.

<sup>2</sup> As represented by the equation  $R = p * M$ , where risk equals a hazard probability together with its magnitude.

<sup>3</sup> Hansen et al. (2003) contains a clear and systematic exposition of the principal contributions made in this direction by different disciplines all of which within the social research domain (such as psychometrics, social psychology and sociology of risk), although focused to the empirical field of food risk.

<sup>4</sup> What is here said is particularly true for the Italian urban and environmental conflicts cases, whereas in other European countries there are different types of local government and local governance, that may actually change the relationship between citizens and institutions, on the one hand, and the shape of the conflicts, on the other. Wide overviews of the situation in many European countries are offered by Rootes (2003) and Weidner (1998).

<sup>5</sup> Through a mechanism similar to trust in people *strictu sensu*, referring to the Luhman's distinction between 'trust' and 'confidence' (Luhmann, 1989).

<sup>6</sup> Video messages of Italy's Prime Minister containing these statements are still easy to find on the Internet.

<sup>7</sup> Many argumentations have been used to criticize incineration technology. Two among all have particularly drawn public opinion attention. One is that the medical community has not a unique position about incineration's long term epidemiological effects due to dioxins and nanopowders. The second, from an economical point of view, is that co-incinerators could not have a profit balance without using state aid (CIP 6),

thanks to a law (9/1991) that includes urban waste into renewable energy category.

<sup>8</sup> Internet sources are many and easily traceable. It is worth referring to the previously quoted Beppe Grillo's blog, the most popular in Italy and probably the one opposed to this type of installation for the longest period of time.

<sup>9</sup> See Wright Mills (1940).

<sup>10</sup> See, for example, Hilgartner (1990) and Hansen et al. (2003), and, for the Italian context, the works of Bucchi and Neresini (Bucchi and Neresini, 2002, 2004 ; Bucchi, 2006 ; Neresini, 2006).

<sup>11</sup> This is what has been actually happening for the High Speed Train (TAV) in the Val di Susa area, especially over the last six years. Something similar was observed in Naples and in some areas of Campania following the 2008 waste emergency, when the army intervened to allow the construction of the Acerra co-incinerator, as it is still doing today to guarantee truck access to the landfills located in areas defined as unsuitable by citizens (some of them being protected natural areas, as in Chiaiano).

<sup>12</sup> Although a full comparison would be improper, an echo of Luhman's distinction between *risk* and *danger* may be found here. In fact, the individual dimension appears to be a direct 'consequence of the decision' made by the social actor, so that 'we can speak of risk – more precisely of the risk of decision' (Luhmann, 1991: 21-22); on the contrary, from an individualistic point of view, the systemic dimension seems to lead to Luhmann's concept of danger, because the possible losses from events related to it could be 'considered as having an external

cause, that is to say, an environmental cause' (ivi: 22). However, danger in Luhmann's sociological theory of risk basically deals with what he calls 'the secrets of Nature' and the problem of the 'cosmological limits' for older civilizations [ivi: 13], whereas systemic events presented in this paper clearly depend on decisions, being their manifestations and consequences interpreted by individuals as such, or as the result of the 'mysterious forces of fate' [ivi: 8]. For this reason, it seems adequate to maintain the label 'risk' for the systemic dimension as well.

<sup>13</sup> <http://www.nimbyforum.it> .

<sup>14</sup> They are the city of Turin and six municipalities located in the South-West side of the Turin metropolitan area: Beinasco, Collegno, Grugliasco, Orbassano, Rivalta and Rivoli.

<sup>15</sup> A new wave on risk is scheduled at the beginning of 2012.

<sup>16</sup> The MonVISO Project (*Monitoraggio Valutativo Impatto Sociale Opera – Plant Social Impact Evaluative Monitoring*) is a joint research project among the Social Sciences Department of the University of Turin, the Trattamento Rifiuti Metropolitan s.p.a. (the company advisor for the co-incinerator) and the Province of Turin. It aims at monitoring the opinions around the waste-to-energy plant presently under construction in the Gerbido area of Turin. This paper uses data from release 2.0 (year 2008), strictly focused on risk topic. The first and main part of the questionnaire revolved around risk perception and social representation of 18 possible hazards (personal behaviours, lifestyle as well as industrial settlements, energy plants and the co-incinerator of Turin); the second part focused on all the intervening variables in the theoretical

framework, such as trust, mass media exposition, attitude towards different decision-making cultures and scientific literacy. The final part was dedicated to the interviewees' most relevant socio-demographic information. For further details on MonVISO project data set and its methodological aspects, see [www.trm.to.it](http://www.trm.to.it).

<sup>17</sup> The area encompasses the cities of Beinasco, Grugliasco, Orbassano, Rivalta, Rivoli and Turin, limited to districts 2 (Santa Rita-Mirafiori Nord) and 10 (Mirafiori Sud), for a total amount of 320,884 people out of a population of 1,704,000 units for the entire Turin Metropolitan area.

<sup>18</sup> Five items dealt with general scientific issues (electrons are smaller than atoms, the sun is a planet, antibiotics kill both viruses and bacteria, prime numbers are always even, the centre of the Earth is hot) and two specifically focused on co-incineration issues (combustion in a waste incinerator must constantly be fed with fuel, 250 grams of slag are produced for every kilogram of waste burned in a co-incinerator).

<sup>19</sup> Cross tabulation referred to scientific literacy and attitude towards the plant provided a non-statistically significant p-value ( $p < 0.377$ ) and therefore has been omitted.

<sup>20</sup> Two different approaches in risk study meet on this point: the socio-anthropologic of Mary Douglas (1970, 1992) and the one known as 'governmentality', developed by some British scholars moving from the work of French philosopher Michael Foucault (see, for example, Foucault, 1978). This research tradition is briefly presented and discussed, among all, by Lupton (1999).

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