Supplementary Information

Operationalizing Climate Change Adaptation Literacy through Framework Development and National Population Evidence from Taiwan

Supplementary Table S1. Questionnaire mapping and knowledge-item wording

Code	Subdimension	Question IDs	Response format
1-1	Definition and goals	Q1, Q2	Knowledge
1-2	Adaptation versus mitigation	Q3; Q12	Knowledge; reverse-scored agreement
1-3	Adaptation versus disaster risk reduction	Q4, Q5	Knowledge
1-4	Necessity and urgency	Q13–Q16	Agreement; Q16 reversed
1-5	Long-term costs and benefits	Q17, Q18	Agreement
1-6	International adaptation directions	Q6, Q10	Knowledge
2-1	National adaptation law	Q7	Knowledge
2-2	National adaptation policy	Q8, Q9, Q11	Knowledge
2-3	Adaptation planning	Q19, Q20	Agreement
3-1	Risk assessment and management	Q25, Q26	Frequency
3-2	Perceived implementation role	Q27, Q28	Frequency
3-3	Civic action	Q29, Q30	Frequency
3-4	Cross-sectoral cooperation	Q21, Q22	Agreement
4-1	Local strategies and resources	Q31, Q32	Frequency
4-2	Everyday-life planning	Q23, Q24	Agreement
4-3	Proactive adaptive capacity	Q33, Q34	Frequency

Question numbers refer to the final Mandarin questionnaire. The instrument contains 11 knowledge questions (Q1–Q11), 13 agreement questions (Q12–Q24), and ten frequency questions (Q25–Q34). English wording is a translation for reporting.

Q1 (1-1)

氣候變遷調適的意思就是要減少碳排放。

Climate change adaptation means reducing carbon emissions.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q2 (1-1)

社會的脆弱度與氣候變遷調適成效的相關度不高。

Social vulnerability has little relationship with the effectiveness of climate change adaptation.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q3 (1-2)

發展耐旱作物是一種氣候變遷「減緩（減碳）」還是「調適」的作為？

Is developing drought-resistant crops a mitigation (carbon reduction) or adaptation measure?
Response options: Mitigation (carbon reduction); Adaptation; Do not know/refuse.
Keyed answer: Adaptation.

Q4 (1-3)

政府為了因應未來可能增加的降雨量，重新設計排水系統。這是哪種氣候行動？

The government redesigns drainage systems in response to possible future increases in rainfall. What type of climate action is this?
Response options: Adaptation; Disaster prevention; Do not know/refuse.
Keyed answer: Adaptation.

Q5 (1-3)

面對未來的氣候變遷衝擊，運用防災經驗就可以妥善面對。

Experience in disaster prevention alone is sufficient to address future climate change impacts.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q6 (1-6)

我國的氣候變遷調適措施可以基本上比照西歐與北歐國家的實施計畫。

Taiwan can largely follow the implementation plans of Western and Northern European countries for its adaptation measures.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q7 (2-1)

為了因應氣候變遷，我國法規只規範政府的義務，並未提及民眾或企業的角色。

Taiwan’s climate change legislation specifies only government obligations and does not address the roles of citizens or businesses.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q8 (2-2)

制定全國性的氣候變遷調適政策與計畫，是地方政府的責任。

Developing national climate change adaptation policies and plans is the responsibility of local governments.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q9 (2-2)

氣候變遷調適政策應全國一體適用，不因特定族群的需求而調整。

Climate change adaptation policy should apply uniformly nationwide without adjustment for the needs of specific groups.
Response options: Yes; No; Do not know/refuse.
Keyed answer: No.

Q10 (1-6)

國際上推動氣候變遷調適的主要目標是什麼？

What is the main objective of international climate change adaptation efforts?
Response options: Energy saving and carbon reduction; Reducing climate risk; Promoting technological development; Do not know/refuse.
Keyed answer: Reducing climate risk.

Q11 (2-2)

提升交通、通訊等措施的韌性，是屬於我國國家氣候變遷調適行動計畫中，哪項領域的策略？

Which sector of Taiwan’s national adaptation action plan covers strengthening the resilience of transport and communications?
Response options: Land use; Energy supply and industry; Health; Life-supporting infrastructure; Do not know/refuse.
Keyed answer: Life-supporting infrastructure.

Supplementary Table S2. Pilot reliability and questionnaire revision

Telephone pilot, n=114, conducted from 27 August to 5 September 2025. Coefficients describe pilot item sets before revision. The pilot protocol used Cronbach's alpha for sets with more than two items and the Spearman–Brown coefficient for two-item sets.

Subdimension	Pilot items	Reliability	Revision
Necessity and urgency	4	0.52	Wording revised
Long-term costs and benefits	2	0.69	Retained
Adaptation planning	2	0.42	One item reworded
Cross-sectoral cooperation	2	0.79	Retained
Risk assessment and management	3	0.84	One item removed
Perceived implementation role	2	0.74	Retained
Civic action	2	0.78	Retained
Everyday-life planning	2	0.60	Retained
Local strategies and resources	2	0.86	Retained
Proactive adaptive capacity	2	0.79	Retained

Supplementary Table S3. Pilot sampling adequacy

Item block	KMO
Basic-understanding agreement items	0.64
Implementation frequency items	0.82
Everyday-adaptation frequency items	0.79

KMO assesses sampling adequacy for factor analysis. These pilot values do not establish the validity of the national-sample analytic summaries.

Supplementary Table S4. Covariate-adjusted marginal means

Weighted least-squares models include generation, sex, education, monthly-income group, and region. HC1 robust covariance estimates were used. Marginal means standardize over the outcome-specific complete sample using survey weights. Model n: knowledge 2,334; support 2,098; reported practice 2,170. Values are marginal means (95% CI).

Group	Knowledge (%)	Support (1–5)	Practice (1–5)
Generation: Generation Z 20–28 years	45.7 (42.6–48.7)	4.18 (4.11–4.24)	2.42 (2.29–2.55)
Generation: Generation Y 29–44 years	46.3 (44.1–48.5)	4.13 (4.07–4.18)	2.56 (2.46–2.65)
Generation: Generation X 45–60 years	42.1 (40.7–43.5)	4.15 (4.12–4.19)	2.64 (2.57–2.71)
Generation: Baby Boomers 61–79 years	41.2 (39.7–42.6)	4.14 (4.10–4.17)	2.88 (2.80–2.97)
Generation: Silent generation 80+ years	34.6 (30.5–38.7)	4.12 (4.01–4.22)	3.05 (2.68–3.42)
Sex: Women	42.9 (41.8–44.0)	4.15 (4.13–4.18)	2.66 (2.60–2.72)
Sex: Men	43.5 (42.2–44.9)	4.13 (4.10–4.17)	2.66 (2.60–2.73)
Education: Primary or less	28.1 (24.5–31.7)	3.85 (3.70–4.00)	2.48 (2.26–2.69)
Education: Junior high	36.3 (33.3–39.3)	3.98 (3.90–4.06)	2.39 (2.22–2.57)
Education: High school	37.9 (36.1–39.6)	4.07 (4.03–4.11)	2.65 (2.56–2.74)
Education: Junior college	43.3 (41.2–45.4)	4.16 (4.10–4.22)	2.62 (2.51–2.73)
Education: University	46.5 (44.9–48.0)	4.21 (4.17–4.24)	2.74 (2.67–2.81)
Education: Master’s or higher	51.9 (49.2–54.7)	4.21 (4.15–4.27)	2.64 (2.50–2.77)
Monthly income (NT$): <30,000	43.0 (41.3–44.6)	4.12 (4.09–4.16)	2.59 (2.51–2.67)
Monthly income (NT$): 30,000–<50,000	42.0 (40.5–43.4)	4.14 (4.10–4.17)	2.63 (2.56–2.70)
Monthly income (NT$): 50,000–<70,000	44.6 (42.5–46.7)	4.14 (4.09–4.19)	2.72 (2.60–2.83)
Monthly income (NT$): 70,000–<100,000	45.8 (42.9–48.7)	4.24 (4.17–4.32)	2.83 (2.67–2.99)
Monthly income (NT$): ≥100,000	46.5 (42.8–50.3)	4.22 (4.13–4.31)	2.88 (2.69–3.08)

Group	Knowledge (%)	Support (1–5)	Practice (1–5)
Region: North	44.2 (42.9–45.5)	4.15 (4.12–4.18)	2.61 (2.55–2.67)
Region: Central	42.3 (40.6–44.0)	4.15 (4.10–4.19)	2.63 (2.55–2.71)
Region: South	42.3 (40.6–43.9)	4.14 (4.10–4.18)	2.75 (2.67–2.83)
Region: East	44.9 (39.0–50.7)	4.15 (4.03–4.26)	2.78 (2.51–3.05)
Region: Offshore islands	42.8 (37.2–48.3)	4.12 (4.03–4.22)	2.89 (2.60–3.19)

Knowledge: Q1–Q11, keyed responses scored 1 and incorrect/unknown/refused responses scored 0. Support: Q12 and Q16–Q24, with Q12 and Q16 reverse-coded. Practice: Q25–Q34. Support and practice require complete valid item sets. Income groups combine original codes 1–4, 5–6, 7–8, 9–11, and 12–23; the lowest group includes no income. Penghu, Kinmen, and Lienchiang form the offshore group.

Supplementary Table S5. National-sample internal consistency

Coefficients use unweighted item covariance matrices among respondents with complete responses for each item set, before demographic exclusions. KR-20 is equivalent to Cronbach's alpha for the binary knowledge items.

Summary	Items	Item-complete n	Coefficient
Knowledge	1,2,3,4,5,6,7,8,9,10,11	2,527	0.568
Support	12,16,17,18,19,20,21,22,23,24	2,258	0.771
Practice	25,26,27,28,29,30,31,32,33,34	2,338	0.902

Internal consistency does not establish unidimensionality, construct validity, or equivalence between demographic groups. The knowledge set covers heterogeneous concepts and policy responsibilities.

Supplementary Table S6. Knowledge sensitivity analysis excluding the drainage item

The ten-item score excludes Q4 and uses the same demographic coding, survey weights, complete-case sample (n=2,334), regression specification, and HC1 estimator as the primary knowledge model. Weighted correlation with the 11-item score: 0.980. Maximum absolute change across adjusted demographic marginal means: 2.19 percentage points.

Contrast	11-item difference (95% CI)	10-item difference (95% CI)
Baby Boomers vs Generation Z	–4.50 (–8.03 to –0.96)	–4.42 (–8.12 to –0.71)
Silent vs Generation Z	–11.05 (–16.31 to –5.79)	–11.97 (–17.50 to –6.44)
Master's or higher vs primary or less	23.84 (19.18 to 28.50)	25.42 (20.56 to 30.27)
Highest vs lowest monthly income	3.53 (–0.66 to 7.72)	3.28 (–1.07 to 7.62)

Differences are percentage points. Intervals are exploratory and unadjusted for multiple comparisons. Full numerical estimates are provided in Supplementary Table S4. Analysis syntax is retained by the authors subject to the data-governance conditions described in the main manuscript.