

Article

Youth and Science in Italy: between enthusiasm and indifference

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The image and perception of science and of scientists is a crucial topic, above all with regards to younger generations, the human capital of the future. For this reason, the National Research Council (CNR), in 2004, asked the IRPPS institute (Istituto di ricerche sulla popolazione e le politiche sociali) to carry out a sample survey of 800 people between the ages of 18 and 29 on the topic. Science and new technology emerged as the topics of most interest, in addition to medicine, history and economics. Scientific content in the mass media is considered to be satisfactory, whereas education in the field of science is considered to be less than satisfactory, above all in relation to the work environment. However, if research in Italy seems weak in the eyes of young people, scientists are not seen the same way but are considered society's second most important profession after that of the entrepreneur. The problem of trust in science is due, above all, to the politics of research, which do not encourage adequate investment in public and private sectors. A factor analysis technique was applied in order to identify models of attitude towards science of various subgroups within the population.

Keywords: Perception of science, youth, factor analysis.

Context

The reduction of the involvement of youth in science as seen, for example, in the drop of enrollment in science faculties in nearly all industrially advanced countries, is widely documented.^{1, 2} The cause of this phenomenon has been based on a theory that there is a crisis in the relationship between science and society that can be traced back to the middle of the last century when some of the effects of science and its applications (those of war, in particular) created an image of science that is not always beneficial and less “close” to people.³ Nevertheless, this situation, decried by many, has not been the subject of an *ad hoc* analysis neither on a national level nor on an international one. The Eurobarometer survey on science and technology⁴ posed a question about the possible causes of the lack of interest on the part of European youth with regards to studies and careers in science, to which they responded in terms of “lack of appeal of science lessons”, “level of difficulty of studies”, “scarce interest on the part of young people with regards to the sciences” and “inadequate remuneration in the field of research”.

Yet there are also phenomena which paradoxically exist side by side: all efforts made at popularizing and communicating science, be they through the mass media or those that stem from scientific-academic environments, are welcomed by society with great attention and, where possible, through considerable participation.⁵

Objectives

An odd contradiction emerges: on the one hand, young people are extremely attracted by knowledge of scientific outcomes, on the other, they seem little inclined to take part in the process of the development of such knowledge themselves. In order to address this problem, the Youth and Science Project (*Progetto Giovani e Scienza*) set out to improve awareness of the main areas of the relationship between

science and society by carrying out a national sample survey of young people, between the ages of 18 and 25, who reside in various geographical locations both urban and rural:

- cultural (level of interest, image and perception of science and of scientists, knowledge);
- democratic and system of government (resources for science, trust in and values of science, communication of science);
- educational (scholastic experiences, self-evaluation, perception of the opportunities for study and work);
- institutional (perception of competitiveness, of the state and of the costs of the national scientific framework).

Awareness of such areas is, in our opinion, the basis for a policy of science geared towards the re-establishment of a bond of trust between science and society, the promotion of science culture, the identification of the crucial points of the relationship between education, science and society, the implementation of strategies to recuperate enrollment in faculties of science and the examination of a possible role of the research world in the communication of science to society.

Methodology

The survey was carried out in February 2004 on a proportionally stratified sample of 800 young Italians between 18 and 29 years of age, who were subdivided by geographic area, sex, and into two wide age groups (18-24 and 25-29 years). The questionnaire was introduced by using the C.A.T.I. (Computer Assisted Telephone Interview) method. The margin of error does not surpass 1.7%⁶ for the entire sample. The questionnaire is exploratory; the inevitable selection and insertion of topics and questions take into account the progress in studies in the field of public communication of science.^{7, 8, 9, 10, 11, 12, 13, 14, 15, 16}

Interest and information about science

Firstly, we set out to evaluate the interest of young people with regards to science subjects in general. The first questions, formulated in quite simple terms, introduce the idea by asking the level of interest in diverse topics (Table 1).

Table 1: Level of interest in general topics.¹⁷

	<i>Percentage of great and sufficient interest</i>	<i>Percentage of great interest</i>
Cinema	81	32
Music	81	53
New technology	76	32
Sports	72	37
Scientific discoveries	65	25
Voluntary work	57	17
Politics	28	8

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

Technology and science rank midway between recreational activities and more demanding activities such as politics and volunteer work, results that do not much differ from those obtained by the Eurobarometer¹⁸ in which the ranking was the same, although inferior to that of politics. Results with regards to new technology are quite interesting: higher for males (82%) and in the Northwest (80%) if compared to Central Italy (67%). As far as scientific discoveries are concerned, there are no notable differences among genders, however there are territorial differences between the Northwest, which

showed a 10% increased ratio of interest compared to the South. Both politics and voluntary work factor in as activities strongly determined by gender whereas residence, is a determining factor on a smaller scale: 43% of males showed great or sufficient interest in politics as opposed to 19% of females; 32% of interviewees in Central Italy as opposed to 25% in the South. On the contrary, 70% of females, particularly those interviewed in Central Italy, showed great or sufficient interest in voluntary work as opposed to 45% of males from the same area.

Family status influences the level of interest of young people; those with at least one parent who has earned a university degree expressed an above average level of interest in all topics presented, whereas the level of interest tended to decrease and even be more limited in relation to lower levels of education. Only volunteer work seems to follow a different, even opposite, logic as it is considered much less interesting by those who come from families in which one of two parents has earned a university degree or high school diploma, whereas those who come from families in which one of two parents has, at most, completed middle school or high school, showed greater interest.

The hierarchy of topics about which those interviewed would like to be most informed, highlight the fact that it is the pure sciences in the strict sense (astronomy and physics), that gather the least amount of interest (Table 2), an advantage to other topics deemed more interesting such as communication. Economics, in particular, obtained surprising results in comparison to a Eurobarometer survey carried out in 1997 among young Europeans:¹⁹ no more than 22% showed an interest in the subject, nearly half the percentage that our survey revealed. This is probably evidence of the attention given to those subjects that guarantee a certain level of employment otherwise difficult to obtain in other fields. Only with regards to differences between the sexes, is there a limited shift towards interest in medicine, mostly on the part of females (+19%), followed by that of history (+5%), while physics is chosen more by males (+9%).

Table 2: Interest in scientific subjects.

	<i>Percentage of favorable responses</i>
Means of communication	76,6
Medicine	66,6
History	51,4
Economics	45,6
Astronomy	38,6
Physics	29,6

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

The methods of fulfilling such interests were thoroughly analyzed by posing a question regarding ways of keeping oneself abreast and of obtaining information on topics considered of interest (Table 3).

Table 3: Methods used for information and updates on science topics.

	<i>Response percentages</i>
Television	63,3
Science magazines	27,5
Newspapers	22,5
None	20,6
Internet	10,5
Radio	8,1

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

Television, ranking first, is obviously the preferred medium for the majority of the population, but is immediately followed by science magazines, which account for nearly 30% of opinions, an excellent result considering the answers to previous questions demonstrated lower levels of interest in topics of

science. Close to 20% of those interviewed claimed neither to watch television or listen to radio programs, nor to look for information on science topics from any of these sources, and nearly 40% do not desire any other source. In any event, more than 5 in 10 people assert that the information provided by the media is quite clear, and a demand arises, if only a minor 43%, for more opportunities for discussion and debate on science topics.

Image and perception of scientists – science as a person

How do young people see science and scientists? The questions posed to those interviewed are written in an almost playful manner in order to obtain a double advantage: to reveal young people's perception of science and to induce a higher level of concentration during the following sections of the questionnaire, which certainly demand greater effort.

The figure of the scientist is described in a series of adjectives that make reference to current stereotypes about the scientist's personality and attributes (Table 4).

Table 4: A scientist is...

Curious	88,9	Boring	6,3	Neither	4,9
Wise	66,1	Careless	17,9	Neither	16,0
Altruistic	64,1	Egotistic	14,5	Neither	21,4
Extravagant	54,6	Ordinary	35,1	Neither	10,3
Unsociable	31,1	Sociable	50,6	Neither	18,1
Dangerous	15,8	Reliable	66,0	Neither	18,1

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

As can be seen, the figure of the scientist that emerges is very positive: a curious and altruistic person, quite sociable, often extravagant, but reliable and wise. Nevertheless, nearly one fifth of those interviewed consider the scientist neither altruistic nor egotistic (21,4%) and even less, neither dangerous nor reliable (18,1%). These percentages, of definite importance, have two possible explanations: the first is that those who responded this way consider the scientist a normal person (therefore, neither better nor worse than people who exercise any other kind of profession), the second involves a manifestation of uncertainty. With regards to the latter, we can refer back to the responses of females who, as will be seen further ahead and according to results of other similar surveys, have a more cautious attitude towards science and its applications, although this does not lessen its positive role.

Along the lines of this result, lie the motivations for choosing a profession in the field of science: it favors intellectual and social aspects. However, the idea of vocation, that a profession in the field of science comes from an innate inclination, also comes to mind (Table 5) and contributes not only to the idea of a circle of people that are chosen or at least have a natural talent, but also to an image of distance and sacredness, far from and indifferent to material aspects such as economic interest and personal prestige.

Table 5: The principal motivation of those in the field of science is...:

	<i>Response percentages</i>
Intellectual curiosity	37,9
The desire to help others	23,8
Natural inclination	22,8
Economic interest	8,0
Prestige	7,8

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

An additional confirmation of this prevailing, favorable representation is shown in the classification of the social importance of professions where scientists rank in second place (27%), but very close to the first: entrepreneurs (28%). Scientists are a figure of success and economic power (Table 6), even if our results fall much lower than the percentages obtained from the Eurobarometer²⁰ where businessmen/businesswomen and politicians rank last, far behind sportsmen/sportswomen, journalists and lawyers. Young Italians prefer, after entrepreneurs and scientists, the figure of the politician, while other professions follow with less than a 10% rating. Among these we also find artists, who represent a model of life for many young people, especially with regards to those in music and show business. Here, a significant difference among the sexes emerges: males clearly prefer the professions of entrepreneur, politician and sportsman, while females clearly prefer liberal professions such as lawyer, journalist, artist and, above all, scientist.

Table 6: Society's most important profession, by gender.

	F	M	Total
Entrepreneur	25,1	31,5	28,4
Scientist	27,7	25,9	26,8
Politician	12,2	18,7	15,5
Lawyer	12,4	6,2	9,3
Journalist	11,7	6,2	8,9
Artist	8,1	6,9	7,5
Sportsman/sportswoman	1,5	2,2	1,9
No response	1,3	2,5	1,9
Total	100	100	100

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

Personal inclinations towards choosing a career in the field of science are divided into two equal groups (50%). Of those (54% male and 44% female) who would like to work in a research center, 57% (61% of males and 51% of females) feel capable of doing so.

This means that nearly 25% of our sample “considers themselves inclined towards science”. This is a very high percentage not only with respect to the ratio of technical and scientific personnel to total number of employed people in Italy, but also with respect to the ratio of researchers to total number of employed people in any country of the world. This amount is probably also superior to the number of those who have had an education in the field of scientific research. Nevertheless, the distance between those who would like to work at a research center and those of feel capable of doing so, demonstrates an “auto selective” mechanism that cannot be explained solely in terms of lack of appeal of science, but also in terms of a lack of desire to make sacrifice. In fact, all those who consider such sacrifices necessary (88%), also believe that they are well worth it (89%), even if this does not indicate, by any means, that they have any intention of doing so. In other words, science, as we have seen, is considered a positive activity “in principle”, even if it does not personally interest those interviewed very much.

The unsuitability that seems to keep people from choosing a career in the field of science can be partly due to psychological aspects,²¹ some of which are tied to the image of science as an institution, and others to the educational history of the field, rather than a lack of willingness to commit oneself. Regarding this aspect (even if only partially explored by our survey), outcomes are interesting to note such as those who claim to have had positive experiences in a laboratory at school show a considerably higher desire to work in an institution of science (+15%) with respect to those who did not have such positive experiences. This accounts more for males than females, and more for those who attended high schools specializing in studies in science and technical institutes, rather than those who attended other kinds of schools.

Table 7: The relationship between having had positive experiences in a laboratory and attitudes towards a career in science.

	F	M	Total
Express desire to work in an institution of science			
interesting laboratory	51	63	58
uninteresting laboratory	39	47	43
Feel capable of carrying out similar work			
interesting laboratory	26	41	35
uninteresting laboratory	20	27	24

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

Science as an institution

The image of science as an institution was explored by means of a series of questions related to the perception of the “quality” and funding of scientific research in Italy compared to that on an international level. A rather unflattering image comes forth: if one third of interviewees have a positive view of Italy’s international role in science (just above 10% are uncertain), more than half of the young people interviewed believe that Italy neither offers a competitive edge nor is in the forefront (Table 8).

Table 8: The international role of scientific research in Italy.

	<i>Agree</i>	<i>Disagree</i>	<i>Neither</i>
Research in Italy is very competitive with respect to other developed countries	37,0	53,1	9,8
Italy is in the forefront with respect to more recent scientific discoveries	39,0	50,6	10,4

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

With regards to resources and funding, as shown in the following table, a wide majority of those interviewed believe that the State spends little on scientific research and a substantial majority believe that the private sector spends little as well (Table 9). These opinions are to be considered even more negative given that a wide majority of those interviewed believe that it is the State that should spend more (Table 10).

Table 9: The funding of scientific research.

	<i>Very much</i>	<i>Sufficiently</i>	<i>Little</i>
How much does the State spend on scientific research in Italy?	3,6	22,1	72,6
How much does the private sector spend on scientific research in Italy?	7,6	39,6	47,1

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

Table 10: What should be the primary source of funding for scientific research?

	<i>%</i>
The public sector	84,1
The private sector	15,3

*Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004*

The central idea of the economic resources needed for the proper functioning of research lies within the combination of the following two responses: the level of trust in research in Italy is clearly related to a perceived generosity or sufficiency in the allocation of public funds, while those who believe that we do not have a competitive edge, believe even more, that public funding is insufficient (Table 11).

Table 11: Italy's competitive edge on research with respect to other developed countries based on the opinion of the amount of State funding for scientific research.

How much does the State spend in Italy for scientific research?	Agree	Disagree	Neither
Very much	62,1	27,6	10,3
Sufficiently	49,2	41,2	9,6
Little	32,5	58,2	9,1
No response	15,4	46,2	38,5
Research in Italy has a competitive edge (average of responses)	37,0	53,1	9,8

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

In order to complete the idea that the young people interviewed have of science as an institution, it would be useful to consider two important elements related to the reality of the workplace: the educational path that “guarantees” the highest potential for work, and remuneration. Hence the idea that physics and the natural sciences offer the lowest work prospects, as opposed to engineering and technology, and the widespread perception that scientists earn little (Tables 12 and 13).

Table 12: In your opinion, which of the following paths of education offers a better chance for work?

	Response percentages
Humanities	14,1
Socio-economic sciences	21,0
Physics and natural sciences	7,9
Engineering and technology	55,0

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

Table 13: How much does a scientist earn?

	Response percentages
Very Much	13,4
Sufficiently	38,9
Little	43,1
No response	4,6

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

The collective opinions, although a bit stereotypical, find a greater connection between the study of science subjects and prospects for work (86% agree). Italian youth idealizes science; it sees it as elitist and far from reach, which contributes to a negative perception of careers in science.²² Nonetheless, a majority also asserts a substantial dissatisfaction with both general (58%) and specialized (51%) systems of education.

Science is seen by those people interviewed as unwelcoming and unattractive, even if it seems clear that they are little informed. It is quite probable that they are not aware that private funding is far less inferior to that of the State and that Italy, in certain areas of science, doesn't entirely lack a competitive edge at an international level. However, they are aware that work prospects for engineers are near to satisfaction²³ and that the socio-economic system in Italy clearly provides little attention to research. Aside from their perception of science and their own capacity to work in the field, the majority of youth sees that State Financial Acts continuously reduce funding for research, finds that very few Italian

companies work in technologically advanced sectors, sees many graduates in studies of science working in areas where their science skills are not required and watches young researchers go to work abroad after one year of temporary employment. To ask ourselves why enrollment in faculties of science in Italy has dropped, would be a rhetorical question. After all, rather than a drop in “vocation”, there seems to be a drop in the perception of actual work prospects.

Trust and values of science

In order to put into context the formation of attitudes toward science, it was deemed necessary to include the concepts of trust and values through two elements: the ethics of the role of science in society and the relationship between scientists and monitoring by society.

Table 14: Do you think that the development of awareness of science...

...	Response percentages
is nevertheless beneficial to humanity?	46,9
is favorable only if monitored by society?	45,4
is in any event dangerous because it tampers with nature?	6,9

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

The concept of methods of promoting awareness of science and that of the scientist’s “freedom” to search for results, although general on the whole, promotes a positive and trustful attitude toward scientists’ work. However, this large consensus (nearly 90% of the sample), is divided into two nearly equal parts: sheer optimists, and those bound by the possibility of monitoring the development of society’s knowledge of science. Only a scarce minority declare themselves wholly pessimistic in this regard.

More specifically, there is an awareness of the risks run by science and technology and a need for a monitoring code, of a general standard of “ethics” with regards to the development of knowledge and science applications that is indicated in other contexts as well.²⁴ At the same time however, a firm belief that science cannot be imposed upon and/or cannot be completely controlled seems to prevail.

Table 15: Trust in and values of science.

	Agree	Disagree	Neither
Every scientific discovery should be monitored for risks	66,3	24,6	8,9
Authorities should require scientists to adhere to standards of ethics	72,9	20,0	7,0
Excessive references to risk can become too constraining for scientific research	57,9	27,6	14,5

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

At first, it may seem surprising to find a high level of positive responses to all three concepts. By taking a closer look, we can see that they do not contrast with one another, but rather implicate the difficulty, risks and matters of ethics that researchers may face.

However, there are diverse nuances within the responses. The first two are quite similar: less than one fourth of the sample disagrees with the idea of external intervention by authorities in order to monitor for possible risks related to scientific discoveries or to require scientists to adhere to standards of ethics. Only very few are undecided. The third set of responses reveals a higher level of neutrality: nearly 15% are undecided about the possibility of damage to scientific research as a result of excessive references to risk.

This leads us back to the question of information and communication. What instruments does society need in order to formulate opinions on such delicate and crucial matters?

Table 16: Information provided by the media should be more clear and thorough about...

	<i>Response percentages</i>
advantages for society	44,9
risks and costs for society	30,0
applications of science	24,4

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

It is not by chance, as regards the quality of information provided by the media, that one can note a certain dissatisfaction with reporting on the effects of scientific research on society both in terms of its advantages and risks. Reporting on themes related to applications of science seems better. The perception of the role of science remains positive if one considers that almost 45% of the interviewees would like more and better reporting on the advantages for society offered by scientific progress, whereas 30% single out the question of risks and costs as if admitting to a certain amount of trust in scientific work. There seems to be the wish for a more articulated science where applications are not an end unto themselves.

Regarding the responsibility to appropriately communicate scientific activity, two opposite models were proposed (Table 17).

Table 17: Communication of science.

	<i>Agree with A</i>	<i>Agree with B</i>	<i>Agree with Both</i>
A. In order to proceed with their objectives, scientists must also communicate outcomes to society.	86,3	7,6	6,0
B. Scientific research must continue; scientists are not responsible for communicating outcomes to society.			

Source: IRPPS-CNR survey - *Giovani e Scienza*, 2004

The percentage in favour of the first is overwhelming. According to the sample, it is the very scientists that should be responsible for communicating the results of their research to society without delegating the delicate matter to others. It is probable that fear of leaving such communication in the hands of incompetent figures who could generate confusion, lack of understanding and could even prove to be an obstacle to scientific progress, does not play a role. More than a lack of trust in journalists (much of the information obtained from the mass media is considered clear, as we have already seen), there is desire for a direct channel of communication between science and society, one that establishes a greater sensibility from the former towards the latter, not just the conveyance of scientific fact, but the sharing of theories, knowledge and approaches. Previously, we were able to ascertain that the figure of a scientist is considered a positive one, almost sacred, distant from our own spheres of interest, conveying to us a sense of inadequacy for various reasons, which can even keep youth from scientific careers. The request for communication with scientists plays a key role in spiraling youth closer to science and, above all, science closer to youth. It is the duty of scientists to come out from the narrow circle of experts and open up to dialogue with society. They will be able to accomplish this task as soon as its multiple, conflicting and contradictory sides come into view.

Factor analysis

In order to acquire a holistic perspective on the possible correlations between the diverse opinions on the topics posed in the questionnaire, we applied the technique of Multiple Correspondence Analysis

(MCA), which allows for the interpretation of complex phenomena by the simultaneous study of various variables,^{25, 26, 27} a particularly appropriate method when dealing with question-based surveys where differentiated information is found. The results are aligned and integrated with the descriptive analysis of data calculated over the frequency of responses to single questions. The next step was to select some of the variables in order to highlight areas of latency, otherwise difficult to observe from an analytical angle, but useful in demonstrating models of attitude of diverse subgroups within the population. Additional, structural variables were introduced during the application, and although they did not play an active role in the analysis, they illustrated the familial, social and scholastic circumstances of those interviewed: interest in science, sources of information on science, the image and perception of science and of scientists, trust in institutions of science and their values along with resources.

The first two axes obtained from the application of the MCA method appear on the graph and allow for the identification of the factors primarily responsible for the differences in opinions and attitudes of those interviewed. The two axes intersect and divide the graph into four quadrants that represent the relationship among variables, four macro-groupings that gather the prevalent orientations of those interviewed and illustrate their characteristics through structural variables. Above all, we look to identify, through the interpretation of factors, the meaning of latent topics that arise.

The first factor deals with interest in science. As previously seen, various national and international surveys have been carried out on whole populations, or sections thereof, concerning general interest or specific interests in topics such as biotechnology. Some of the results, such as an average interest in science and technology and a predominant importance attributed to knowledge in the field of medicine, have been confirmed in our own survey.

The questionnaire was created in order to distinguish various interests in science. The first two are those obtained from previous surveys: interest in science with respect to other cultural and social elements, and level of interest in various topics of science. Means of satisfying or stimulating interest were added to these: firstly, scholastic experience in terms of teachers, books and laboratories; second, informal means of communication such as the mass media, interpersonal relationships and family; then, interest in working in an institution of science and one's own perceived capacity to do so; lastly, motivations for working in the field of science.

The first axis denotes a consistent decline in interest in science, which encompasses the majority of aspects taken into account. The negative side is found to the left of the graph and indicates a scholastic interest in science, which according to those with a high profile of interest, was later reinforced more by publications and internet than by television, which nevertheless represents the principal means of acquiring science information. Opposite, is the positive side, which indicates a general lack of interest in science and research; gender and geographic location are not determining variables. The main catalyst is derived from level culture in the form of formal education; those with advanced university degrees or those who attended a university expressed more interest than those who didn't.

The second factor represents the image of science; a distinction between the person of science and the institution of science is revealed. The former mainly involves the question of the figure of the scientist, whereas the latter involves the capacity for innovation and a competitive edge in research, trust in the science system and the handling of risk factors. Along this axis, various attitudes and aptitudes of youth are found as well. The lack of interest in the proposed science topics is interesting to note, be it with regards to the image of the scientist or that of science as an institution. Such indifference is evident in the neutral stances. The axis progressively reads in the direction of a profile of those who see science in a positive light. The apparent contradiction that leads some young people to believe both that research in Italy doesn't have a competitive edge at an international level and that scientists are careless and unsociable, can be understood by distinguishing the two types of science: the institution of science that does not necessarily reflect a positive image of the scientist, and vice-versa.

A brief description of the characteristics found in the four quadrants created by the two axes on the factor analysis map.

Quadrant I. The future scientists, *science enthusiasts*. The first quadrant represents positive attitudes towards science whether they were brought about by personal interest in a career in science, a favorable perception of Italian research at an international level

or beneficial experiences at school. Here we find a good representation of those that actively seek information on science in the media, on the internet and, even if on a lesser scale, on television as well. They express desire to work in a research institute and believe that becoming a scientist is worth the sacrifice. They are also critical and sensitive with regards to the interaction between science and society as they believe that authorities should impose standards of ethics in research. Moreover, they found science texts easy to understand and have fond memories of science teachers. Their interest in science comes from an excellent education (university degree, engineering and medical students) or from scholastic experiences that produced a positive outlook on science. All in all, they are a group who has already chosen to pursue a career in science.

Quadrant II. *The skeptics.* This group is characterized by a detached attitude towards science even if they took an active role in the survey. They do not read cultural texts and have little interest in scientific discoveries, politics and voluntary work. Their view of science is contradictory: on the one hand, they believe that research in Italy has a competitive edge at an international level, on the other, they believe scientists to be careless and unsociable. Their view of science is stereotypical, one that comes from outside, thus not well founded and not very accurate. Such an attitude, both contradictory and uncritical, comes from a lack of access to the tools needed for the development of critical thinking skills, and is probably a result of the average-low level of education that distinguishes this group.

Quadrant III. *The indifferent ones.* In this area of the graph we find those with a total lack of interest in science. It represents people that are completely unmotivated and that do not take a stance on any of the areas of the survey: from trust in and values of science, to the role of science in Italy at an international level. They do not acquire information on science from any source and have no opinion on the image of the scientist. Their memories of science in secondary school (science texts were difficult to understand) are not pleasurable and would not like to work in a scientific environment. They are a group of people with an average-low level of education and do not want to continue to study.

Quadrant IV. *The intellectuals.* This group is characterized by a positive attitude towards general culture, including science, but not exclusively. Their interest in science is has little to due with the image of the scientist or the institution of science. They are people who pay close attention to scientific discoveries, new technology, cinema and politics and they crave more information on history, medicine, economics, physics, astronomy and sources of information. They could also work in an institution of science and are cultured people with a remarkable sense of self that keeps them from succumbing to stereotypes about science and scientists.

Conclusions

The essence of the results obtained from the survey is that the younger generations' view of science is based on a personal interest in the science disciplines that stems from personality traits and personal experiences, the representation of science based on the figure of the scientist and his/her role in society, the role of science in Italy and its role at an international level. The main catalyst is derived from level culture in the form of formal education in terms of an advanced university degree or having attended a university.

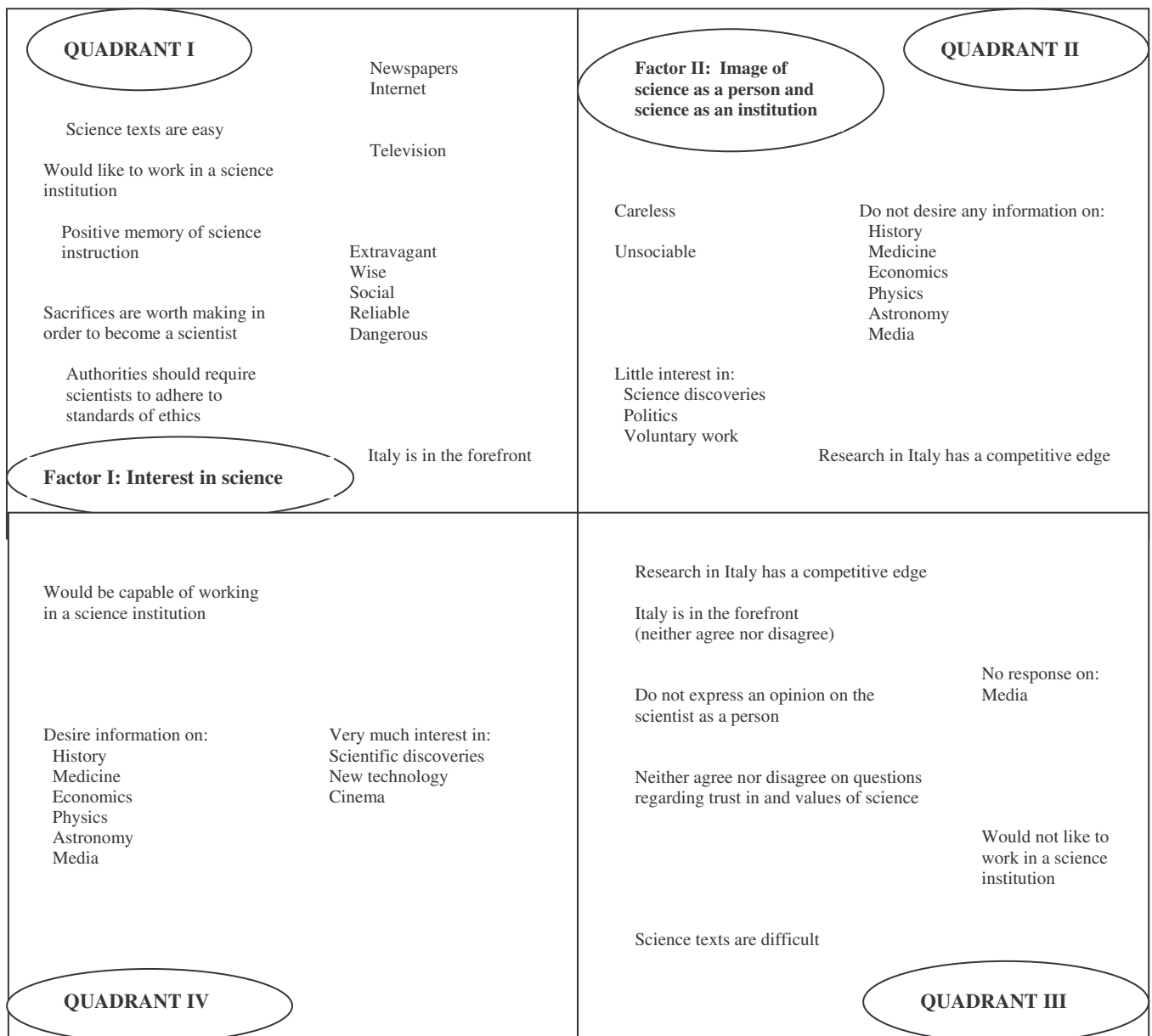
Previously proposed hypotheses²⁸ are confirmed, according to which information reported by the media, even if precise is understood principally only by certain particularly receptive groups within the population. A low level of education is generally related to little sensitivity to science topics. Often, the

little information obtained lacks depth and is subject to a variety of stereotypes. The situation is quite different for those who have the advantage of a high level of culture without using the media as a main reference point; they refer to additional sources, and manage and acquire information autonomously and with a critical eye.

Furthermore, the structure of the data suggests an absence of strong, opposing views; few matters create conflicting stances. The points of view do not reveal social groups, genders or scholastic curricula that are tied to specifics, but rather transcend differences of opinion and facilitate a uniform debate. This is due, in part, to the formulation of the questionnaire and to the heuristic structure of the survey, which, as previously mentioned, satisfies the need for an all-encompassing, “generalized” exploration of younger generations’ attitudes towards science.

This does not mean that the results are of little interest, but on the contrary, this survey once again reveals the marginal role that science and its difficulties play in debate and in society’s perception.

Figure 1: Factor analysis map (Factors 1 and 2).



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