

Public Support to Flood Risk Management: Insights from an Italian Alpine Survey using Systems Thinking - Annexes

Table S1 The questionnaire translated from Italian.

code	Question	Options
Cat	The project focuses on 5 generic categories of communication and anticipation actors, choose your own or the closest one	<ul style="list-style-type: none"> • Citizen • Public administrator • Journalist / communication professional • Professional / technician (land management or flood risk sector) • Student or teacher
Q1	(risk perception) How much do you agree with the following statements?	<ul style="list-style-type: none"> • Floods are a real danger for my territory (Q1.1) • Flood events will become more frequent (Q1.2) • Risks are minimized by hydraulic defense works in the area (Q1.3) • The general population has few tools and little awareness to deal with risks (Q1.4) • In general, floods do not constitute a concrete danger for Trentino (Q1.5)
Q2	In your opinion, who is responsible for the prevention of flood risks?	<ul style="list-style-type: none"> • The Mayor and the Municipality (Q2.1) • Citizens (Q2.2) • Civil Protection Department (Fire Brigade, Geological Service, Risk Prevention Service, ...) (Q2.3) • Eastern Alps River Basin District (Q2.4) • Farmers, foresters, and others who can help keep canals or waterways clean (Q2.5) • Mountain Basins Service - PAT (Q2.6) • Urban planning and planning sector - PAT (Q2.7)
Q3	In your opinion, who is responsible for the management of flood emergencies?	<ul style="list-style-type: none"> • The Mayor and the Municipality (Q3.1) • Citizens (Q3.2) • Civil Protection Department (Fire Brigade, Geological Service, Risk Prevention Service, ...) - PAT (Q3.3) • Eastern Alps River Basin District (Q3.4) • Farmers, foresters, and others who can help keep canals or waterways clean (Q3.5) • Mountain Basins Service - PAT (Q3.6) • Urban planning and planning sector - PAT (Q3.7)
Q4	Do you remember a recent flood event (or debris flow, or other related to heavy rain) in your municipality or nearby?	<ul style="list-style-type: none"> • I don't know / I don't remember (Q4.1) • No events in my territory (Q4.2) • Yes (if yes which one) (Q4.3)
Q5	In your opinion, considering the most recent flood event in your territory or in Trentino, what were the main consequences?	<ul style="list-style-type: none"> • Loss of life (Q5.1) • Damage to agricultural activities (Q5.2) • Flooding of common areas (Q5.3) • Property damage (Q5.4) • Closure of economic activities (Q5.5) • Psychological trauma (Q5.6) • Pollution of water and / or land (Q5.7) • Interruption of drinking water and / or electricity supply (Q5.8) • 9. other (Q5.9)
Q6	In your opinion, what actions can increase flood risks in the coming years?	<ul style="list-style-type: none"> • Building close to waterways (Q6.1) • Increase in the impermeability of the territory (e.g. asphalt, pavements) (Q6.2) • Narrowing of waterways (e.g. Sub-bridges, between roads and buildings) (Q6.3) • Overexploitation of agricultural land (Q6.4) • Poor maintenance of manholes or other drainage works in urban areas (Q6.5) • Poor maintenance of the woods (Q6.6) • Poor management of waterways (e.g. Cleaning from possible obstructions) (Q6.7) • Abandonment of maintenance of hydraulic defence works (Q6.8) • Other (Q6.9)
Q7	In your opinion, what actions could improve the response to flood events in your area?	<ul style="list-style-type: none"> • Improving knowledge of risk (Q7.1) • Map the danger on the territory (Q7.2) • Monitor minor rivers and streams (Q7.3) • Build new or more robust protective structures (e.g., embankments, bridges) (Q7.4) • Create new contingency plans (Q7.5) • Compulsory flood risk insurance (Q7.6)

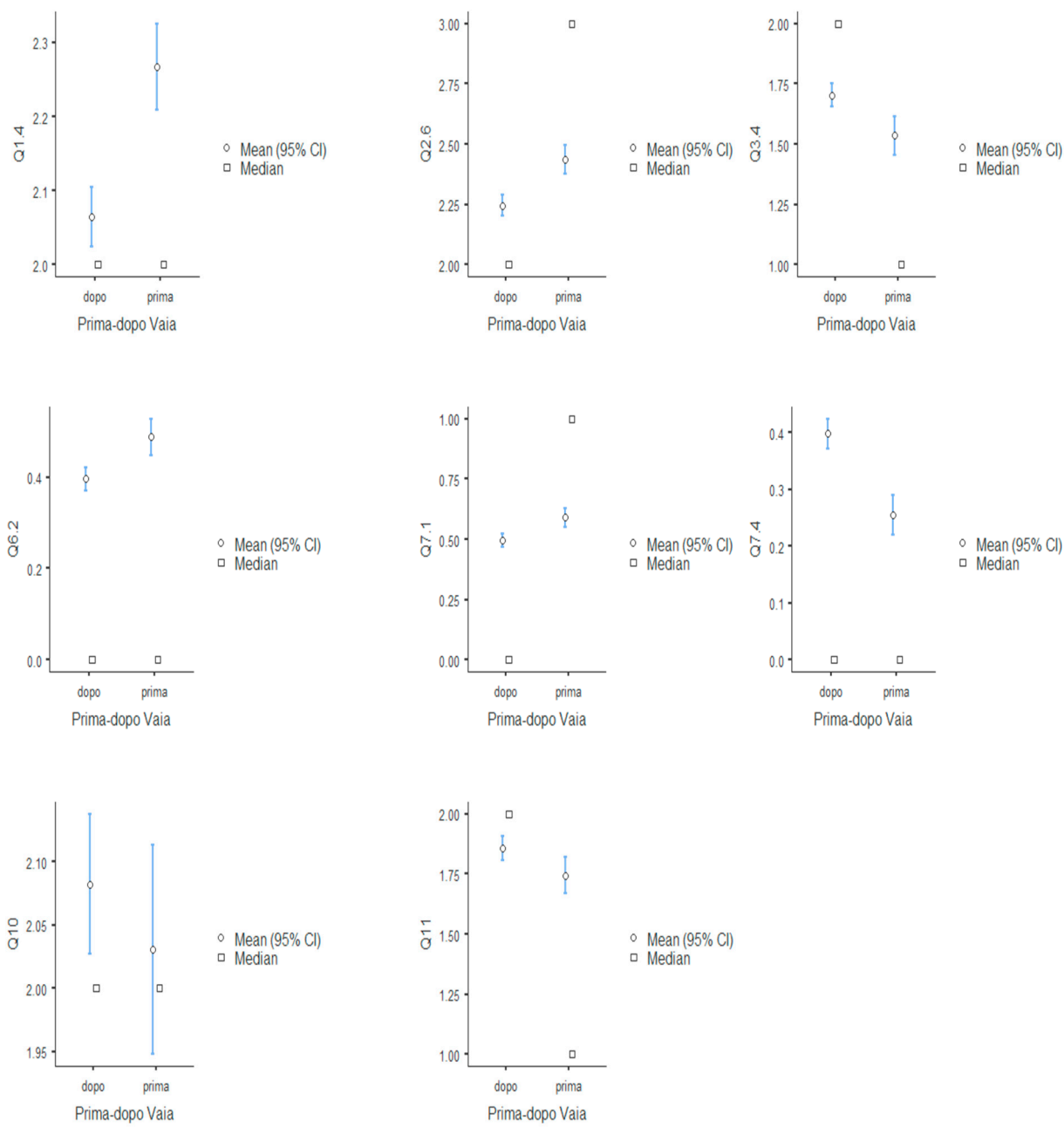
		<ul style="list-style-type: none"> • Training for local technicians and professionals (Q7.7) • Training for citizens, families, and schools on what to do / not to do in case of events (Q7.8) • Other: (Q7.9)
Q8	According to her, what behaviours should be avoided in case of heavy rainfall?	<ul style="list-style-type: none"> • Ignore forecasts and weather warnings (Q8.1) • Not caring about where to leave the car (perhaps it could obstruct the flow of water or emergency vehicles) (8.2) • Do not know the danger zones or the closest escape or gathering areas, where to go in case of need (Q8.3) • Do not worry about the risks for your underground rooms (garages, cellars) and things that they contain of value (eg cars) or dangerous (such as pesticides, paints, other substances dispersible in water) (Q8.4) • Move through the valley as usual (eg for work, school), passing over or near flooded water courses (Q8.5) • Stop near the waterways or bridges during the event to see for yourself (and take a selfie with the flood waves behind you) (Q8.6)
Q9	Do you have experience of rescue in flood events or evacuation simulations?	<ul style="list-style-type: none"> • As a volunteer (not just occasional) in Civil Protection, Fire Brigade, Red Cross or similar emergency response organizations (Q9.1) • Participated in simulations of catastrophic events (excluding simple evacuation tests) (Q9.2) • Experienced disasters involving personnel and emergency vehicles (Q9.3) • None of these (Q9.4)
Q10	If you were to evacuate tonight, how easily would you find temporary accommodation (e.g. with relatives, neighbours, etc.)?	from "No difficulty" (1) to "Notable difficulty" (4)
Q11	If a notice from the Mayor arrives to evacuate the area where you live, would you do it immediately?	From "Certainly, the Mayor has the responsibility and adequate information" (1) to "After evaluating with my or other information" (4)

Table S2 Significant differences in questionnaire responses based on selected variables.

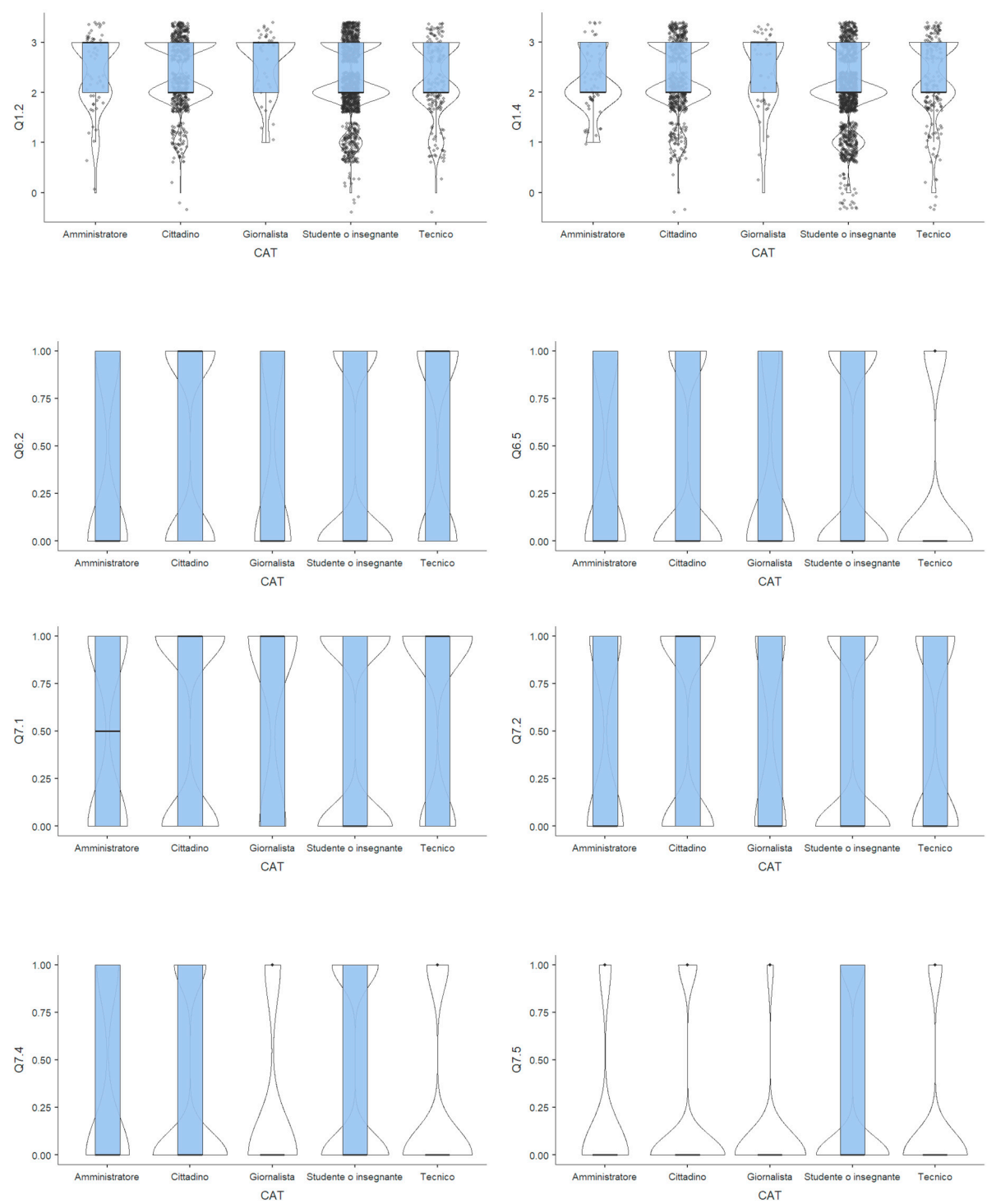
Variable	Q1	Q2	Q3	Q6	Q7	Q10	Q11
Before/after Vaia ^a	Q1.4	Q2.6	Q3.4	Q6.2	Q7.1 Q7.4	P 0.371	P 0.007
Cat - Respondent category ^b	Q1.2 Q1.4	Q2.2, Q2.5, Q2.6, Q2.7	Q3.4, Q3.6, Q3.7	Q6.2 Q6.5	Q7.1, Q7.2 Q7.4, Q7.5	P < .001	P < .001
Q9 Experience ^a	-	Q2.6	-	-	-	P 0.051	P 0.030
Gender ^a	Q1.3	Q2.4	Q3.2, Q3.4 Q3.5, Q3.6 Q3.7	Q6.5	Q7.5	P < .001	
Level of education ^b	Q1.2, Q1.4 Q1.5	Q2.2, Q2.5 Q2.6, Q2.7	Q3.1, Q3.3 Q3.4, Q3.6 Q3.7	Q6.2 Q6.5 Q6.7	Q7.1, Q7.2 Q7.3, Q7.4	P 0.008	P < .001
Age ^b	Q1.2 Q1.4	Q2.2, Q2.4 Q2.5, Q2.6 Q2.7	Q3.1, Q3.4 Q3.6, Q3.7	Q6.2 Q6.5	Q7.1, Q7.2 Q7.4, Q7.5 Q7.8	P < .001	P < .001
Geographical area ^b	Q1.4	Q2.6	-	-	Q7.4	P < .001	P 0.012

^a U Test of Mann-Whitney, for independent samples, with P < .001; ^b ANOVA non-parametric, Kruskal-Wallis Test with P < .001.

Figures S1 Descriptive plots about the Vaia windstorm impact on variables (“dopo” = after, “prima” = before).



Figures S2 Descriptive box plots about the differences among the respondent categories
(“Amministratore” = public administrator; “Cittadino” = citizen; “Giornalista” = journalist or communication professional; “Studente o insegnante” = student or teacher; “tecnico”= technician or expert)



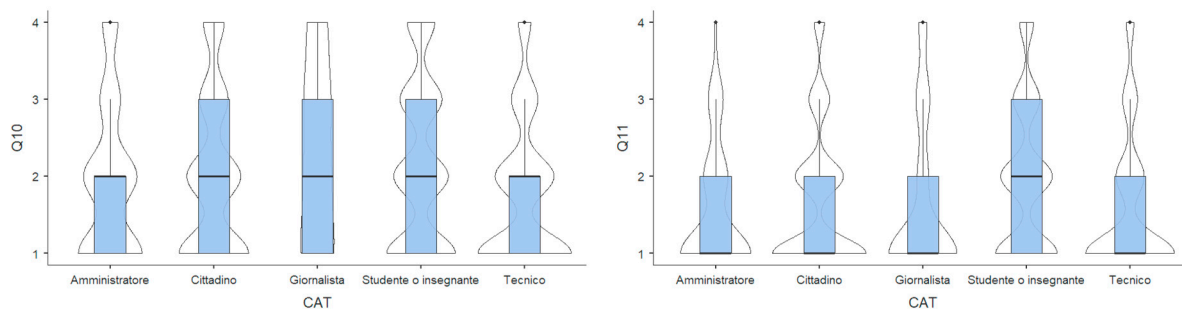
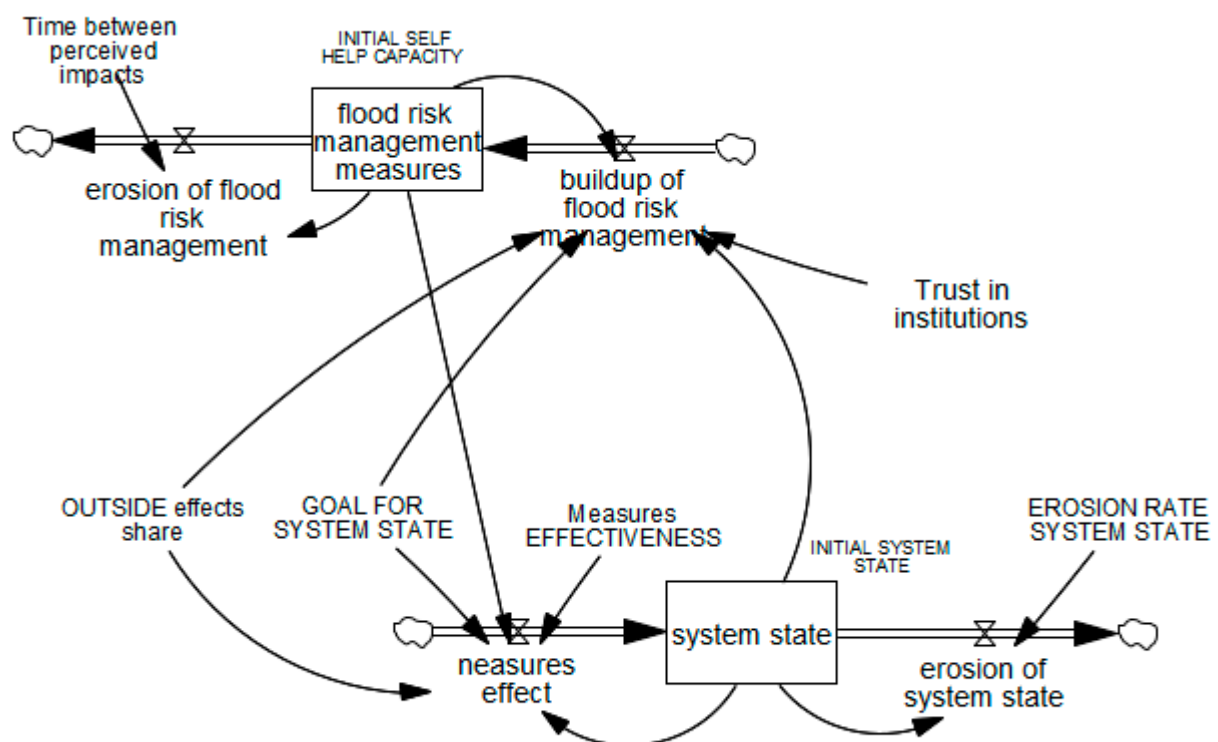


Figure S3 The simulation model.



Model documentation

(01) buildup of flood risk management= Trust in institutions*flood risk management measures*((1-OUTSIDE effects share)*(GOAL FOR SYSTEM STATE-system state))

Units: capacity/Month

(02) erosion of flood risk management= Time between perceived impacts*flood risk management measures

Units: capacity/Month

(03) erosion of system state= EROSION RATE SYSTEM STATE*system state

Units: state/Month

(04) EROSION RATE SYSTEM STATE=0.2

Units: 1/Month

(05) FINAL TIME = 100

Units: Quarter

The final time for the simulation.

(06) flood risk management measures= INTEG (+buildup of flood risk management-erosion of flood risk management, INITIAL SELF HELP CAPACITY)

Units: capacity

(07) GOAL FOR SYSTEM STATE=2

Units: state

(08) INITIAL SELF HELP CAPACITY=1

Units: capacity

(09) INITIAL SYSTEM STATE= 1

Units: state

(10) INITIAL TIME = 0

Units: Quarter

The initial time for the simulation.

(11) Measures EFFECTIVENESS= 1

Units: 1/(Month*capacity)

(12) neasures effect=

Measures EFFECTIVENESS*flood risk management measures*((1-OUTSIDE effects share)*(GOAL FOR SYSTEM STATE-system state))

Units: state/Month

(13) OUTSIDE effects share = 0.7

Units: Dmnl

(14) SAVEPER = TIME STEP

Units: Quarter [0,?]

The frequency with which output is stored.

(15) system state= INTEG (measures effect-erosion of system state, INITIAL SYSTEM STATE)

Units: state

(16) Time between perceived impacts= 0.2

Units: **undefined**

(17) TIME STEP = 0.05

Units: Quarter [0,?]

The time step for the simulation