20th Annual Climate Prediction Applications Science Workshop

The Socioeconomic Value of Weather Information: The Case Study of the Households in Taiwan

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Outline

1. Background
2. Research Process & Survey design
3. Survey Results
4. Conclusions

Background

WHY DO PEOPLE WATCH WEATHER FORECASTS?

WHAT INFORMATION DO PEOPLE WANT TO GET?

HOW DO PEOPLE **INTERPRET** WEATHER INFORMATION?

WHAT ACTION DO PEOPLE TAKE AFTER GETTING THE INFORMATION?

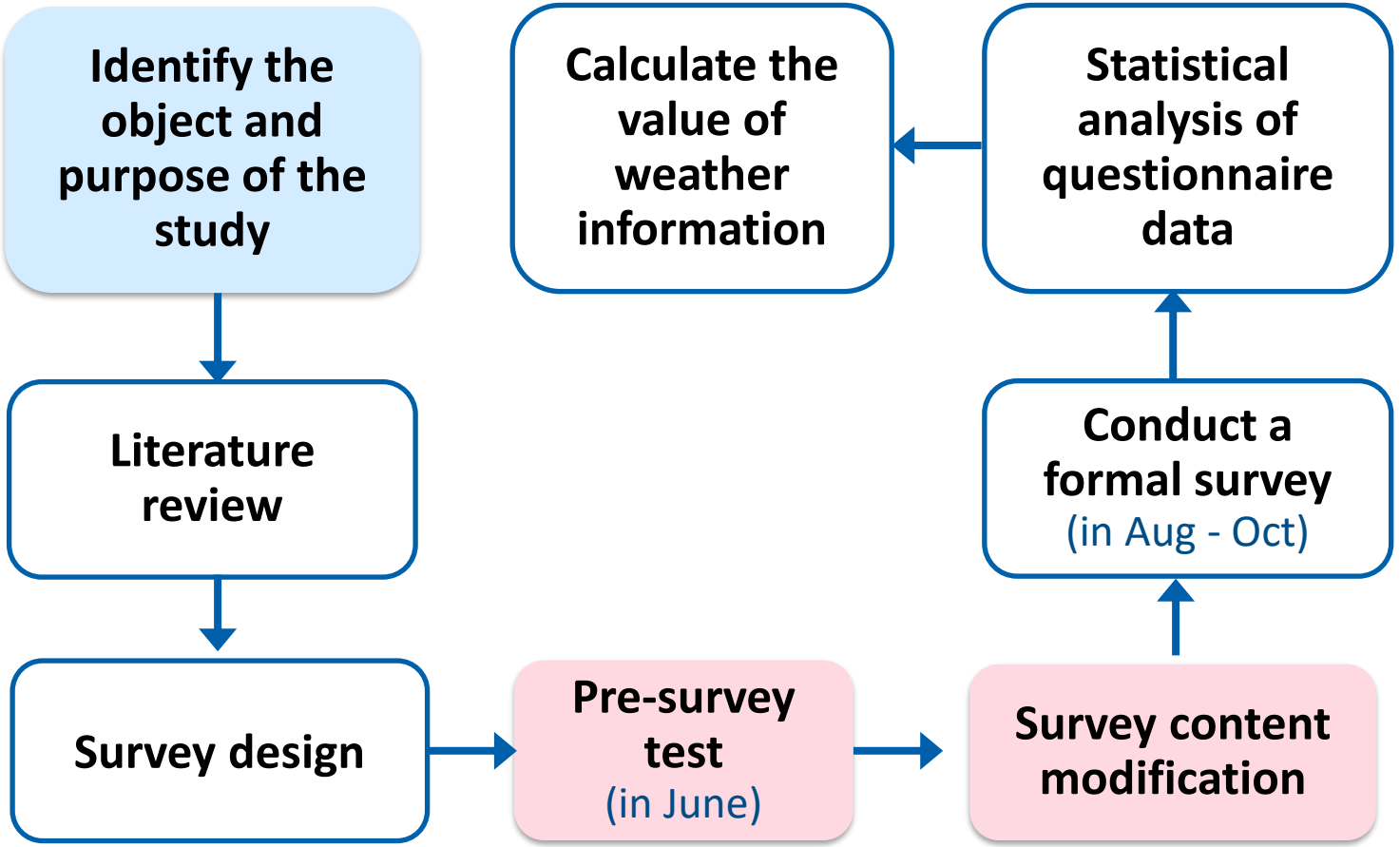
WHERE DO PEOPLE **ACCESS** THE INFORMATION?

- The value of weather information not only comes from advanced technology and accurate observations, but also depends on how people apply weather information to improve the convenience, comfort, and safety of their lives.
- The content of weather information, receiving channels, as well as people's personal characteristics, socioeconomic background, and environmental experience will affect people's degree of trust and evaluation of weather information.
- To reveals the application and the importance of the weather information, this study conducted telephone surveys for the public in six special municipalities and other 16 counties/cities (non-six special municipalities) in Taiwan in 2020 and 2021, respectively.

Funding source: This research was funded by Meteorological Information Center, Central Weather Bureau, Taiwan .

Research Process & Survey Design

The Research Process of the Evaluation of Public Weather Information



Research Methodology

- Contingent Valuation Method (CVM)

Survey Methodology

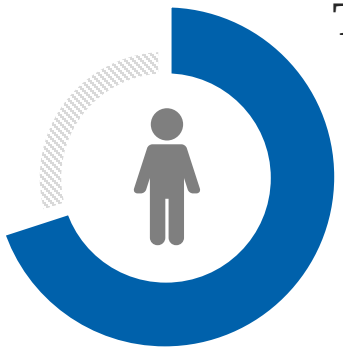
- Telephone Interviews for those who are over 20 years old.
- **2020 Survey:** 6,416 respondents in six special municipalities; each municipality has at least 1,068 respondents.
- **2021 Survey:** 6,013 respondents in the other 16 counties/cities (non-six special municipalities); it is sampled according to the population ratio of each county/city.

Surveys in municipality and non-municipality areas

A municipality is a living area that integrates population, economic industry, transportation network, ecological environment,… etc., and accelerates the trend of population concentration in municipality areas.

Land Area of Taiwan:
3.62 million hectares

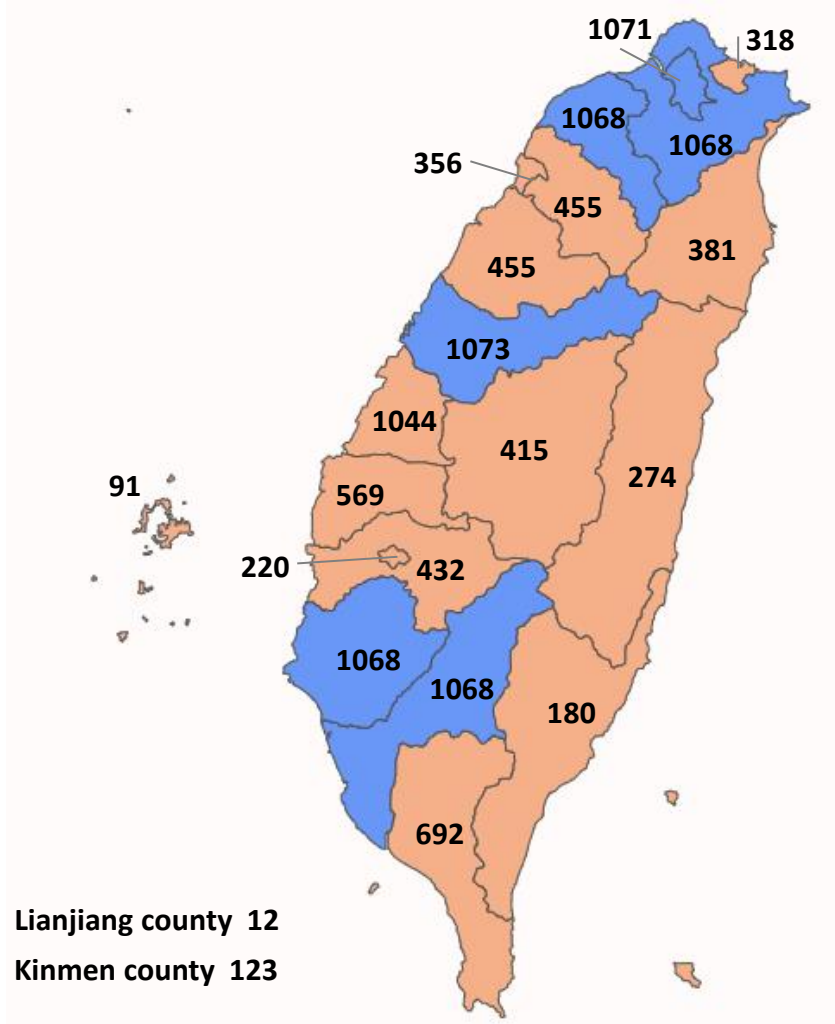
six special municipalities account for
30%



Total Population of Taiwan:
23.58 million people

six special municipalities account for
70%

Numbers of survey respondents and the geographic distribution



Lianjiang county 12

Kinmen county 123

Survey Design (the common questions in 2020 and 2021 surveys)

Watching / Getting Weather Forecasts	• From What Channels? • What Information? • How Often? • What Purpose?
People's Point of View for CWB	• Degree of Influences of Weather Forecasts on Daily Life • The Degree of Satisfaction on CWB Weather Forecasts
The Values of Weather Forecasts	• The WTP of Current Weather Forecasts ◦ The reason for WTP=0
The Applications of Weather Forecasts	• The Needs for Weather Application Services? In What Aspects? • The WTP for the Weather Application Services
Personal Information	• The Characteristics of Interviewees: gender, age, education, job, transportation methods, income…,etc.

Survey Results

Basic Information of Interviewees – Gender, Age, and Education

Six special municipalities (2020 survey)							Non-six special municipalities (2021 survey)				
Taipei	New Taipei	Taoyuan	Taichung	Tainan	Kaohsiung		Northern	Central	Sothern	Eastern	Outer islands
1,071	1,068	1,068	1,073	1,068	1,068	No. of Observations	1,580	2,680	692	835	226
						Gender (%)					
39.68	44.66	45.13	41.94	44.19	41.10	Male	43.04	47.31	41.91	45.03	53.54
60.32	55.34	54.87	58.06	55.81	58.90	Female	56.96	52.69	58.09	54.97	46.46
						Age (%)					
7.84	10.49	10.39	9.13	8.80	7.40	20-29	7.78	7.65	7.08	6.47	8.41
7.75	10.96	11.42	11.74	10.58	10.77	30-39	8.10	10.00	6.65	8.14	6.19
13.91	15.73	18.07	16.96	17.23	15.26	40-49	12.78	13.77	13.44	11.50	13.72
25.21	26.22	23.69	25.82	25.37	24.16	50-59	25.19	24.81	27.17	25.39	23.45
26.24	23.78	24.34	25.82	23.69	27.34	60-69	27.53	26.94	29.91	28.50	26.99
18.77	12.64	11.70	10.25	13.95	14.61	≥ 70	18.54	16.83	15.46	19.88	21.24
						Educational level (%)					
4.11	6.46	7.40	5.78	7.40	7.40	Elementary School (And below)	7.66	11.83	8.67	7.66	11.95
5.70	8.90	6.84	6.71	7.68	6.74	Junior high	8.99	12.54	10.84	9.58	15.49
22.41	25.37	27.53	30.29	29.87	30.71	Senior high	28.48	30.37	33.96	31.26	30.09
15.22	16.10	14.89	15.38	15.07	17.32	Junior college	12.97	13.92	15.90	15.57	11.50
39.03	34.46	34.36	31.78	31.37	30.15	University	31.77	25.04	23.70	27.07	24.34
13.54	8.61	8.90	10.07	8.61	7.68	Master and above	9.62	5.71	6.07	8.26	5.75

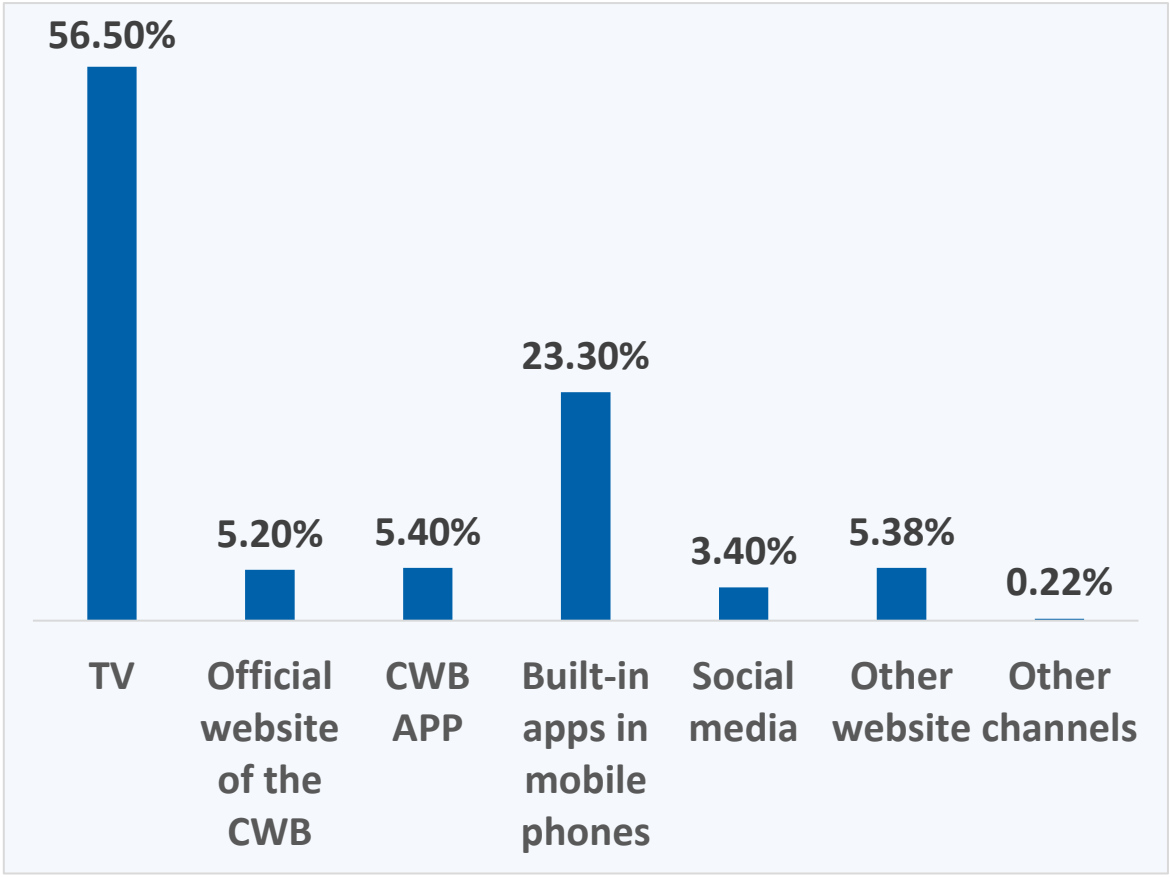
Basic Information of Interviewees – Occupation

Six special municipalities (2020 survey)							Non-six special municipalities (2021 survey)				
Taipei	New Taipei	Taoyuan	Taichung	Tainan	Kaohsiung	Occupation (%)	Northern	Central	Sothern	Eastern	Outer islands
0.19	0.66	1.50	3.26	3.93	3.00	Agriculture, forestry, fishing and animal husbandry	5.19	18.81	20.66	10.90	8.41
1.87	6.74	11.05	12.67	13.01	9.18	Traditional manufacturing	9.11	13.25	6.94	3.71	5.75
3.64	4.87	6.84	2.98	2.15	3.37	Information/electronics	6.90	1.19	0.29	1.56	0.88
3.45	3.56	3.75	3.45	3.37	3.46	Construction/engineering	2.59	3.06	4.19	3.11	2.65
25.68	28.75	25.28	26.84	26.12	23.50	Service industry (including commercial)	18.35	20.11	23.55	25.03	21.68
5.88	5.15	3.56	2.61	2.53	2.06	Finance and insurance	1.65	1.42	0.87	1.80	0.44
1.12	0.84	1.78	1.49	1.50	1.87	Transportation and warehousing	1.14	0.97	1.16	0.60	0.88
6.63	6.74	6.65	7.08	8.90	5.99	Army, police, public sector and education	8.10	6.16	6.50	10.06	14.16
2.99	3.65	2.72	2.24	2.25	2.81	Student	2.22	2.84	1.88	1.44	4.87
10.92	10.67	9.74	11.56	9.64	12.45	Homemaker	15.57	12.99	14.74	14.01	12.39
2.99	2.90	1.97	2.33	1.97	2.81	Unemployed	2.72	1.60	1.30	2.04	0.44
33.89	24.91	24.25	22.65	23.69	29.03	Retired	26.14	17.57	17.77	25.75	27.43

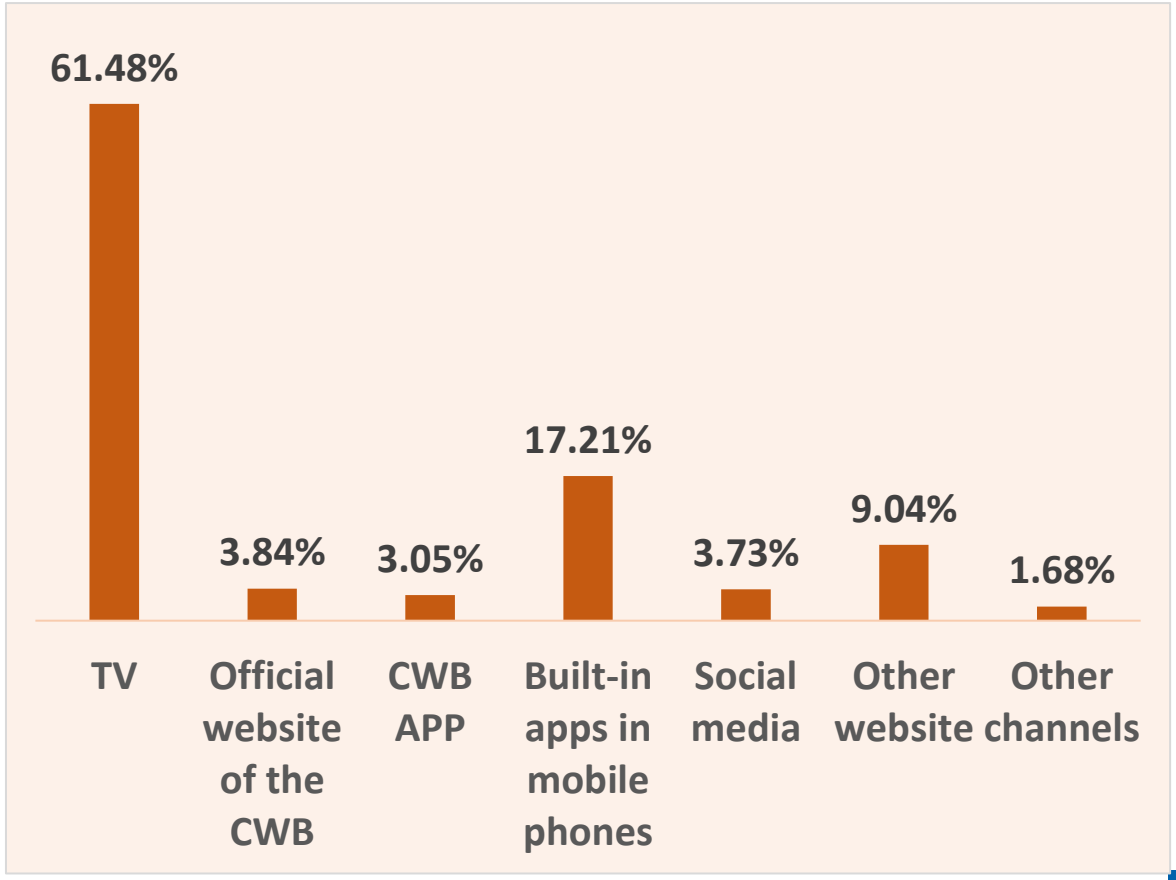
Channels to Access Weather Forecasts

- Overall, TV stations are the most used channel for interviewees to access weather forecasts, followed by built-in apps in mobile phones.

Six special municipalities (2020 survey)

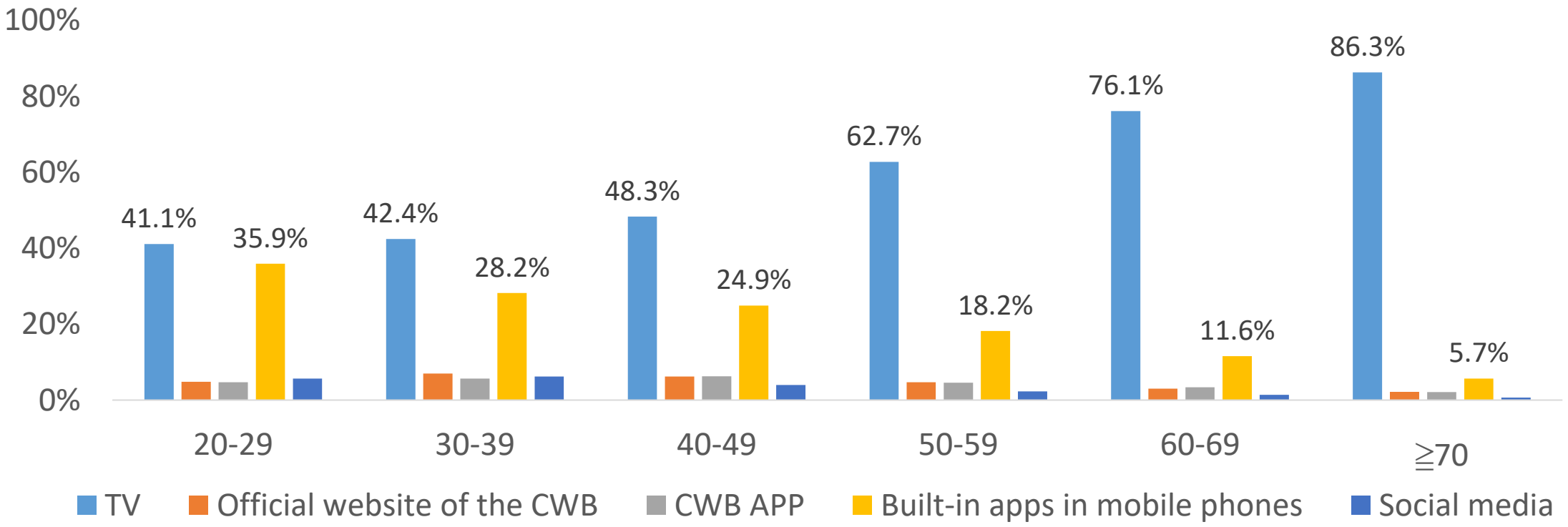


Non-six special municipalities (2021 survey)



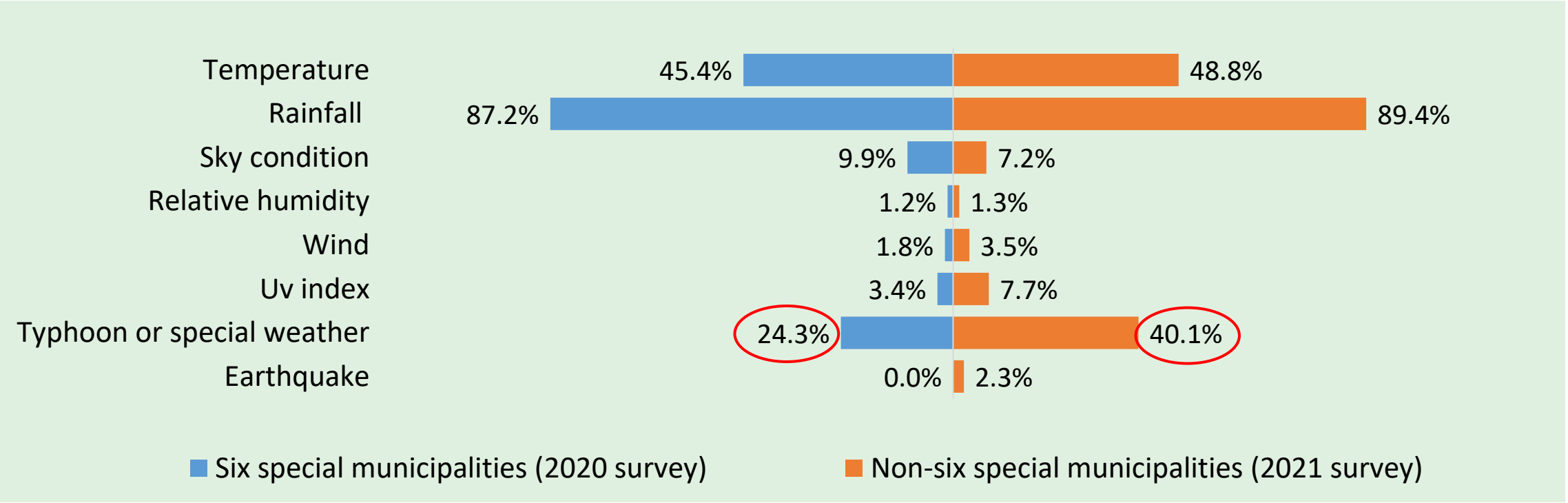
Channels to Access Weather Forecasts
– by different age groups (combined national data)

- Elder generation is more likely to access weather information through TV.
- Younger generation is more likely to access weather information through new distribution channels (such as apps, websites and social media).



Weather Information that Interviewees Are Concerned About

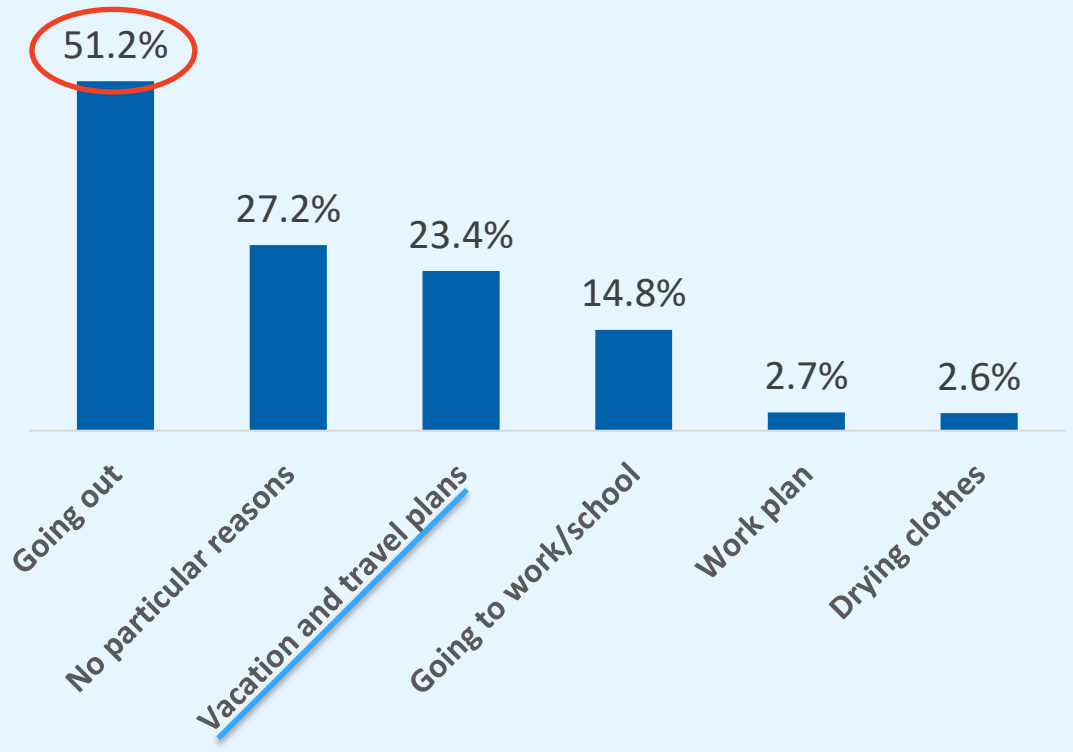
- Most people in Taiwan are concerned about "rainfall" and "temperature."
- "Typhoon or special weather" ranks the third, interviewees in non-six special municipalities have higher degree of concerns (40.1% vs. 24.3%).



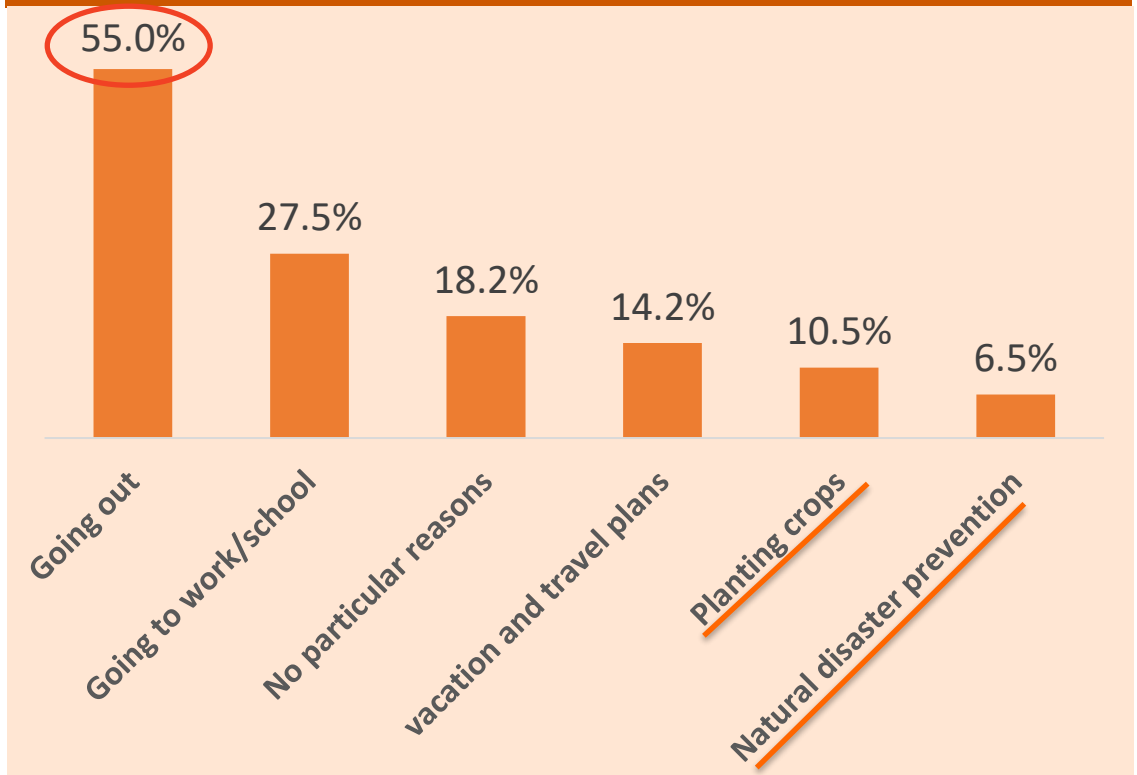
Purposes of Accessing Weather Information (top 6)

- "**Going out**" is the top 1 reason for accessing weather information.
- For interviewees in non-six special municipalities, "**planting crops**" is a very important purpose for the interviewees to access weather information, which may be related to the industry structure of non-six special municipalities. "**Natural Disaster Prevention**" is an important purpose as well.

Six special municipalities (2020 survey)

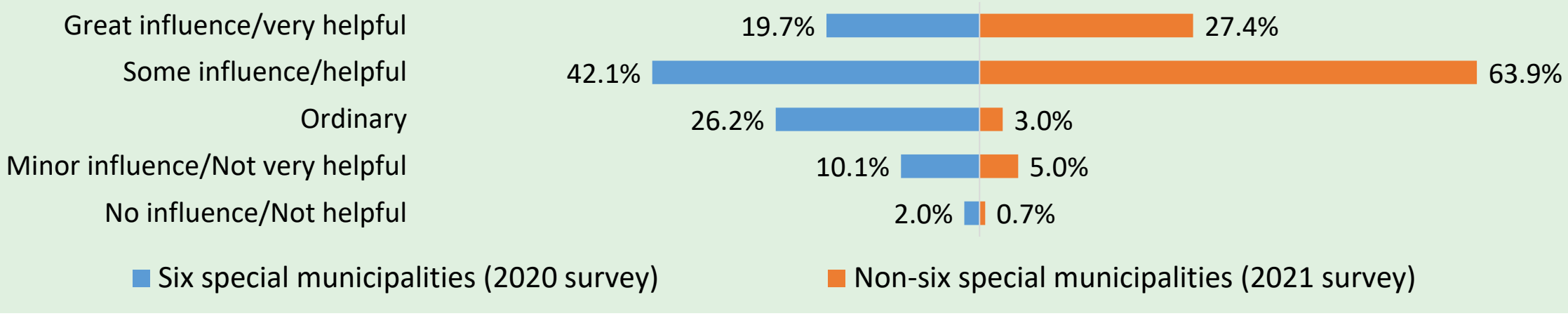


Non-six special municipalities (2021 survey)

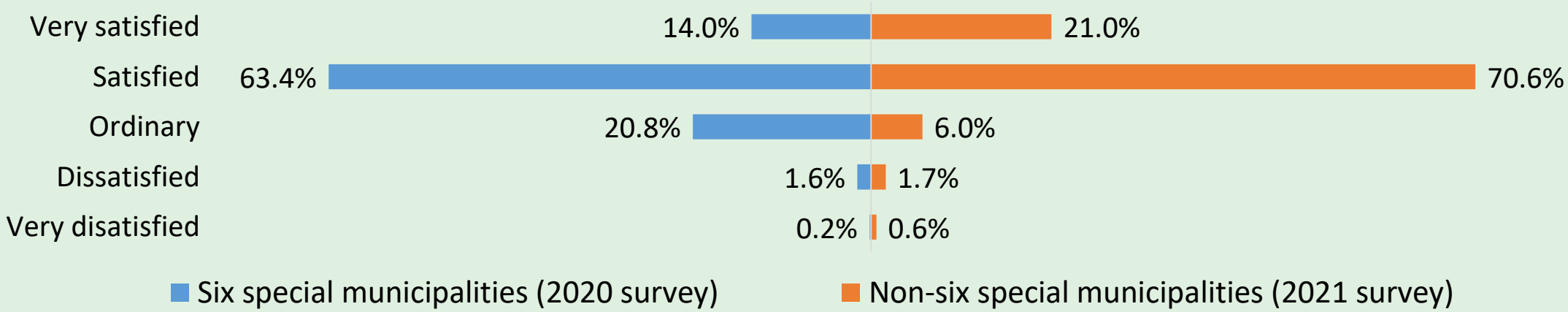


Interviewees' Subjective Rating of Weather Forecasts

Degree of Influences of Weather Forecasts on Daily Life



Degree of Satisfaction on CWB Weather Forecasts

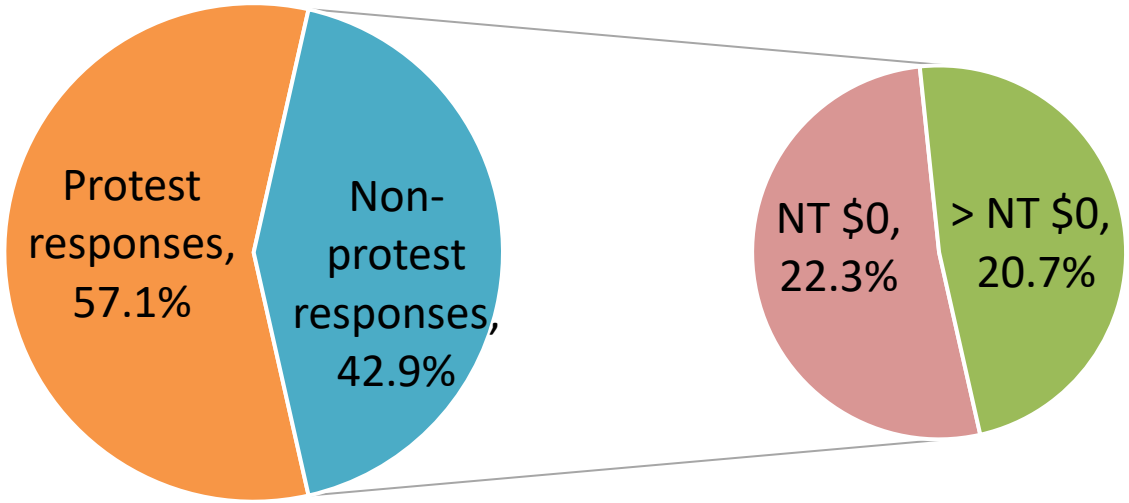


Interviewees' Willingness-to-pay (WTP) for Weather Forecasts

- The proportion of non-protest responses are similar in six special municipalities and non-six special municipalities.
- Focusing on the non-protest responses, a higher proportion of interviewees from non-six special municipalities are willing to pay for weather forecast information. However, the average WTP is lower in the non-six special municipalities (34.48 NTD vs. 39.55 NTD).

Six special municipalities (2020 survey)

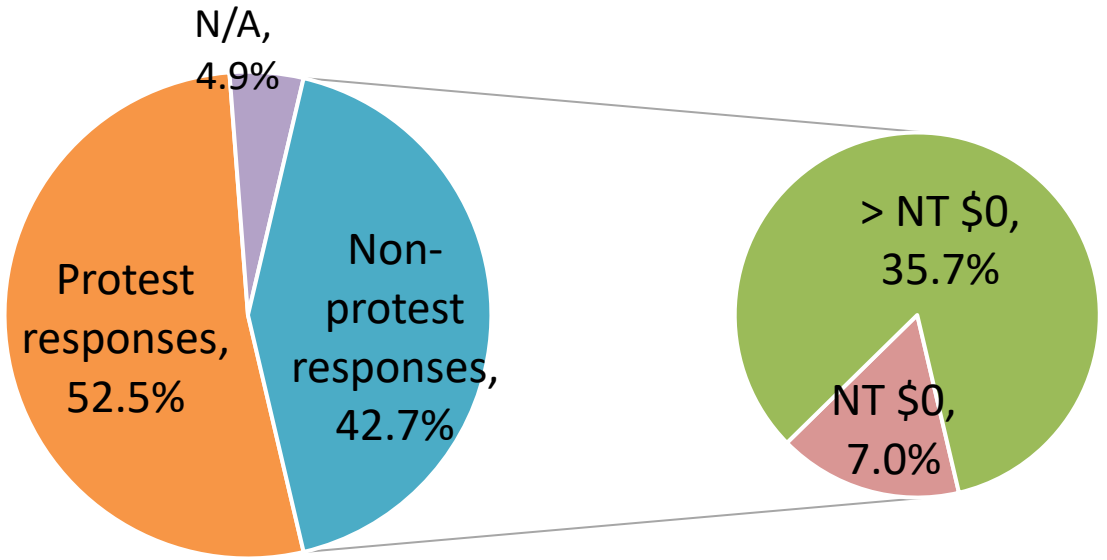
Weighted sample size n=8,598
After removing protest response, n=3,691



Average willing-to-pay (WTP) per person per month = 39.55 NTD

Non-six special municipalities (2021 survey)

Weighted sample size n=3,806
After removing protest response, n= 1,623

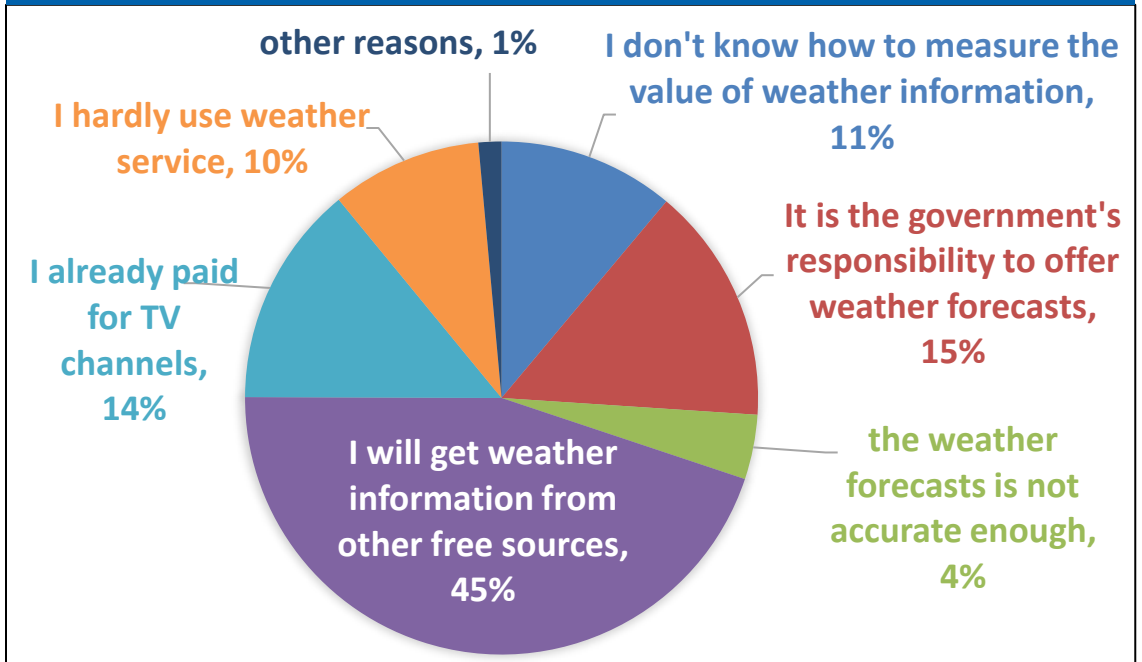


Average willing-to-pay (WTP) per person per month = 34.48 NTD

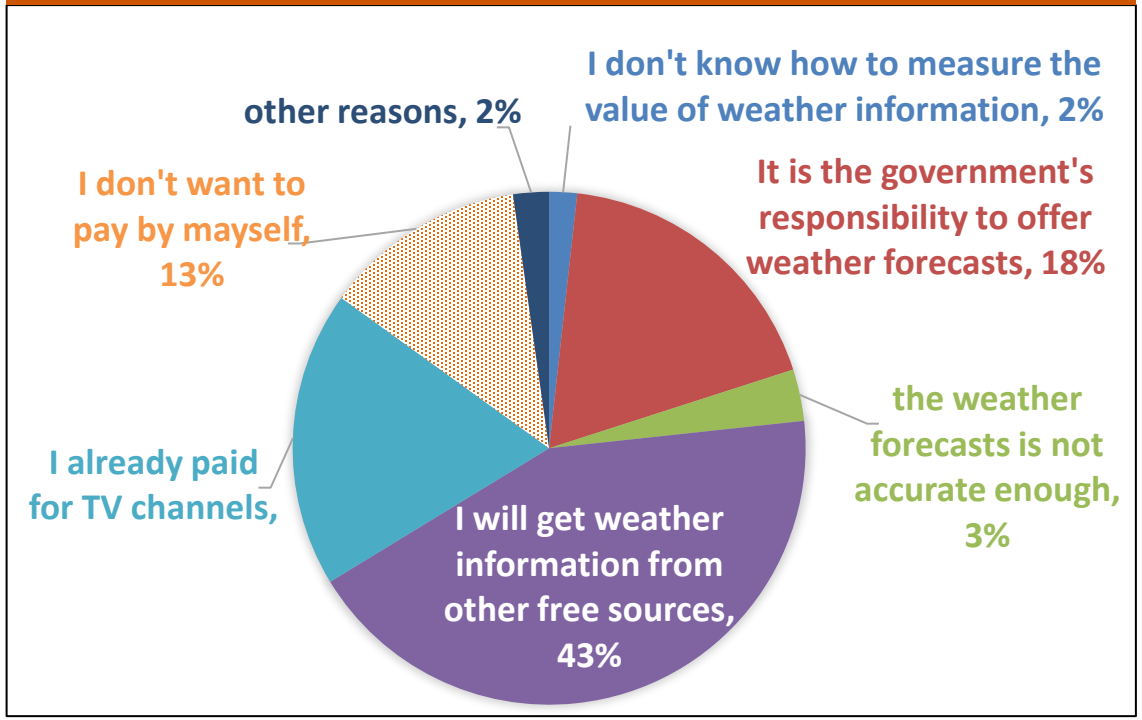
Protest Responses and Possible Reasons

- **Protest responses (protest bids):** The interviewee states a zero bid not because he/she thinks the weather information is worthless, but because of other reasons.
- In our research, the **top 3 reasons** for being the protest responses are "**getting weather information from other free sources**," "it is the **government's responsibility**," and "**I already paid for TV channels**."

Six special municipalities (2020 survey)

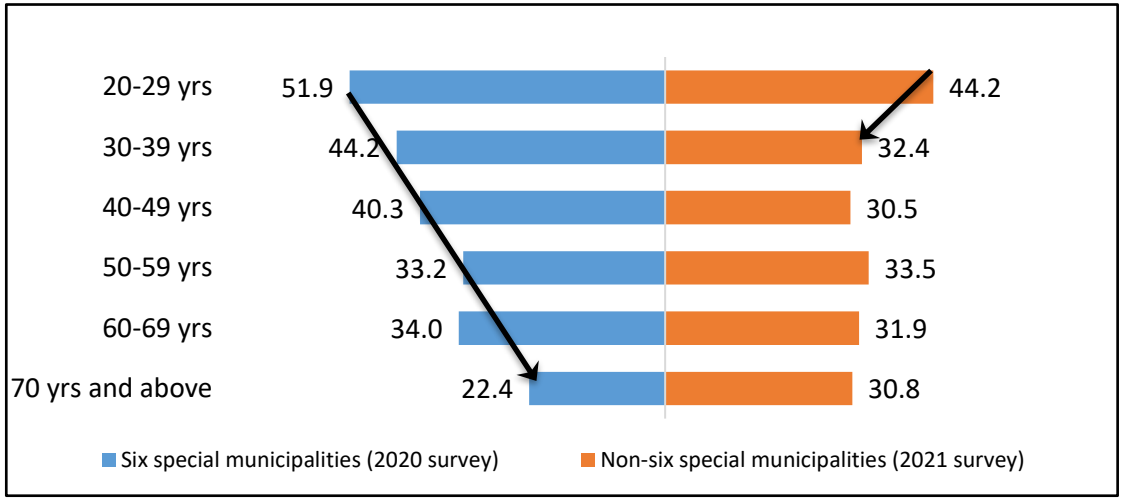


Non-six special municipalities (2021 survey)

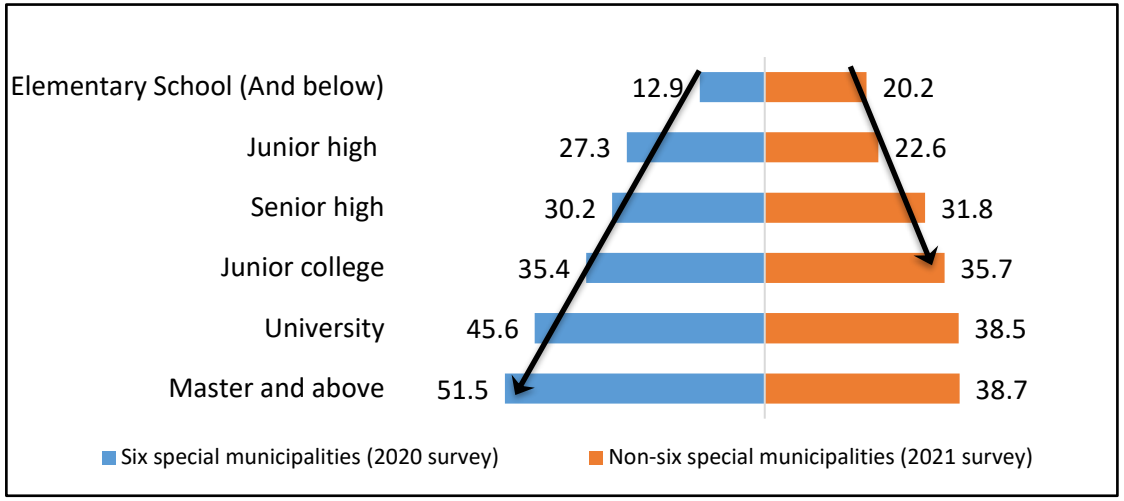


WTP and Interviewees' Socioeconomic Background

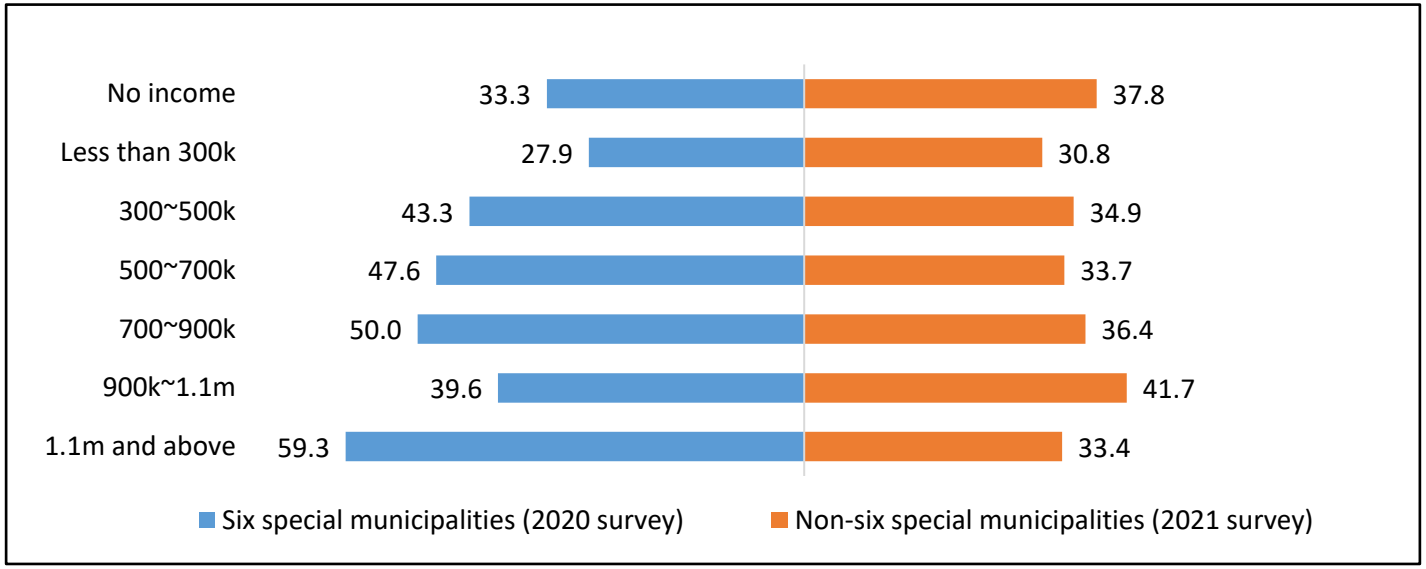
WTP vs. Age



WTP vs. Education



WTP vs. Income



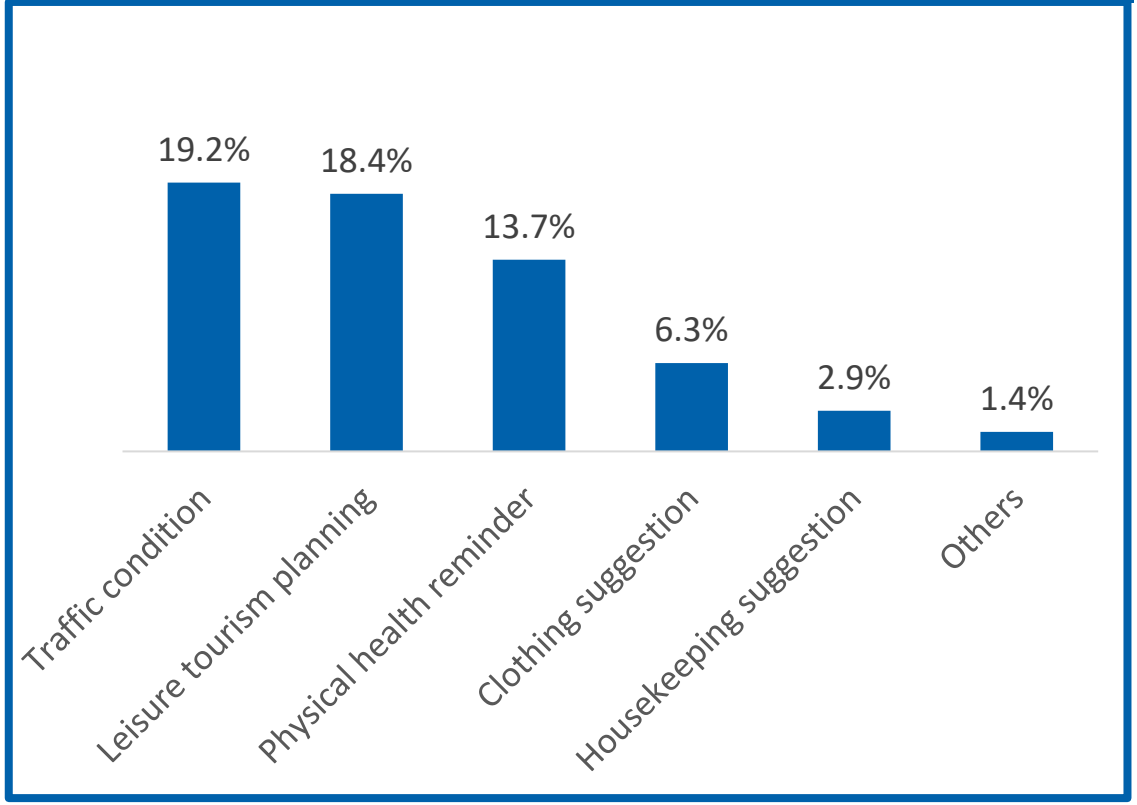
Do people need value-added weather application services and how much are they willing to pay?

- 63.4% of interviewees in non-six special municipalities needed value-added weather application services, which is much higher than that of six special municipalities (42.4%).
- 35.7% of the interviewees in non-six special municipalities are willing to pay for the weather application services, which is higher than that of six special municipalities (17.4%). However, the average WTP in the six special municipalities (NTD 39.30) was higher than that of non-six special municipalities (NTD 27.76).

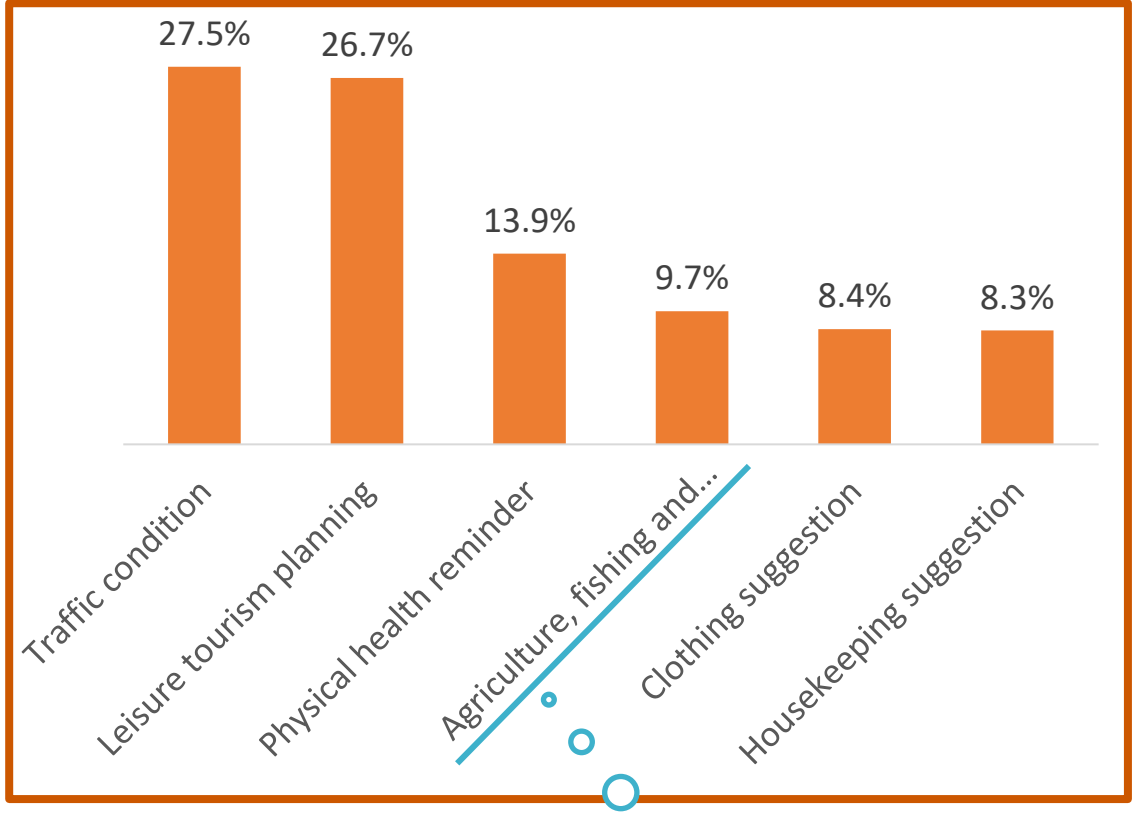
	Six special municipalities		Non-six special municipalities	
Weighted sample size	8,598	100%	3,806	100%
Do you need value-added weather application services?				
No	4,957	57.6%	1,393	36.6%
Yes	3,642	**42.4%**	2,412	**63.4%**
How much are you willing to pay for the value-added weather application services? (for "YES" group)				
N/A	343	4.0%	125	3.3%
0	1,801	20.9%	928	24.4%
Above 0 (offering a price)	1,498	**17.4%**	1,360	**35.7%**
Average willing-to-pay price (NT$)	**39.30**		**27.76**	

In What Aspects Do People Want Weather Information to Applied to?

Six special municipalities (2020 survey)



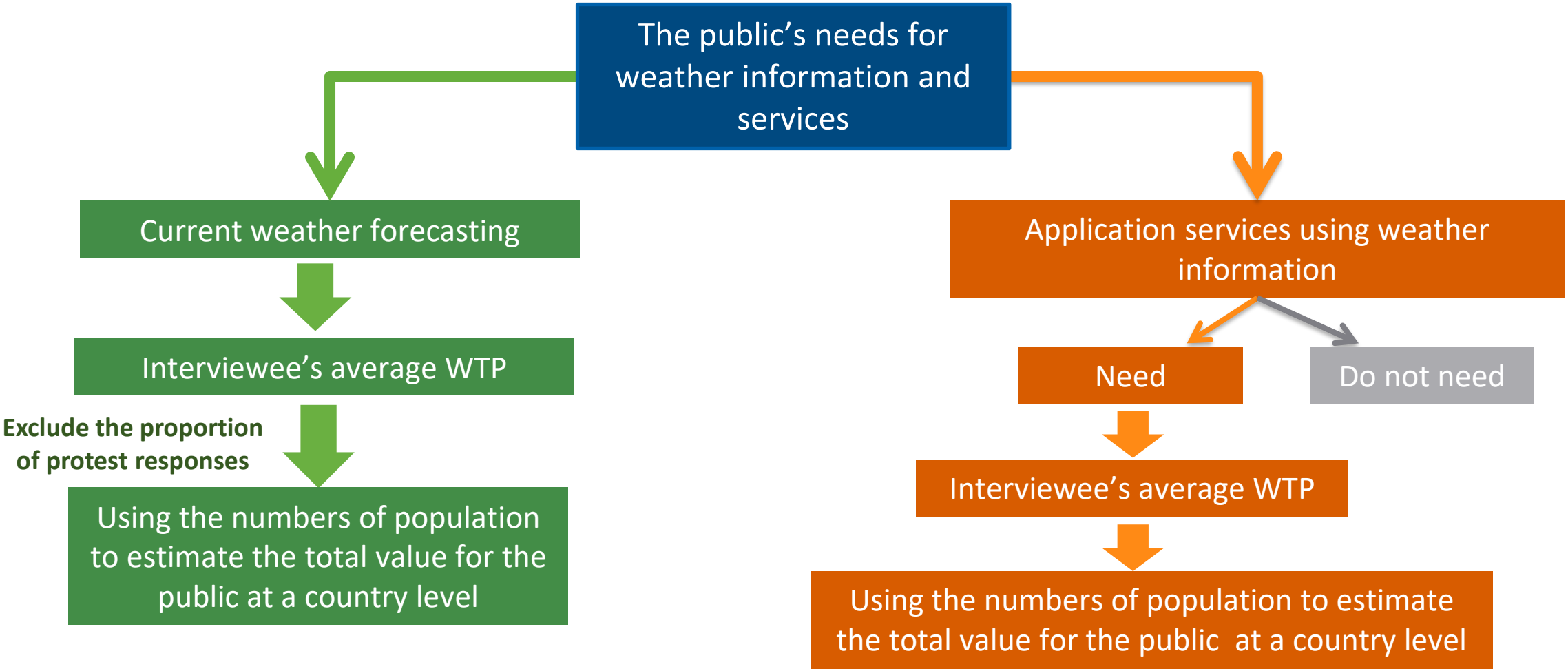
Non-six special municipalities (2021 survey)



Especially in central & southern Taiwan

Calculate the Value of Weather Information from the Public Point of View

- Use contingent valuation method (CVM) and ask the user's willingness-to-pay through survey.



The Value of Weather Information

The Value of Weather Forecasts
(value of marketization)

	Average WTP per person per month (NTD)
Six special municipalities	39.55
Non-six special municipalities	34.48

The Value of Weather Application
(potential value – to be realized)

	Average WTP per person per month (NTD)
Six special municipalities	39.30
Non-six special municipalities	27.76

Calculate the value at a country level using population data

Calculate the value at a country level using population data

Estimation of potential value of weather information (conservative scenario)

Unit: bn NTD/year

	Value of weather Forecasts		Value of weather application		Total (in the long run)
Six special municipalities	2.53~2.94	+	2.46~2.91	=	4.99~5.85
Non-six special municipalities	0.98~1.29	+	1.16~1.36	=	2.14~2.49

* **Conservative scenario**: exclude the public who might belong to the protest responses and the public who did not need value-added application services.

Conclusions

Conclusions

- It is found that **the channels to access weather information vary by age groups**. Our survey results show that **"TV station" was the most important channel** for interviewees to obtain weather information, which my due to the fact that **the survey was conducted through home phones,** and it is therefore easily to reach elder interviewees. However, it is also found that **younger generation is more likely to use "Built-in apps in mobile phones"** to access weather information.
- **People's WTP for weather information may differ from their personal characteristics**. For example, age has a negative effect on the WTP amount while education has a positive impact.
- six special municipalities and non-six special municipalities are different in regional environments and industry structure, and therefore lead to differences in the demand for or application of weather information services.
  - For example, people in non-six special municipalities are more concerned about typhoon or special weather (for disaster prevention) as well as the information in agriculture-related applications.
- To make weather services closer to the needs of the public, **a more detailed investigation of the weather service needs of the people in specific groups or regions should be carried out**.

Thank you!