



VIROPLANT

D6.2 – REPORT ON INTERGENERATIONAL SURVEYS ABOUT VIRUS-BASED PPP
ACCEPTANCE

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1. SUMMARY

In this report we present the preliminary analysis elaborated on the base of two surveys, one administered during winter 2018-2019, and the other during spring 2021. We used two different questionnaires, with different structures and modes of interaction with the respondents, because the outbreak of Covid-19 pandemic forced us to rethink the survey instrument in order to avoid the possibility that the coronavirus issue could eventually invalidate the data obtained. Results are presented in three analytical categories (knowledge, information, perception), all contributing to the definition of the process of social acceptability of innovation and the connected perceived risk. Some insights on gender difference and generational gap on these lines of inquiry is also discussed.

2. APPROACH

The literature review discussed in Deliverable 6.1. (Carradore *et al.*, 2019) revealed a lack of data regarding public perception of virus-based biotechnology and more generally of Plant Protection Products (PPPs). A dual focus on acceptance emerged. On the one hand, in fact, especially in the field of medicine (gene therapy and phage therapy), a virus-based product is proposed as both an innovative solution and an 'extreme weapon' (to be only used as *extrema ratio*) to patients, in order to make acceptance more cogent. This, however, is possible because of the general trust in the figure of the physician. Therefore, trust is not placed on the efficacy of the biotechnological device, but on the competence and prestige of the physician. Moving from medicine to agriculture, we find cases in which, for socio-cultural reasons, institutions bypass citizenship for fear that top-down phytosanitary interventions may be opposed from below. This strategy can be explained by a specific configuration of the 'knowledge gap' in functionally differentiated societies, which allows the expert not to communicate in an active and participatory way with citizens (Pellizzoni, 2011; Frickel *et al.*, 2010; Hess, 2016). Social trust in experts is essentially based on the *accountability* side (i.e., on the disposition to explain what has been or is going to be technically done, based on what scientific criteria, with what purpose in terms of policy) rather than on the *responsibility* side (i.e., on the deontological disposition to take on the burdens for decisions made and consequences towards a citizenry of which it is a part and of which it is the custodian of a social mandate). For this reason, the sociological approach adopted in this quantitative part of the research is twofold: to shift the focus from the purely cognitive to the perceptual-decisional

dimension; and to unpack acceptability as different reactions towards the unexpected (e.g., Cerroni 2003).

3. METODOLOGY

During the first two years of Viroplant project, as part of the dissemination activities, a questionnaire (see Annex 1) was constructed to assess knowledge about viruses and bacteria in the public, taking into account high school students and adults (farmers and stakeholders). The administration of the survey was done in paper form by the staff of CNR-IPSP during meetings with schools and producers. This questionnaire was administered to the same audience ex-ante and ex-post a presentation of virus-based biotechnological innovation in plant protection. The implicitly evaluative setting did not allow us to treat the data that emerged with a strong sociological reliable value. However, some evidence represented the starting point for the development of the Citizen Science pilot experience which consisted in training and active engagement of high school students as interviewers. After this second experience it was possible to develop a second questionnaire, new in terms of both mode of administration (via Google form) and structure, focused no longer on knowledge but on the relationship between risk perception and acceptability of virus-based biotechnological innovation.

Following the evidence gathered during the previous phases of the research conducted by UNIMIB team and, above all, due to the outbreak of the coronavirus pandemic, the second questionnaire (see Annex 3) was administered to high school students and their parents in order to gain some insight of the intergenerational dialogue about biotechnological innovations. It is difficult to assess the extent of the social impact caused by the pandemic not only at the level of behavior but, also, at the level of personal and collective risk perception (Freedman *et al.*, 2020; Panzeri *et al.*, 2021; Schnepf and Christmann, 2021; Semino, 2021). For this reason, in this second round of surveys, similarly to what happened with Delphi and Focus Group (see D.6.3), we tried to avoid that the Covid19 pandemic became the center of the discussion. In particular, we operated a sort of triangulation of the areas of relevance of virus based (VB)-PPPs: a) Food safety, b) Environment and c) Agriculture. This approach allows an elaboration of the main theme (VB-PPPs' social acceptance) while reducing moral interference (value judgments) between researcher and respondent. On the other hand, from a constructivist point of view (Foerster, 1984), this approach is already conditioning to the extent that comparisons between the three mentioned angles are implicitly or explicitly suggested. In any case, here the questionnaire instrument played a role of first measurement of what emerged in the previous parts of the research, and the sampling is not

representative: therefore, all data collected even with this second questionnaire should be treated as first indications for a further phase of quantitative data collection.

3.1. FIRST QUESTIONNAIRE

The first version of the questionnaire consisted of 23 close questions and 1 open question, and it was organized around the following 4 blocks (Annex 1).

- 1) General knowledges concerning viruses and bacteria.
- 2) Acceptance of virus-based biotechnological innovations.
- 3) Knowledges concerning biotechnological innovations.
- 4) Risk perception related to virus-based biotechnological innovation.

Since the questions were asked in a rigid and direct manner, the sociological usefulness of the data collected is rather small. However, from the initial evidence that emerged, it was possible to partially rethink the structure of the questionnaire. To this end, it was decided to include the point of view of the respondents through a Citizen Science pilot project.

3.2. CITIZEN SCIENCE PILOT PROJECT

During the winter 2019, within the project of Alternating School-Work coordinated by CNR-IPSP, a pilot project of Citizen Science has been realized with the participation of high school students in the realization and administration of a questionnaire in the form of structured interview. The project involved students of the IV year of a scientific high school of Turin (Italy) for the part concerning the collection, processing and reporting of data collected. The data are related to the perception of ordinary people (intended as non-scientists in general) on the use of alternative methodologies for the management of agronomic problems related to biotic stress, with the use of microorganisms (especially viruses) as agents of biocontrol or any derived biotechnology products. The sample consisted of 2 classes V of the scientific high school and 2 classes V of the classical high school and their parents. The pilot project had the following phases:

1. Training for students on bio-risk and on socio-psychological research on risk perception. In this phase, students learned the rudiments of the quantitative research method, the cognitive meanings of the data that can be collected, and how to conduct the structured interview.
2. Workshop on re-designing the questionnaire (Annex 2). The researchers, together with the students, reasoned around the limitations of the first questionnaire and came up with a version that took into account the language and compilation difficulties of non-expert respondents. The result

was a questionnaire of 17 questions, which left more room for the theme of risk perception and attitudes towards biotechnological innovation in agriculture.

3. Data collection: the students involved in the pilot projects interviewed 1 class V of the scientific high school and 1 class V of the classical high school. These students were asked to propose the questionnaire to their parents. The questionnaire had to be administered by the students themselves, and not filled out directly by their parents.

4. Data elaboration. With the help of the math teacher, students have organized some statistical analysis. At this stage, students encountered some organizational difficulties. However, this was a valuable opportunity in terms of resilience, as facing of a lack of specific statistical training and a lack of computer skills, students shared the personal knowledge they possessed and filled in the gaps by calling on teachers in the school.

5. Public presentation. In an unusual setting in which roles were reversed, students presented the results of their analysis in front of CNR-IPSP scientists. The communication of the results was a moment of confrontation in which the students as young transdisciplinary researchers showed what was learned during the different phases of the Citizen Science project.

The work of data collection and evaluation of results was carried out under the supervision of researchers from IPSP CNR and researchers from the UNIMIB team.

SAMPLING

The sample has a quite equal gender distribution for the group of high school students (49.4% female and 50.6% male) although with differences related to the type of high school. Looking at all other categories taken together, i.e. the group of youth and adults, the gender distribution is unbalanced: 36.4% female and 63.6% (See Tab. 3.2.1.)

	Female	Male
Technical and Professional school Students (N=26)	40.7%	59.3%
Scientific high school Students (N=118)	44.1%	55.9%
Classical high school Students (N=42)	59.5%	40.5%
University Students (N=43)	37.2%	62.8%
Teachers and Professors (N=11)	72.7%	27.3%

Farmers (N=7)	-	100%
Entrepreneurs (N=5)	40%	60%
Technicians (N=6)	12.5%	87.5%
Retired (N=5)	60%	40%
Employees (N=4)	25%	75%
School Staff (N=4)	50%	50%
Other (N=3)	-	100%

Tab. 3.2.1 Gender distribution among the subgroup of the sample

3.3. SECOND QUESTIONNAIRE

In the third year of VIROPLANT, we have applied the preliminary results of Delphi and Focus Groups in designing a new survey on intergenerational perception of VB-PPPs. The target of this part of the research were students in high-schools and their parents. The pandemic impacted this part of the research both thematically and logistically. For the first aspect, it was decided not to ask questions about the coronavirus and Covid-19, but to possibly let comments emerge spontaneously in the open-ended questions of the questionnaire. Social distancing and distance learning made data collection complicated. Principal goals of this quantitative task are to control the gender variable and the transmission of values, drivers, and resistances about biotechnological innovation. Indeed, the school system is a socializing place of acquisition of competences, skills, and values. Nevertheless, school is also a place for social differentiation, where conflict and negotiation of the traditional and stereotypical thinking can emerge. Differently to our initial aim, to evaluate how the imaginary about virus works, the survey has been designed to gain the interrelation of three analytical levels implied around VB-PPPs, which emerged significantly in Delphi and Focus Groups: food safety, environmental and agriculture. For logistical reasons, data collection was done through the Google Form platform, sharing a link with teachers engaged by CNR-IPSP team as gatekeepers. The questionnaire was anonymous, all data have been collected without any tracking.

SAMPLING

In the design phase, we decided to focus attention on the last two classes of high school (both from technical and professional schools, and scientific and classical high school) and to involve students aged 18 and older for two reasons: a) fourth and fifth grade students have science subjects

in their curricula that allow them to understand some technical aspects of the questions in the questionnaire; b) since they are citizens of age, we wanted to explore the degree of participation in public life through some questions in which they were asked to express a decision or to hypothesize a social behavior. In order to assess the intergenerational dimension, we asked the students to share the questionnaire's link with one of their parents or legal guardians. We deliberately left free the choice between the father and the mother, since this choice is a significant information to assess the direction and degree of intergenerational communication. In other words, the degree of transmission of the questionnaire between students and parents/legal guardians gives a measure, however spurious, of the degree of transmission of knowledge and activation in participation in a public undertaking such as scientific research. With respect to the purely exploratory purposes of the survey in question, it has allowed us to grasp a datum that is interesting in its own way.

	<i>Technical and Professional school (N=97)</i>	<i>Scientific and Classical high school (N=52)</i>	<i>Secondary school (N=6)</i>	<i>High school diploma (N=13)</i>	<i>Bachelor's and Master's degree (N=8)</i>
<i>Students (N=149)</i>	29.9% female 70.1% male	67.3% female 32.7% male			
<i>Parents/Legal guardians (N=27)</i>			33.3% female 66.7% male	69.2% female 30.8% male	100% female 0% male

Tab. 3.3.3.1 Students' school and Parents/Legal guardians' education level

The total number of respondents is 176: 84.7% students and 15.3% parents. This means that only 18.12% of students were able to actively involve their parents in filling out the questionnaire. This disproportion may be due to a complex of factors inherent intra-family dynamics: however, it suggests considerations on the knowledge gap that may thus arise. Since the questionnaires were anonymous, it is not possible to know which subgroup of students did not involve the parents. The gender distribution is 70.4% female and 29.6% male for parents/legal guardians and 47.2% female and 52.8% male for the students. Although we cannot consider these numbers significant, it is interesting to note that mothers are involved more than twice compared to fathers. The

geographical-residential context is distributed as follow: 29% provincial town, 26% city 25% countryside; 18% suburbs; 1,1% mountain (see Tab.2).

Residence context			Subjects		Totale
			Parent/Legal guardian	Student	
Countryside	counts		3	41	44
	% in Residence context		6,8%	93,2%	100,0%
City	counts		9	37	46
	% in Residence context		19,6%	80,4%	100,0%
Mountain	counts		1	1	2
	% in Residence context		50,0%	50,0%	100,0%
Provincial town	counts		9	42	51
	% in Residence context		17,6%	82,4%	100,0%
Suburbs	counts		5	28	33
	% in Residence context		15,2%	84,8%	100,0%
Total	counts		27	149	176
	% in Residence context		15,3%	84,7%	100,0%

Tab. 3.3.3.2 Contingency chart: Residence context - Respondents (N=176)

Regarding to the residential context and the relationship between the two categories of subjects, it is possible to observe that the intergenerational transmission of the questionnaire is easier in urbanized contexts (city, suburbs, and provincial town) than in rural contexts in which, out of 41 students, only 3 had their parent/legal guardian complete the questionnaire. Data collected do not allow to draw a statistically robust profile; however, it is possible to hypothesize that intra-household dialogue on food health, environment, and agriculture issues is relatively easier in contexts that are more central to the circulation of knowledge and innovation, although these issues may be more sensitive and understood in the rural context.

QUESTIONNAIRE

The questionnaire is structured into four section and three macro areas (food safety, environmental, agriculture) of inquiry with some questions that cut across the different areas (see Annex 3).

The first section is biographical (Q1-Q8) in which the status of the respondent (student or parent/legal guardian), type of school (for students) and educational qualification and profession (for parents/legal guardians), gender and context of residence were asked.

Food safety is the main topic of the second section of the questionnaire (Q9-Q19) and includes questions about the degree of subjective relevance in the absence of specific elements in a food

recipe (Q9-Q15), availability of food safety information (Q15), and personal consumption of information and sources used (Q16-Q17). Finally, one question addresses the case of palm oil and reactions following the case that struck a chord with the public a few years ago (Q18-Q19).

The environment is the topic investigated in the third area (Q20-Q25). Here the first three questions about virus-based products for plant protection are asked, without specifying the agricultural area (Q20-Q22), in the form of a referendum promoted by a committee of scientists. They are asked to express a position and to indicate a prediction about the outcome of the fictitious referendum, giving reasons for the outcome. Subsequent questions address the availability of information on environmental issues, consumption, and sources of information used (Q23-Q25).

The fourth section includes seven questions about the perceived risk to human and environmental health of as many objects or processes (Q26-Q32). We then asked a question about trust in science to improve quality of life (Q33) before introducing the fifth section on agriculture. In five questions we asked to express the degree of concern and therefore perception of risk regarding the introduction of an object-process near one's home (Q34-Q38). The last questions of the questionnaire deal again with the perception of risk of GMO ingredients for food safety (Q39-Q40). The last two questions deal with a second fictitious referendum, similar to the previous one, about the introduction of a therapy for the treatment of diseases in humans (Q41-Q42). In closing, we asked a follow-up question about the respondents' daily life context (Q43) and a final open-ended research feedback question.

4. FINDINGS

4.1. KNOWLEDGE

Microbiology is a highly specialized knowledge, not equally distributed in the population. Through the first questionnaire, we were able to detect a knowledge gap regarding the dangerous nature of viruses and bacteria. Regarding bacteria, 92.8% of high school students stated that they can sometimes be useful. This is the highest percentage when compared to other age cohorts: 21-34 years 89.8%; 35-87 years 84.4%. From the point of view of gender difference, there are values between 93.9% (16-20 years) and 100% (21-34 and 35-87 years) for female respondents; for male respondents, the values on this question decrease as age increases: 91.7% for the 16-20 years, 83.9% for the 21-34 years and, finally, 75.9% for the 35-87 years cohort. In the latter case, a 10.3% "I do not

know" response is significant: from the point of view adopted in our research, it can be interpreted as an *admission* of lack of knowledge.

However, a different scenario emerges from the question referring to the nature of viruses. The 16-20 and 35-87 year old cohorts are split between "always harmful" (49.4% and 46.7%) and "sometimes useful" (44% and 40%). There are minimal variations (less than 3 percentage points) related to gender in the answers "always harmful". Differently, in "sometimes useful" there is a significant variation in the 35-87 year old cohort: females 56.3% and males 31%. As in the case of bacteria, a 13.8% "don't know" is found. Regarding the central cohort (21-34 years), the answers "sometimes useful" reached 65.3%, while "always harmful" ranged from 27.8% of females to 19.4% of males. The aggregated figure, however, expresses a strong polarization in which the gender variable does not seem to be significant: 43.8% "always harmful" and 47.3% "sometimes useful".

Microbiological knowledge ranges from issues human-related to animal and environmental concerns. Regarding the agricultural field, the concept of biocontrol is commonly used in Italian with the expression '*lotta biologica*' ("biological fight") and which is used to describe the strategy of pest control in the so-called organic crops. This semantics can lead to confusion in the population of non-experts. Through the question "Do you think '*lotta biologica*' is dangerous in the consequences it produces on the environment", we find a 22.5% "I do not know", 22.7% "Yes" and 53.8% "No". In this case, there are no significant gender gaps, with the exception of "I don't know" in the 16-20 year old cohort: 18.3% females, 26.2% males. Again, males express their lack of knowledge about the subject more significantly than females. To the question "Do you think '*lotta biologica*' is pest and disease control by natural enemies", we find that 72.7% answered "Yes", 7.3% answered "No" and 13.5% answered "I don't know" (6.5% did not answer the question). An increase in the proportion who answered "Yes" can be seen as age increases: 67% 16-20; 77.6% 21-34; 86.7% 35-87. The gender gap in the 16-20 cohorts is 5.6%; 0.4% in the 21-34 cohort and 8.4% in respondents who are 35-87 years old. In the latter case, the expression of not knowing is greater in the female population 35-87 (12.5%) than in the male population (just 3.4%).

Data reported refer to the sample reached within the Citizen Science experiment and therefore do not possess statistical significance. As already mentioned, their value consists in stimulating reflection on the other parts of the research and especially in designing the qualitative activities (Delphi and Focus Group). We will discuss below some of the results that emerged from the second questionnaire whose sample, although smaller in terms of numbers, is less influenced by the

interaction setting. Indeed, the questionnaires were administered through the sharing of a link, filled out digitally via Google form and delivered anonymously and automatically to the research team.

4.2. SOURCES OF INFORMATION IN FOOD SAFETY AND ENVIRONMENTAL ISSUES

Before delving into the complex issue of acceptability, it is necessary to focus on what is a crucial dimension in the formation of worldviews and, in particular, of the social perception of risk. In the second questionnaire some questions were about information in relation to food safety (Q15-Q17) and the environment (Q23 and Q25). The most frequently used sources for information on the respective themes were social media (64.2% food safety, 75% environmental issues). Perhaps the most significant data shown in Table 4.2.1. are a distinction regarding school as a source of information with respect to two topics: food safety (32.4%) and environmental issues (46%). This difference can also give us an indirect measure of the different penetration that those topics have within the school context. This is probably connected with the growing importance that the theme of climate change has been assuming in public opinion during last years and, consequently, within school institution itself.

	<i>Food safety</i>	<i>Environmental issues</i>
Social media	64.2%	75%
Radio, TV	20.5%	41.5%
General sources	36.4%	49.4%
Scientific sources	48.3%	46.6%
Friends	31.8%	30.1%
Family	37.5%	26.1%
School	32.4%	46%

Tab. 4.2.1. Sources of information in "food safety" (Q17) and "environmental issues" (Q25). (N=176)

Considering broader perception of information availability (Table 4.2.2.), the diagnosis of parents/legal guardians is markedly different from that of students. Quite often male adults highlight a very negative opinion (12.5%) while female adults a very positive opinion (10.5%). On the other hand, students present an almost opposite distribution to that of adults: female students are more centered (only 1.6% express extremely positive or negative values), while male students expressing an extremely positive judgment account for 10.6%. In general, the median judgment (3 out of 5) is the one getting the most approval, especially among adults (66.7%) then students (36.2%).

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	15. In your opinion, in general, the availability of health food information is	very poor		12,5%	3,7%
		2	15,8%	25,0%	18,5%
		3	68,4%	62,5%	66,7%
		4	5,3%		3,7%
		great	10,5%		7,4%
		Tot.	100,0%	100,0%	100,0%
Student	15. In your opinion, in general, the availability of health food information is	very poor	1,6%	7,1%	4,7%
		2	32,8%	18,8%	24,8%
		3	35,9%	36,5%	36,2%
		4	28,1%	27,1%	27,5%
		great	1,6%	10,6%	6,7%
		Tot.	100,0%	100,0%	100,0%
Tot.	15. In your opinion, in general, the availability of health food information is	very poor	1,2%	7,5%	4,5%
		2	28,9%	19,4%	23,9%
		3	43,4%	38,7%	40,9%
		4	22,9%	24,7%	23,9%
		great	3,6%	9,7%	6,8%
		Tot.	100,0%	100,0%	100,0%

Tab. 4.2.2. Q15. "In your opinion, the availability of information on food safety issues is:" (N=176)

The frequency of seeking information (Tab. 4.2.3.) is also in this case on the median position (3 out of 5 on the never/almost never a daily scale). A gender difference that emerges concerns the students who expressed the "never/almost never" value: males outnumber females by 8.2 percentage points.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	16. How often do you inquire about health food issues?	never/almost never	5,3%		3,7%
		2	10,5%		7,4%
		3	47,4%	62,5%	51,9%
		4	31,6%	37,5%	33,3%
		daily	5,3%		3,7%
		Tot.	100,0%	100,0%	100,0%
Student	16. How often do you inquire about health food issues?	never/almost never	9,4%	17,6%	14,1%
		2	35,9%	20,0%	26,8%
		3	34,4%	40,0%	37,6%
		4	14,1%	15,3%	14,8%
		daily	6,3%	7,1%	6,7%
		Tot.	100,0%	100,0%	100,0%
Tot.	16. How often do you inquire about health food issues?	never/almost never	8,4%	16,1%	12,5%
		2	30,1%	18,3%	23,9%
		3	37,3%	41,9%	39,8%
		4	18,1%	17,2%	17,6%
		daily	6,0%	6,5%	6,3%
		Tot.	100,0%	100,0%	100,0%

Tab.4.2.3. Q16. "How often do you get informed about food safety issues?" (N=176)

Information on environmental issues is judged to be available on average level (3/5) by 63% of adults and by just 35.5% of students, who express more positive judgments (values 4/5 and 5/5): 41.7% compared to 22% of adults who express only 4/5. From the point of view of gender distinction, women give positive ratings (4/5) to a greater extent than males: 26.3% female, 12.5% male. This trend on the 4/5 value is also found among female (43.8%) and male (25.9%) students (Tab. 4.2.4.).

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	23. In your opinion, in general, the availability of information about the environment is	very poor	5,3%		3,7%
		2	10,5%	12,5%	11,1%
		3	57,9%	75,0%	63,0%
		4	26,3%	12,5%	22,2%
		Tot.	100,0%	100,0%	100,0%
Student	23. In your opinion, in general, the availability of information about the environment is	very poor	3,1%	5,9%	4,7%
		2	20,3%	16,5%	18,1%
		3	31,3%	38,8%	35,6%
		4	43,8%	25,9%	33,6%
		great	1,6%	12,9%	8,1%
Tot.	100,0%	100,0%	100,0%		
Tot.	23. In your opinion, in general, the availability of information about the environment is	very poor	3,6%	5,4%	4,5%
		2	18,1%	16,1%	17,0%
		3	37,3%	41,9%	39,8%
		4	39,8%	24,7%	31,8%
		great	1,2%	11,8%	6,8%
Tot.	100,0%	100,0%	100,0%		

Tab. 4.2.4. Q23. "In your opinion the availability of information on environmental issues is:" (N=176)

The frequency of the search for information on environmental issues (Tab. 4.2.5) is very marked on the medium-positive values in adults: 44.4% on the 3/5 value and 40.7 on the 4/5 value. As far as students are concerned, there is an unbalance on the values that indicate greater frequency (from 3/5 to 5/5), and 14.1% of male and female students state that they get informed daily; this is significant compared with only 5.3% of female adults.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	24. How often do you inquire about environmental issues?	never/almost never	5,3%		3,7%
		2	5,3%	12,5%	7,4%
		3	42,1%	50,0%	44,4%
		4	42,1%	37,5%	40,7%
		daily	5,3%		3,7%
		Tot.		100,0%	100,0%
Student	24. How often do you inquire about environmental issues?	never/almost never	1,6%	2,4%	2,0%
		2	15,6%	12,9%	14,1%
		3	26,6%	36,5%	32,2%
		4	42,2%	34,1%	37,6%
		daily	14,1%	14,1%	14,1%
		Tot.		100,0%	100,0%
Tot.	24. How often do you inquire about environmental issues?	never/almost never	2,4%	2,2%	2,3%
		2	13,3%	12,9%	13,1%
		3	30,1%	37,6%	34,1%
		4	42,2%	34,4%	38,1%
		daily	12,0%	12,9%	12,5%
		Tot.		100,0%	100,0%

Tab. 4.2.5. "How often do you get informed about environmental issues?" (N=176)

4.3. RISK PERCEPTION OF GMOS AND PESTICIDES

The public perception of risk related to virus-based biotechnological innovations is deeply linked to two agri-food innovations: chemical pesticides and GMOs. Through some questions of the questionnaire, we were able to measure the degree of relevance and danger perceived by non-experts. Regarding GMOs, in Q9 "How important is it to you that a food is Gmo-free?" (Tab. 4.3.1.) the judgment is differentiated according to gender: for females, values between 3/5 to 5/5 cover over 84.2% in parents/legal guardians and 79.7% in students. There is a generational difference for male respondents: for students, GMO-free is a value considered particularly important (values from 3/5 to 5/7) in 75.3%.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	9. How important is it to you that a food is "GMO-free"?	not at all/not very important	15,8%	25,0%	18,5%
		2		25,0%	7,4%
		3	31,6%	25,0%	29,6%
		4	26,3%		18,5%
		very important/essential	26,3%	25,0%	25,9%
		Tot.		100,0%	100,0%
Student	9. How important is it to you that a food is "GMO-free"?	not at all/not very important	4,7%	9,4%	7,4%
		2	15,6%	15,3%	15,4%
		3	26,6%	30,6%	28,9%
		4	32,8%	29,4%	30,9%
		very important/essential	20,3%	15,3%	17,4%
		Tot.		100,0%	100,0%
Tot.	9. How important is it to you that a food is "GMO-free"?	not at all/not very important	7,2%	10,8%	9,1%
		2	12,0%	16,1%	14,2%
		3	27,7%	30,1%	29,0%
		4	31,3%	26,9%	29,0%
		very important/essential	21,7%	16,1%	18,8%
		Tot.		100,0%	100,0%

Tab. 4.3.1. Q9. "How important is it to you that a food is GMO-free"?

If the previous question expresses a generic attitude towards the expression "GMO-free", with Q39 we move from an abstract level of value to a more concrete one of food choice. In Tab. 4.3.2. we can observe different attitudes between both adults and students, as well as between males and females: 10.5% of adult females are willing to continue buying the product versus 0% of female students; the decision to give up the product involves 36.8% of adult females versus 20.3% of female students, while there is no significant difference between adult males and male students (12.5% and 12.9%). Regarding males, the decision to continue buying the product is stronger in adults (25%) than in students (15.3%). Finally, in the intergenerational comparison there is a significant increase in the willingness to obtain more information before deciding (more marked in adult males, 62.5%, and in female students, 79.9%).

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	39. Imagine that the manufacturer of your favorite food introduces a genetically modified ingredient that allows for a 20% price reduction. What would be your reaction?	I continue to buy the product	10,5%	25,0%	14,8%
		Before deciding to purchase it I want to inform myself	52,6%	62,5%	55,6%
		I renounce the product	36,8%	12,5%	29,6%
		Tot.	100,0%	100,0%	100,0%
Student	39. Imagine that the manufacturer of your favorite food introduces a genetically modified ingredient that allows for a 20% price reduction. What would be your reaction?	I continue to buy the product		15,3%	8,7%
		Before deciding to purchase it I want to inform myself	79,7%	71,8%	75,2%
		I renounce the product	20,3%	12,9%	16,1%
		Tot.	100,0%	100,0%	100,0%
Tot.	39. Imagine that the manufacturer of your favorite food introduces a genetically modified ingredient that allows for a 20% price reduction. What would be your reaction?	I continue to buy the product	2,4%	16,1%	9,7%
		Before deciding to purchase it I want to inform myself	73,5%	71,0%	72,2%
		I renounce the product	24,1%	12,9%	18,2%
		Tot.	100,0%	100,0%	100,0%

Tab. 4.3.2. Q39 "Imagine that the manufacturer of your favourite food introduces a genetically modified ingredient that allows for a 20% price reduction. What would be your reaction?" (N=176)

Q27 asked to estimate the potential damage of genetically modified products to human and environmental health. About 25 males, both adults and students, agreed that they were unable to estimate GMOs. There seems to be a strong gender distinction regarding "high damage": 42.1% of adult females and 35.9% of female students, compared with 12.5% of adult males and 16.5% of male students. Also strongly polarized is the "moderate damage" judgment between adult males (62.5%) and females (15.8%); this polarization is not found among students (the gap is less than 6 percentage points). In general, female consider GMOs highly dangerous for the 37.3; instead, main position of males is "moderate damage" (30.1%). Despite the fragmentary distribution of responses across generations and genders, it is possible to find in the female respondents a more pronounced perception of danger in the use of GMOs.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	27. In your opinion, how harmful to human and environmental health is the use of genetically modified products?	high damage	42,1%	12,5%	33,3%
		slight harm	5,3%		3,7%
		moderate damage	15,8%	62,5%	29,6%
		I don't know how to evaluate it	31,6%	25,0%	29,6%
		not at all harmful	5,3%		3,7%
	Tot.		100,0%	100,0%	100,0%
Student	27. In your opinion, how harmful to human and environmental health is the use of genetically modified products?	high damage	35,9%	16,5%	24,8%
		slight harm	14,1%	21,2%	18,1%
		moderate damage	32,8%	27,1%	29,5%
		I don't know how to evaluate it	14,1%	25,9%	20,8%
		not at all harmful	3,1%	9,4%	6,7%
	Tot.		100,0%	100,0%	100,0%
Tot.	27. In your opinion, how harmful to human and environmental health is the use of genetically modified products?	high damage	37,3%	16,1%	26,1%
		slight harm	12,0%	19,4%	15,9%
		moderate damage	28,9%	30,1%	29,5%
		I don't know how to evaluate it	18,1%	25,8%	22,2%
		not at all harmful	3,6%	8,6%	6,3%
	Tot.		100,0%	100,0%	100,0%

Tab. 4.3.3. Q27. "In your opinion, how harmful to human and environmental health is the use of genetically modified products?" (N=176)

The perception of pesticides is particularly diverse. The general tendency is to associate pesticides with "high damage", although it is more marked in students (63.9% female, 60.2% male), slightly reduced in female parent/legal guardians (57.9%) and markedly reduced in male adults (25%). The

statement "I don't know how to evaluate it" is more pronounced in adults (10.5% female, 25% male) than in students (4.7% female, 1.2% male).

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	26. In your opinion, how harmful to human and environmental health is the use of pesticides?	high damage	57,9%	25,0%	48,1%
		slight harm	5,3%		3,7%
		moderate damage	26,3%	50,0%	33,3%
		I don't know how to evaluate it	10,5%	25,0%	14,8%
		Tot.	100,0%	100,0%	100,0%
Student	26. In your opinion, how harmful to human and environmental health is the use of pesticides?	high damage	65,6%	63,5%	64,4%
		slight harm	4,7%	4,7%	4,7%
		moderate damage	25,0%	28,2%	26,8%
		I don't know how to evaluate it	4,7%	1,2%	2,7%
		not at all harmful		2,4%	1,3%
Tot.	100,0%	100,0%	100,0%		
Totale	26. In your opinion, how harmful to human and environmental health is the use of pesticides?	high damage	63,9%	60,2%	61,9%
		slight harm	4,8%	4,3%	4,5%
		moderate damage	25,3%	30,1%	27,8%
		I don't know how to evaluate it	6,0%	3,2%	4,5%
		not at all harmful		2,2%	1,1%
Tot.	100,0%	100,0%	100,0%		

Tab. 4.3.4. Q26. "In your opinion, how harmful to human and environmental health is the use of pesticides?" (N=176)

4.4. ACCEPTANCE OF VIRUS-BASED BIOTECHNOLOGICAL INNOVATIONS

Social acceptance of VB-PPPs was addressed in both questionnaires. In the questions posed in the first one (Annex 2), people are asked to express a level of agreement with the introduction of virus-based techniques in medicine and plant protection.

"BACTIOPHAGE" AND "VIRUS" IN MEDICINE AND AGRICULTURE

- Q13. If there was a possibility to use bacteriophages to fight some human diseases, what would be your opinion about it?

The degree of maximum acceptance expressed in the 16-20 cohort is 48.8% (56.1% females, 41.7% males); in the 21-34 cohort it is 20.4% (22.2% females and 19.4% males); in the 35-87 cohort it is 17.8% (25% females and 13.8% males). Thus, as age increases, the degree of maximum acceptance decreases. Similarly, between the younger and older cohorts, the degree of uncertainty ("I don't know") increases from 22.9% (18.3% of females and 27.4% of males) to 55.1% (66.7% of females and

48.4% of males) in the 21-34 cohort and 46.7% in the older cohort. In the latter case, there is a gender difference: the degree of uncertainty is greater in males (62.1%) than in females (18.8%).

- Q15. If there were a possibility of using viruses to fight human diseases, what would be your opinion about it?

In this formulation, which unlike the previous one contains the term "virus", the share of consensus "quite favorable" is 40% (48.3% female) and (33.3% male) and 26% "very favorable" (25% female, 27.1% male). Those who answered "I don't know" are 18.1% (16.4% female and 19.4% male). A different gender acceptance can be observed depending on the cohort examined. In the 16-20 year old cohort, 20.2% of males say they are "not very favorable" and "not at all favorable", while for females it is 10.9%. In the 21-34 year old cohort, the most frequently answered option (46.9%) is "I don't know" in which females reaches 55.6% and males 41.9%. In the 35-87 cohort, there seems to be more acceptance by females: the judgments "quite favorable" and "very favorable" reach 75% (compared with 48.2% of males).

- Q14. Currently some research is being done to use genetically modified viruses to fight insects that transmit serious diseases in plants. What is your opinion about this?

The overall attitude of respondents is moderately favorable 61.5% (58.6% female, 63.9% male) and very favorable 9.2% (11.2% female, 7.6% male). Again, the proportion of "I don't know" respondents is a minority: 16.9% (16.4% female and 17.4% male). On the other hand, if we look at the gender and generational dimensions, these respondents grow from the first cohort 16-20 years old (13.3%) to the second cohort 21-34 years old (26.5%). In the 35-87 cohort, however, there is greater uncertainty in males (24.1%) than females (12.5%). "Not at all favorable" ratings are made by 7.2% of the 16-20 cohort, 6.2% of the 21-34 cohort, and 17.8% in the 35-87 adult cohort.

- Q16. If instead of chemical pesticides it were possible to use the following alternatives in agriculture, what would be your opinion about them? [bacteriophages]

Moving from medicine to agriculture, it can be observed that, in general, judgments are significantly on the side of acceptance: "quite favorable" covers 39.2% with a higher value in females (44%) than males (35.4%); "very favorable" is 8% (9.5% females and 6.9% males). Second, "I don't know" responses reach 40.8% with a higher value in males (48.6%) than females (31%). Responses of less or no acceptance overall reach 13% (15.6% in females and 9.1% in males). Other differences on the gender dimension concern the "I don't know" uncertainty in the 35-87 year old cohort: 69% males and 25% females. In the other cohorts there is also a male predominance in this response, but with a less pronounced gap. In the 21-34 cohort: 61.1% females and 77.4% males; in the 16-20 cohort: 25.6% females and 31% males.

- Q16. If instead of chemical pesticides it were possible to use the following alternatives in agriculture, what would be your opinion about them? [virus]

The use of viruses as an alternative treatment in agriculture is accepted by 43.5% of respondents, with a higher value in females (46.6%) than males (41%). However, the proportion of "I don't know" responses (33.5%) is significant and is higher in males (37.5%) than in females (28.4%). The "not very favorable" and "not at all favorable" responses are 10% (14.7% in females, 6.3 in males) and 13.1% (10.3 females and 15.3 males), respectively. From a generational perspective, acceptance is more common in females in each cohort, although in the 21-34 cohort there are no "very favorable" responses from either males or females. In fact, in this cohort there is a polarization on the responses, "quite favorable" (33.3% females and 41.9% males) and "I don't know" (66.7% females and 58.1% males). The expression of not knowing shows a gap between the first cohort and the other two: from 20.5% to 61.2% in the second and 51.1% in the third.

- Q17. In Apulia the olive trees are suffering from a serious disease caused by a bacterium. If there was a possibility to use highly specific viruses to fight the insect that transmits this bacterium, what would be your opinion about it?

In this question, we come down to an even more concrete and circumscribed level. The case of *Xylella fastidiosa*, a bacterium that causes a disease in the olive tree, has also become a case of public mobilization by farmers and environmental movements in the Puglia region of Italy. The question therefore serves to delimit the scope of application of a virus-based technology to a case localized geographically and an object as culturally dense as the olive tree for the landscape and culture of the Mediterranean (Colella *et al.*, 2019).

In general, there seems to be a large degree of acceptance: "very favorable" 33.8% (greater in males than females by about 10 percentage points) and "fairly favorable" at 43.1% (in this case females outnumber males by about 10 percentage points). The sum of the two options taken together reaches 79.9%. On the non-acceptance side, "somewhat favorable" is 9.2% and "not at all favorable" only 1.9%. Looking at the differences between the cohorts, the "I don't know" responses increase as age increases: 6.6% in the 16-20 cohort, 18.4% in the 21-34 year-olds, and 24.4% in the 35-87 year-olds (with respect to gender, there is a gap of almost 10 percentage points in the 35-87 cohort: 18.8 females and 27.6 males). In general, the males who express a maximum level of acceptance decrease as age increases, going from 44% (16-20 years) to 35.5% (21-34 years) and finally to 24.1 (35-87). As far as females are concerned, on the other hand, this value decreases more tenuously: from 29.3% in the first cohort to 27.8% in the second and 25% in the third cohort.

Vice versa, non-acceptance increases from 0.6% in the first cohort to 2% in the second, reaching 6.7% in the third cohort. In the latter cohort, 12.5% of women are not in favor of this innovation.

REACTING TO THE UNEXPECTED

The introduction of an innovation occurs with or without the involvement of the population and a negotiation with institutions and experts. In the second questionnaire, we asked a series of questions (Q34-Q38) in which we ask to express the reaction to an unexpected event related to agricultural practices.

- “Imagine that in the field bordering your house you begin using one of the products listed below. What would be your first reaction to the use of...?”

In the synoptic table (Table 4.4.1) the five responses corresponding to different ways of positioning oneself regarding the unexpected are shown. Acceptance is often understood in passive terms, "I do nothing because I suppose everything is in order", which implies a trust in science and regulatory institutions, as well as - in this case - in neighborhood behavior. From this pole, two modes of "unacceptance" can be distinguished: a passive one, as discontent that does not translate into any external behavior; and an active one as mobilization from below towards institutions. Compared to these strong and polarizing reactions, other reactions that are more moderate and open to the construction of meaning are also possible. The first can be defined as a type of acceptability oriented towards otherness: in fact, "I ask the owner of the field for clarification" indicates a willingness to know the meaning and context of something perceived as unexpected. The second one, "I inform myself", is more oriented towards the individual acquisition of information without this resulting in a social relationship. We call these last two options within the label of acceptability as momentary suspension of judgment on acceptance since they set in motion the subjective ability to arrive at a conscious and reasoned judgment.

Data show that VB-PPPs are "passively accepted" in 21% of respondents compared to GMOs (31.3%) and pesticides (26.1%). "Passive unaccepted" in the three cases are essentially at the same level: pesticides outnumber VB-PPPs and GMOs by 1.1%; while active unacceptance is more pronounced than in the other cases (11.9%). Overall, acceptability is high (59.6%), more directed at the self than at comparison with the other. If we look at the other cases, it is interesting to observe that for GMOs there seems to be an "unacceptance" (15.4%) that is lower than acceptance (31.3%) and above all than acceptability (53.4%), even though it is more directed towards self-learning than towards comparison with others.

Reactions	<i>Passive acceptance</i>	<i>Passive unacceptance</i>	<i>Active unacceptance</i>	<i>Other-oriented acceptability</i>	<i>Self-oriented acceptability</i>
	"I do nothing because I suppose everything is in order"	"I get scared, but I do nothing"	"I get scared, and I mobilize with the neighbors and the Municipality"	"I ask the owner of the field for clarification"	"I inform myself"
Pesticides	26.1%	8.5%	10.2%	28.4%	26.7%
GMOs	31.3%	7.4%	8%	22.2%	31.2%
Virus-based PPPs	21%	7.4%	11.9%	26.1%	33.5%
Manure and compost	79%	1.7%	0.6%	5.1%	13.6%
Bees and pollinating insects	73.9%	1.1%	3.4%	%	17.6%

Tab. 4.4.1. Reactions toward the unexpected in terms of acceptance and acceptability. "Imagine that in the field bordering your house a farmer begins using one of the products listed below. What would be your first reaction to the use of" (Q34-Q38) [N=176]

With respect to this general picture, it is possible to refine the analysis at the level of gender distinction. In the case of VB-PPPs there are no relevant differences (>4%) with the exception of the response "I get scared but I do" (12% female and 3.2% male).

	Gender		Totale
	Female	Male	
I ask the owner of the field for clarification	24,1%	28,0%	26,1%
I inform myself	33,7%	33,3%	33,5%
I get scared and I mobilize with the neighbors and the Municipality	10,8%	12,9%	11,9%
I get scared but I do nothing	12,0%	3,2%	7,4%
I do nothing because I suppose everything is in order	19,3%	22,6%	21,0%
	100,0%	100,0%	100,0%

Tab. 4.4.2. Q36. "Imagine that in the field bordering your house, a farmer begins using one virus-based plant protection products. What would be your first reaction?"

In the case of pesticides (Tab. 4.4.3.) we can observe a greater gender polarization on "passive acceptance", with a difference of 15.2% (18.1% female and 33.3% male), and on "passive unacceptance" with a difference of 13.5% (15.7% female, 2.2% male). The answer "other-oriented acceptability" is more frequent in females (31.3%) than in males (25.8%).

	Gender		Totale
	Female	Male	
I ask the owner of the field for clarification	31,3%	25,8%	28,4%
I inform myself	26,5%	26,9%	26,7%
I get scared and I mobilize with the neighbors and the Municipality	8,4%	11,8%	10,2%
I get scared but I do nothing	15,7%	2,2%	8,5%
I do nothing because I suppose everything is in order	18,1%	33,3%	26,1%
	100,0%	100,0%	100,0%

Tab. 4.4.3. Q34. "Image that in the field bordering your house, a farmer begins using pesticides. What would be your first reaction?" (N=176)

Even in the GMOs case Tab. 4.4.4.) there is a polarization on "passive acceptance", greater in males (37.6%) than in females (24.1%). Similarly to the case of VB-PPPs, a second prevailing attitude in males is "self-oriented acceptability" (34.4%), decidedly higher than "other-oriented acceptability". Females, on the other hand, tend to express forms of unacceptance (active and passive) for 22.8% versus 8.6% of males.

	Gender		Totale
	Female	Male	
I ask the owner of the field for clarification	25,3%	19,4%	22,2%
I inform myself	27,7%	34,4%	31,3%
I get scared and I mobilize with the neighbors and the Municipality	10,8%	5,4%	8,0%
I get scared but I do nothing	12,0%	3,2%	7,4%
I do nothing because I suppose everything is in order	24,1%	37,6%	31,3%
	100,0%	100,0%	100,0%

Tab. 4.4.4. Q35. "Image that in the field bordering your house, a farmer begins using GMOs. What would be your first reaction?" (N=176)

PUBLIC DECISIONS ON THE INNOVATION

In some circumstances, the introduction of a new technology, which is particularly controversial from an ethical point of view, is submitted to the attention of citizens through the form of a referendum. In the questionnaire, we formulated two fictitious referenda for the authorization of the use of VB-PPPs in agriculture and of phage therapy in medicine. The questions make explicit that these referendums are supported by a committee of scientists, in order to be able to measure the degree of trust accorded to them by citizens.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	20. In some countries of the world is underway an experiment that sees the use of viruses to fight some plant diseases. In the hypothesis that in Italy a committee of scientists promotes a referendum to authorize this technique, what would be your positio	I abstain	15,8%	25,0%	18,5%
		before deciding I want to inform myself better	63,2%	62,5%	63,0%
		I am against it even though I trust scientists	10,5%	12,5%	11,1%
		I am in favor because I trust scientists	10,5%		7,4%
		Tot.	100,0%	100,0%	100,0%
Student	20. In some countries of the world is underway an experiment that sees the use of viruses to fight some plant diseases. In the hypothesis that in Italy a committee of scientists promotes a referendum to authorize this technique, what would be your positio	I abstain	1,6%	9,4%	6,0%
		before deciding I want to inform myself better	81,3%	67,1%	73,2%
		I am against it even though I trust scientists	3,1%	4,7%	4,0%
		I am in favor because I trust scientists	14,1%	18,8%	16,8%
		Tot.	100,0%	100,0%	100,0%
Tot.	20. In some countries of the world is underway an experiment that sees the use of viruses to fight some plant diseases. In the hypothesis that in Italy a committee of scientists promotes a referendum to authorize this technique, what would be your positio	I abstain	4,8%	10,8%	8,0%
		before deciding I want to inform myself better	77,1%	66,7%	71,6%
		I am against it even though I trust scientists	4,8%	5,4%	5,1%
		I am in favor because I trust scientists	13,3%	17,2%	15,3%
		Tot.	100,0%	100,0%	100,0%

Tab. 4.4.5. Q20. Parents/Legal guardians and Student positions on VB-PPPs authorization (N=176)

The general picture that emerges from Q20 (Tab. 4.4.5.) on VB-PPPs is characterized by a strong component of subjects who, before deciding, wish to acquire more information (63% in adults; 73.2% in students). This attitude, using the terminology introduced earlier, expresses a "self-oriented acceptability". It is more marked in female students than in male students. In adults this value is substantially indifferent with respect to gender. Abstentionism is three times greater in adults (more in males, 25%, than in females, 15.8%) than in students. Positive acceptance is greater in students (especially males, 18.4%) than in adult females (10.5%) while there are no adult males in favor. Unacceptance is greater in adults than in students with no significant variation according to gender. Asking the expected outcome, we intend to assess the individual respondent's perception of the climate of opinion around an issue that is then objectified in the outcome of the referendum. It is therefore a question from which we can obtain a representation of the "imagined majority". (Noelle-Neumann, 1984).

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	21. Regardless of your position, what do you think the outcome of the referendum set forth in the previous question might be?	Approved	15,8%		11,1%
		Not approved	26,3%	12,5%	22,2%
		Quorum not reached due to abstention	57,9%	87,5%	66,7%
		Tot.	100,0%	100,0%	100,0%
Student	21. Regardless of your position, what do you think the outcome of the referendum set forth in the previous question might be?	Approved	29,7%	38,8%	34,9%
		Not approved	42,2%	40,0%	40,9%
		Quorum not reached due to abstention	28,1%	21,2%	24,2%
		Tot.	100,0%	100,0%	100,0%
Tot.	21. Regardless of your position, what do you think the outcome of the referendum set forth in the previous question might be?	Approved	26,5%	35,5%	31,3%
		Not approved	38,6%	37,6%	38,1%
		Quorum not reached due to abstention	34,9%	26,9%	30,7%
		Tot.	100,0%	100,0%	100,0%

Tab. 4.4.6. Q21. Expected outcome of the referendum on VB-PPPs authorization (N=176)

From the point of view of adults, it is considered more probable that the referendum will not reach a quorum (66.7%) with a strong distinction based on gender: 57.9% females and 87.5% males; for students instead, the percentage is much lower: 28.1% females and 21.2% males. "Not approved" is considered probable by 40.9% of students (with no relevant gender distinction), by 26.3% of

females and only 12.5% of males. It is noteworthy that male students consider approval more likely than females by a 9.1% gap. The second fictitious referendum on the use of bacteriophages in medicine presents a general picture of prevalence of "self-oriented acceptability" (59.1%), which is higher in adults (77.8%), especially in females (84.2%) than in males (62.5%). In students there is a gender gap of only 1% and this option collects 55.7% of responses. Acceptance related to trust in scientists is about three times higher in students (more in females, 34.4%, than in males, 28.2%) than in adults. Abstention option between adults and students shows no notable differences.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	41. Therapy based on the use of bacteriophages (a type of virus that feeds on harmful bacteria) is being tested in combating some sometimes lethal infectious diseases, such as cholera and dysentery, with promising results. Scientists anticipate similar (v	I abstain	5,3%	12,5%	7,4%
		before deciding I want to inform myself better	84,2%	62,5%	77,8%
		I am against it even though I trust scientists		12,5%	3,7%
		I am in favor because I trust the scientists	10,5%	12,5%	11,1%
		Tot.	100,0%	100,0%	100,0%
Student	41. Therapy based on the use of bacteriophages (a type of virus that feeds on harmful bacteria) is being tested in combating some sometimes lethal infectious diseases, such as cholera and dysentery, with promising results. Scientists anticipate similar (v	I abstain	7,8%	8,2%	8,1%
		before deciding I want to inform myself better	56,3%	55,3%	55,7%
		I am against it even though I trust scientists	1,6%	8,2%	5,4%
		I am in favor because I trust the scientists	34,4%	28,2%	30,9%
		Tot.	100,0%	100,0%	100,0%
Tot.	41. Therapy based on the use of bacteriophages (a type of virus that feeds on harmful bacteria) is being tested in combating some sometimes lethal infectious diseases, such as cholera and dysentery, with promising results. Scientists anticipate similar (v	I abstain	7,2%	8,6%	8,0%
		before deciding I want to inform myself better	62,7%	55,9%	59,1%
		I am against it even though I trust scientists	1,2%	8,6%	5,1%
		I am in favor because I trust the scientists	28,9%	26,9%	27,8%
		Tot.	100,0%	100,0%	100,0%

Tab. 4.4.7. Q41. Parents/Legal guardians and Student positions on phage therapy authorization (N=176)

The expected outcome of the referendum, in this case, shows a different perception between parents/legal guardians and students: respectively 25.9% and 47.7% predict approval. For adult females the most probable outcome is "not approved" (42.1%), while for adult males "quorum not reached due to abstention" (62.5%). Regarding students, the gender dimension has a marked effect (>8%) on the "approved": 53.1% female and 43.5% male.

Respondent			Gender		Totale
			Female	Male	
Parent/Legal guardian	42. Regardless of your position, what do you think would be the outcome of the referendum set forth in the previous question?	Approved	21,1%	37,5%	25,9%
		Not approved	42,1%		29,6%
		Quorum not reached due to abstention	36,8%	62,5%	44,4%
		Tot.	100,0%	100,0%	100,0%
Student	42. Regardless of your position, what do you think would be the outcome of the referendum set forth in the previous question?	Approved	53,1%	43,5%	47,7%
		Not approved	25,0%	32,9%	29,5%
		Quorum not reached due to abstention	21,9%	23,5%	22,8%
		Tot.	100,0%	100,0%	100,0%
Tot.	42. Regardless of your position, what do you think would be the outcome of the referendum set forth in the previous question?	Approved	45,8%	43,0%	44,3%
		Not approved	28,9%	30,1%	29,5%
		Quorum not reached due to abstention	25,3%	26,9%	26,1%
		Tot.	100,0%	100,0%	100,0%

Tab. 4.4.8. Q42. Expected outcome of the referendum on phage therapy authorization (N=176)

From the comparison between the two referendums (Tab. 4.4.9), it is possible to observe a preponderant tendency towards information seeking ("self-oriented acceptability") especially in the case of VB-PPPs. As regards acceptance, the result is higher in the case of medicine (27.8%); while unacceptance is identical.

	VB-PPPs	Phage Therapy in human medicine
Before deciding I want to inform myself better	71.6%	59%
Abstention	8%	8%
I am favor because I trust in scientists	15.3%	27.8%
I am against it even though I trust in scientists	5.1%	5.1%
I am against it because I distrust in scientists	0%	0%

Approved	31.3%	44.3%
Not approved	38.1%	29.5%
Quorum not reached due to abstention	30.7%	26.1%

Tab. 4.4.9 Referendum for the introduction of virus-based products in medicine and in plant protection (Q20,21,22,41,42) [N=176]

It is noteworthy that in both cases there are no *"I am against it because I distrust in scientists"* responses. The aversion as reflected in some responses to question Q22 relates to the lack of popular participation and the suspicion that beyond the work of the researchers, the implementation of such an innovation may not be done in an efficient, safe and controlled manner:

- Especially after the pandemic I don't think people would approve of using viruses
- Because it would be too dangerous in a time of crisis like now.
- Because it would certainly bring economic benefits and often the economy is benefited at the expense of the welfare of citizens
- Because the idea that man has of viruses (covid-19) would probably induce him to reject this project. This is because of misinformation/disinterest and fear of going against something irreversible/uncontrollable.
- The population is opposed but disinterested in food issues
- There would be the fear of dangerous mutations of viruses (since in some people there is the doubt that the covid was born from laboratory errors) also harmful to plants. This pandemic has made us more careful and afraid of viruses.

From these answers we can say that the non-acceptance of innovation is not strictly linked to the work or reputation of scientists, but to the role played by all the actors involved in the innovation process: experts, end-users, communicators and policymakers.

5. DISCUSSION

The most prominent trait from both questionnaires is a strong need for information, which does not always reflect a true lack of information. Above all, adults believe that availability of information is at an average level, especially for females. In the intergenerational comparison of the frequency of daily information seeking, both male and female students are at nearly three times the percentage of adult females.

From the analysis it emerges that GMOs are considered undesirable in the diet to a greater extent by adults and by female students, which corresponds to a desire for more information on the subject. In the analysis, particular attention was paid to the dimension of admission of ignorance. This is particularly important when faced with negatively connoted items because they indirectly can give insight into the fiduciary link with experts. Thus, adult and student males report being unable to estimate the harm caused by GMOs, while adult females perceive harm to a greater

extent than student females. Perception of harm to human and environmental health from pesticides is higher in students than in adults. In the latter case, the perception of maximum harm is expressed by 25% of men and 57.9% of women. The statement "I don't know how to evaluate it" is more pronounced in adults than in students.

We analyzed acceptance in its positive and negative aspects, as well as the entire process through which conscious and concerted acceptance is achieved: acceptability. VB-PPPs are "passively accepted" in 21% of respondents, while "Passive unaccepted" is essentially at the same level for VB-PPPs, Pesticides and GMOs. Active unacceptance is more pronounced in VB-PPPs than the other cases (11.9%). Looking at the acceptability levels, it is generally high (59.6%), and self-oriented acceptability is greater than other-oriented acceptability. Refining the analysis at the level of gender distinction, in the case of VB-PPPs there are no relevant differences (>4%) with the exception of the response "I get scared but I do nothing" (12% female and 3.2% male).

We can observe a greater gender polarization for pesticides: there is more "passive acceptance" by males and a greater "passive unacceptance" by females. The attitude "other-oriented acceptability" is more frequent in females (31.3%) than in males (25.8%). Even in the case of GMOs, there is a gender polarization on the level of "passive acceptance" by male greater than female. Similarly to the case of VB-PPPs, a second prevailing attitude in males is "self-oriented acceptability" (34.4%), decidedly higher than "other-oriented acceptability". Females, on the other hand, tend to express forms of unacceptance (active and passive) for 22.8% versus 8.6% of males.

Attitudes therefore are distributed between positions of acceptance and acceptability in different ways and weights across genders and generations. The general picture that emerges from Q20 (Tab. 4.4.5.) on VB-PPPs is characterized by a strong component of subjects who, before deciding, wish to acquire more information. This attitude of "self-oriented acceptability" is more marked in female students than in male students. In adults this value is substantially indifferent with respect to gender. A positive acceptance is greater in students while there are no adult males in favor. Unacceptance is greater in adults than in students with no significant variation according to gender. This kind of attitude partially reflects the provision of the referendum: for 66.7% of adult it will not reach the quorum. From the comparison between the two referendums, we can see a preponderant tendency towards a "self-oriented acceptability" especially in the case of VB-PPPs; regarding "acceptance", the result is higher in the case of medicine than agriculture, while unacceptance is identical.

In both cases, the absence of "*I am against it because I distrust in scientists*" responses suggests that the aversion of this biotechnological innovation is not related to the crisis of the fiduciary pact between experts and non-experts, but to a lack of public participation in the decision-making. The suspicion of hidden interests behind the work of the researchers as well as doubt on the efficient and controlled implementation of such an innovation may explain this minoritarian position.

4. FINAL REMARKS

At the end of this quantitative part of WP6 research on Social Acceptance, the results presented here invite reflection on the following points. From the methodological point of view, the Citizen Science experience had the merit of improving the previous questionnaire and, above all, of making students junior researchers in psycho-sociological and biotechnological disciplines. Since one of the major results that emerged from the Focus Group phase is the inevitable role that researchers can have in building democratic contexts of open and non-biased discussion towards innovation, we can say that this Citizen Science experiences (both in quantitative and qualitative ways) can be refined and further tested. Adhering to the principles of public engagement and Responsible Research and Innovation (<https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation>), we tried to *elaborate* acceptability, rather than aiming to *measure* it through tools that either prove inadequate to grasp the complexity of the theme-problem, or force subjects to "invent" a response to a solicitation that does not belong to their daily life experience. These weaknesses related to quantitative methods, which are even more problematic when faced with objects negatively connoted in common sense as in the case of virus-based biotechnologies, push toward an integration with qualitative methods (mixed-methods). In our research we have tried to develop a "working method" (even before research method) able to "take into account" the diversity of data and, above all, our historical moment. The pandemic has forced us as researchers to readjust the tools we developed, not to compromise the quality of the data to be collected. The analysis presented here represents a first purely descriptive reading that made intelligible some of the evidence that had already emerged in the qualitative research and that is presented in the final report (Del. 6.3) to which reader is referred.

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ANNEX 1: FIRST QUESTIONNAIRE

BEFORE CLASS

BEFORE CLASS

BEFORE CLASS

ANONYMOUS SURVEY

Date: _____ Place: _____
 male female age _____

1) Bacteria are:

- always detrimental sometimes useful
 always useful neutral I don't know

2) Viruses are:

- always detrimental sometimes useful
 always useful neutral I don't know

3) Which organisms can be infected by viruses?

- animals plants fungi bacteria

4) Have you ever heard about phages? yes no

5) Please, give a definition of phages?

6) Do you agree with the following sentences about biological control?

- it is a new military strategy based on chemical weapons
 yes no I don't know
- it is detrimental for the environment
 yes no I don't know
- it is the control of parasites and diseases through natural enemies
 yes no I don't know
- it has a negative impact on the environment compared to artificial products
 yes no I don't know

7) In your opinion, this image represents:

- a bacterium a virus
 a spider a lunar module
 a robot a phage an insect



8) Do you agree with the use of genetically modified viruses against insect transmitting plant diseases?

- yes no I don't know

9) Have you heard about genetically modified mosquitoes to fight malaria? yes no

10) Do you agree with their use?

- yes no I don't know

11) Do you agree with the use of viruses against plant diseases? yes no I don't know

12) Have you heard about Gene Silencing? yes no

13) Have you heard about the Nobel Prize in Physiology or Medicine given in 2006 to Fire and Mello for their discovery of RNA interference (RNAi)?

- yes no

14) In your opinion, can Gene Silencing be used in medicine against some diseases? yes no

15) Have you heard about VIGS technique (Virus Induced Gene Silencing) and its possible use against plant diseases?

- yes no

16) Do you agree with the use of phages against plant diseases? yes no I don't know

17) How much do you agree with the use of genetically modified viruses against the fungus *Rhizoctonia solani*, responsible of many plant diseases?

- not at all somewhat rather strongly
 I don't know

18) In your opinion, which of the following organisms are used for biological control in agriculture?

- insects nematodes viruses
 phages fungi bacteria

19) If you were the owner of a farm, would you use these organisms for biological control?

- insects nematodes viruses
 phages fungi bacteria

20) How much do you agree with the use of viruses in biological control for human health?

- not at all somewhat rather strongly
 I don't know

21) In your opinion, can release in the environment of viruses used in biological control be risky?

- yes no I don't know

22) Have you heard about phages used in medicine against bacteria resistant to all antibiotics?

- yes no I don't know

23) In your opinion, can release in the environment of phages used in biological control be risky?

- yes no I don't know

24) How much do you agree with the use of phages in biological control for human health?

- not at all somewhat rather strongly
 I don't know

25) In your opinion, this image represents something detrimental for humans?

- yes no I don't know



These data will be treated as anonymous and they will be used as aggregate data.

ANNEX 2: FIRST QUESTIONNAIRE REDESIGNED

Date: _____ Place: _____ male female age _____ Type of high school or educational qualification _____ profession _____

1) In general, how often do you inquire about scientific topics?

Not at all Rarely Sometimes Often

1A) From what sources do you get information about scientific topics? _____

2) Write one or more words that come to mind associated with the following terms:

VIRUS _____

BIOLOGICAL _____

BIOTECHNOLOGICAL _____

3) How would you define bacteria?

always harmful sometimes useful
 always useful neutral I don't know

4) How would you define viruses?

always harmful sometimes useful
 always useful neutral I don't know

5) Which of these organisms can be infected by viruses? (multiple answers possible)

animals plants fungi bacteria

6) Have you ever heard of bacteriophages or phages? yes no

7) What do you think bacteriophages or phages are? _____

8) What does this picture look like?

9) Does the image, in your opinion, represent something directly harmful to humans?

yes no don't know

10) What does the expression "biological warfare" make you think of?

- it is a new military strategy that makes use of chemical weapons yes no I don't know
- it is dangerous in its consequences on the environment yes no I don't know
- it is the control of pests and diseases by natural enemies yes no I don't know

- it is what happens when artificial products are not used yes no I don't know

11) Have you ever heard of bacteriophages that can be used in human medicine against bacteria that are resistant to all antibiotics?

yes no I don't know

12) In Australia, genetically modified mosquitoes are being tested to combat malaria. If they could be used in Europe, what would be your position?

not at all in favor not very in favor quite in favor very in favor I don't know

13) If there was a possibility to use bacteriophages to fight some human diseases, what would be your opinion about it?

not at all favorable little favorable quite favorable very favorable I don't know

14) Currently some research is being done to use genetically modified viruses to fight insects that transmit serious diseases in plants. What is your opinion about this?

not at all favorable little favorable enough favorable very favorable I don't know

15) If there were a possibility of using viruses to fight human diseases, what would be your opinion about it?

not at all favorable little favorable enough favorable very favorable I don't know

16) If instead of chemical pesticides it were possible to use the following alternatives in agriculture, what would be your opinion about them?

- insects not at all favorable little favorable enough favorable very favorable I don't know

- fungi not at all favorable little favorable quite favorable very favorable I don't know

- viruses not at all favorable little favorable quite favorable very favorable I don't know

- bacteriophages not at all favorable little favorable quite favorable very favorable I don't know

- bacteriophages not at all favorable little favorable quite favorable very favorable I don't know

17) In Apulia the olive trees are suffering from a serious disease caused by a bacterium. If there was a possibility to use highly specific viruses to fight the insect that transmits this bacterium, what would be your opinion about it?

not in favor not very favorable fairly favorable very favorable I don't know

The data collected is anonymous (as it cannot be traced back to those directly involved) and will be used in aggregate.

ANNEX 3: SECOND QUESTIONNAIRE

Survey on Food, Environment and Agriculture - Project H2020 VIROPLANT - University of Milan-Bicocca

Dear Participant

You have been invited to participate in a survey of students in grades IV and V and their parents coordinated by the MaCSIS Interuniversity Center of the University of Milan-Bicocca.

Before deciding whether you would like to take part in the study, please read the information below carefully.

What is the purpose of the study?

The general purpose of this study is to investigate attitudes towards some issues related to food safety, environmental health and agriculture.

How long does the questionnaire take to complete?

The estimated duration of completion is approximately 15 minutes.

Why do we suggest you participate?

The study is part of the European Research Project H2020 VIROPLANT. We propose you to participate because we are interested in the differences between adolescents and adults regarding biotechnological innovation.

Are you obliged to participate?

Your participation is completely free. Furthermore, if you change your mind and wish to withdraw, you are free to do so at any time without explanation.

What are the steps required to participate in the study?

Participation in the study is subject to detailed information about the characteristics, risks and benefits of the study (see below). After this information has been provided, you may consent to participate in the study. Only after you have given your consent will you be able to actively participate in the proposed study.

What will you be asked to do?

The study will be conducted online. You will be asked to answer a series of questions about the three areas of inquiry. There are no right or wrong answers, so you are free to express your thoughts.

What are the benefits?

The study will increase knowledge about the attitudes of citizens of different age groups to issues of great public importance. This knowledge will help in the implementation of more inclusive policies at European level.

What are the risks, side effects, discomforts?

This research does not contain sensitive questions related to the sphere of intimacy. However, if you feel uncomfortable answering a question, please note that you can stop filling out the questionnaire at any time. Your data will be saved and sent to the collection center only after you have completed the questionnaire.

How is the confidentiality of the information guaranteed?

The questionnaire is completely anonymous and the data collected will be used exclusively within the VIROPLANT Project in aggregate form, so that the data and identity of individuals cannot be traced. At the end of the research, the collected data will be deleted and will no longer be accessible.

Other important information

Please note that the study will be conducted in accordance with the ethical principles set forth in the Declaration of Helsinki and the Convention on Human Rights and Biomedicine (Oviedo Convention).

Questions?

For further information and communications during the study, please write to:

Roberto Carradore (roberto.carradore@unimib.it)

Matteo Tonoli (m.tonoli3@campus.unimib.it)

<https://www.viroplant.eu>

*Mandatory field

1. Consent to participate in the study THE UNDERWRITER in light of the information provided: *
 - I AGREE
 - DO NOT AGREE Go to section 18 (Thank you!).

Master data

2. Respondent *
 - Student/StudentPass to question 3.
 - Parent/Legal GuardianPasses to question 4.

Student

3. School*
 - Classical High School
 - Scientific High School
 - Other High School
 - Technical Institute
 - Professional Institute
 - Other:

Skip to question 6.

Parent

4. Educational level*
 - Elementary school certificate
 - Secondary school certificate
 - High school diploma
 - Bachelor's degree
 - Master's Degree/Single Cycle Degree
 - PhD

5. Job/Profession *

Skip to question 6.

Master Data

6. Age *

7. Gender *

- F
- M
- Other

8. Residence context *

- Urban center
- Urban periphery
- Provincial town
- Agricultural countryside
- Other:

Food safety

9. How important is it to you that a food is "GMO-free"? *

not at all / not very important - very important / essential [1-5]

10. How important is it to you that a food be "preservative-free"? *

not at all / not very important - very important / essential [1-5]

11. How important is it to you that a food be "dye-free"? *

not at all / not very important - very important / essential [1-5]

12. How important is it to you that a food be "gluten-free"? *

not at all / not very important - very important / essential [1-5]

13. How important is it to you that a food be "palm oil free"? *

not at all / not very important - very important / essential [1-5]

14. How important is it to you that a food be "sugar free" *?

not at all / not very important - very important / essential [1-5]

15. In your opinion, in general, the availability of health food information is: *

very poor – great [1-5]

16. How often do you inquire about health food issues *?

never/almost never – daily [1-5]

17. Where do you document yourself regarding food issues? You may indicate more than one option *

Select all applicable items.

- Social Networks/Social Media
- Radio/TV
- Newspapers, weeklies or generalist websites
- Books, journals, or scientific or educational websites
- Friends and acquaintances
- Family
- School
- Other: _____

18. A few years ago, the palm oil food case broke out. As a result of this incident, have you changed your food choices? *
- Yes (Please skip to question 19)
 - No (Please skip to question 19)
 - Don't remember
19. Why? * _____

Environment

20. In some countries of the world is underway an experiment that sees the use of viruses to fight some plant diseases. In the hypothesis that in Italy a committee of scientists promotes a referendum to authorize this technique, what would be your position? *
- before deciding I want to inform myself better (Pass to question 23)
 - I abstain (Pass question 23)
 - I am in favor because I trust the scientists (Pass to question 23)
 - I am against it even though I trust scientists (Pass question 22)
 - I am opposed because I do not trust scientists (Pass question 23)
21. Regardless of your position, what do you think the outcome of the referendum set forth in the previous question might be? *
- Approval
 - Not approved
 - Quorum not reached due to abstention

Move on to question 23.

22. Why? * _____

23. In your opinion, in general, the availability of information about the environment is: *

very poor – great [1-5]

24. How often do you inquire about environmental issues? *

never/almost never – daily [1-5]

25. Where do you document yourself on environmental issues? You may indicate more than one option *

Select all applicable items.

- Social Networks/Social Media
- Radio/TV
- Newspapers, weeklies or generalist websites
- Books, journals, or scientific or educational websites
- Friends and acquaintances

- Family
- School
- Other:

Human and environmental health

26. In your opinion, how harmful to human and environmental health is the use of pesticides? *
- not at all harmful
 - slight harm
 - moderate damage
 - high damage
 - not know how to evaluate it
27. In your opinion, how harmful to human and environmental health is the use of genetically modified products? *
- not at all harmful
 - slight harm
 - moderate damage
 - high damage
 - not know how to evaluate it
28. In your opinion, how harmful to human and environmental health is deforestation? *
- not harmful at all
 - slight harm
 - moderate damage
 - high damage
 - not know how to evaluate it
29. In your opinion, how harmful to human and environmental health is water pollution? *
- not at all harmful
 - slight damage
 - moderate damage
 - high damage
 - not know how to evaluate it
30. In your opinion, how harmful to human and environmental health is air pollution? *
- not at all harmful
 - slight damage
 - moderate damage
 - high damage
 - not know how to evaluate it
31. In your opinion, how harmful to human and environmental health are electromagnetic fields? *
- not at all harmful
 - slight damage
 - moderate damage
 - high damage
 - not know how to evaluate it
32. In your opinion, how harmful to human and environmental health is overbuilding? *
- not at all harmful
 - slight damage
 - moderate damage
 - high damage
 - not know how to evaluate it

Scientific research

33. Do you think scientific research in environmental and food science can improve the quality of our future life? *
- Yes
 - No
 - I Don't know

Agriculture

Imagine that in the field bordering your house you begin using one of the products listed below. What would be your first reaction to the use of:

- 34. Pesticides *.
 - I get scared but do nothing
 - I get scared and mobilize with the neighbors and the municipality
 - I do nothing because I suppose everything is in order
 - I inform myself
 - I ask the owner of the field for clarification
- 35. GMOs *
 - It marks only an oval
 - I get scared but I do nothing
 - I get scared and I mobilize with the neighbors and the Municipality
 - I do nothing because I suppose everything is in order
 - I inform myself
 - I ask for clarification to the owner of the field
- 36. Virus-based plant protection products*.
 - I get scared but do nothing
 - I get scared and I mobilize with the neighbors and the Municipality
 - I do nothing because I suppose everything is in order
 - I inform myself
 - I ask for clarification to the owner of the field
- 37. manure and compost *
 - It only marks an oval.
 - I get scared but do nothing
 - I get scared and I mobilize with the neighbors and the Municipality
 - I do nothing because I suppose everything is in order
 - I inform myself
 - I ask for clarification to the owner of the field
- 38. bees and pollinating insects *
 - I get scared but I do nothing
 - I get scared and I mobilize with the neighbors and the Municipality
 - I do nothing because I suppose everything is in order
 - I inform myself
 - I ask the owner of the field for clarification

- 39. Imagine that the manufacturer of your favorite food introduces a genetically modified ingredient that allows for a 20% price reduction. What would be your reaction? *
 - I renounce to the product (Go to question 40)
 - Before deciding to purchase it I want to inform myself
 - I continue to buy the product (Go to question 40)

Skip to question 41.

40. Why? * _____

Innovative therapies

- 41. Therapy based on the use of bacteriophages (a type of virus that feeds on harmful bacteria) is being tested in combating some lethal infectious diseases, such as cholera and dysentery, with promising results. Scientists anticipate similar (virus-based) therapies to combat more common diseases such as pharyngitis in the future. Assuming that in Italy a committee of scientists promotes a referendum to authorize this technique, what would be your position? *
 - before deciding I want to inform myself better
 - I abstain
 - I am in favor because I trust the scientists
 - I am against it even if I trust scientists
 - I am against it because I do not trust scientists

42. Regardless of your position, what do you think would be the outcome of the referendum set forth in the previous question? *
- Approved
 - Not approved
 - Quorum not reached due to abstention

43. This is the last question and we would like to know how often you see a tractor on your commute to school/work? *
- never
 - rarely/sometimes
 - often/every day

44. Thank you for your cooperation. If you want you can add a comment or a brief reflection on the topics covered in the questionnaire.

Thank you! For further information or questions you can contact us at the following addresses:

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