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Media-driven Climate Literacy and Adaptive Behaviour among Rural Women: Evidence from Structural Equation Modelling

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Abstract:

Objectives: This study examined the influence of traditional and digital media information sources on climate change knowledge, risk perception, and adaptive behaviour among rural women in five climate-sensitive districts of Tamil Nadu using Structural Equation Modelling (SEM).

Methods: A descriptive cross-sectional survey was conducted among 982 rural women selected through stratified random sampling. Data were collected using a structured bilingual questionnaire and analysed using descriptive statistics, reliability analysis, Pearson's correlation, Confirmatory Factor Analysis (CFA), and Structural Equation Modelling (SEM).

Findings: Television remained the dominant source of climate-related information, while digital media complemented traditional communication channels. The measurement and structural models showed satisfactory fit (measurement model: CFI = 0.919, RMSEA = 0.037; structural model: CFI = 0.924, RMSEA = 0.036). Media exposure significantly influenced climate change knowledge ($\beta = 0.576$) and risk perception ($\beta = 0.258$), whereas climate change knowledge was the strongest predictor of adaptive behaviour ($\beta = 0.371$). The direct effect of risk perception on adaptive behaviour was not statistically significant. Overall, media-driven climate literacy enhanced adaptive behaviour and strengthened climate resilience among rural women.

Novelty: This study integrates traditional and digital media exposure, climate change knowledge, risk perception, and adaptive behaviour within a unified SEM framework among rural women in climate-sensitive districts of Tamil Nadu. The findings provide empirical evidence to support climate communication, gender-responsive adaptation policies, and community-based resilience programmes.

Keywords: Climate change; Climate communication; Rural women; Media exposure; Climate literacy; Risk perception; Adaptive behaviour; Structural Equation Modelling.

1.0 Introduction

The climate crisis has become a critical environmental threat affecting rural communities worldwide. Rising temperatures, irregular rainfall, droughts, floods, and extreme weather events increasingly affect agricultural productivity, food security, and rural livelihoods. In India, where agriculture remains highly dependent on monsoon rainfall, climate variability has intensified concerns regarding environmental sustainability and the resilience of farming communities (IPCC, 2022; UNEP, 2024).

Rural women play a vital role in agriculture, household resource management, and family welfare. Their close dependence on natural resources makes them particularly vulnerable to climate-related risks while simultaneously possessing valuable experiential knowledge of local environmental changes. Their ability to respond effectively to climatic challenges is influenced by access to reliable climate information, communication channels, institutional support, and locally appropriate adaptation practices (Huyer et al., 2024; Jannat & Kusakabe, 2024).

The media have become an increasingly important source of climate-related information for rural communities. Traditional communication channels such as television, radio, and newspapers, together with digital platforms, facilitate the dissemination of weather information, environmental knowledge, and adaptation strategies. Effective climate communication improves climate literacy, strengthens risk perception, and encourages the adoption of adaptive practices that enhance resilience to climate change (Ballew et al., 2019; Moser, 2016; Schäfer & Painter, 2021).

Although previous studies have examined media exposure, climate change knowledge, risk perception, and adaptive behaviour independently, relatively few have integrated these constructs within a single Structural Equation Modelling (SEM) framework to explain how media exposure influences adaptive behaviour through climate knowledge and risk perception among rural women.

Therefore, the present study examines the relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour among rural women in five climate-sensitive districts of Tamil Nadu using Structural Equation Modelling (SEM). The study contributes to the literature on environmental communication and climate adaptation by providing empirical evidence on the pathways through which media exposure enhances climate knowledge, shapes risk perception, and influences adaptive behaviour among rural women in climate-sensitive regions.

2.0 Literature Review

2.1 Media Exposure and Climate Knowledge

The media play a central role in shaping public understanding of climate change by disseminating information on environmental risks, weather variability, and adaptation strategies. Among rural women, repeated exposure to climate information through both traditional and digital media enhances awareness of climate variability and facilitates informed adaptation decisions. Repeated exposure to credible climate information strengthens climate literacy and supports informed decision-making regarding environmental issues (Ballew et al., 2019; IPCC, 2022; Schäfer & Painter, 2021).

Traditional media continue to be important sources of climate information in rural areas because of their wide accessibility and familiarity. Television effectively communicates complex environmental information through audio-visual content that is easily understood by diverse audiences. Digital media have further expanded opportunities to access climate information through search engines, websites, and social networking platforms, enabling users to obtain information quickly and participate in discussions on climate and environmental issues (Moser, 2016; Tume et al., 2018). Media exposure therefore provides the foundation for improving climate knowledge, which subsequently influences perceptions of environmental risk. These findings suggest that greater exposure to reliable media information is expected to enhance climate change knowledge among rural women.

2.2 Climate Knowledge and Risk Perception

Climate knowledge refers to an individual's understanding of the causes, consequences, and impacts of climate change. Rural communities acquire climate knowledge through direct observations of environmental changes, including changing rainfall patterns, increasing temperatures, declining crop productivity, and water scarcity in their immediate environment. Such knowledge contributes to greater awareness of environmental risks and strengthens risk perception (Siegrist & Arvai, 2020; Thaker, et al., 2020). Previous studies have shown that individuals possessing greater climate knowledge are more likely to recognise environmental threats and support environmentally responsible behaviour and adaptation practices (Siders & Pierce, 2021; van Valkengoed & Steg, 2022). Climate literacy, therefore, serves as an important mechanism for translating environmental information into climate awareness, risk recognition, and adaptive decision-making. Accordingly, greater climate change knowledge is expected to strengthen respondents' perception of climate-related risks.

2.3 Risk Perception and Adaptive Behaviour

Risk perception influences how individuals evaluate environmental threats and decide whether to adopt adaptive responses. Rural households commonly employ coping strategies such as water conservation, tree planting, recycling, livelihood diversification, and sustainable resource management to reduce climate-related risks (Huyer et al., 2024; Myeni & Wentink, 2021).

Studies have demonstrated that individuals who perceive greater climate-related risks are generally more willing to implement adaptive measures that reduce environmental vulnerability and improve resilience (Bagagnan et al.,2019; Ghazali et al., 2023). Understanding the relationships among media exposure, climate knowledge, risk perception, and adaptive behaviour is therefore essential for developing effective climate communication strategies that support sustainable adaptation, particularly among rural women living in climate-sensitive

agricultural regions. Therefore, the relationships among these constructs form the basis for the structural model examined in the present study.

3. Theoretical Framework

The present study is grounded in the Diffusion of Innovation (DOI) Theory (Rogers, 2003) and the Protection Motivation Theory (PMT) (Rogers, 1983). These complementary theories provide the conceptual foundation for understanding how media exposure influences climate change knowledge, risk perception, and adaptive behaviour among rural women.

The DOI explains how communication channels facilitate the dissemination of new ideas and innovations, thereby influencing individuals' knowledge and behavioural change. In the present study, traditional media (television, radio, newspapers, and magazines), digital media (search browsers and social media), women's self-help groups, and local authorities represent important communication channels through which rural women acquire climate-related information. Increased exposure to these information sources is expected to enhance climate change knowledge.

The PMT proposes that individuals are more likely to adopt adaptive and preventive behaviours when they recognise environmental threats and believe that appropriate coping measures can effectively reduce potential adverse consequences (Rogers, 1983). In the context of the present study, climate change knowledge is expected to strengthen risk perception and encourage the adoption of adaptive and preventive measures.

Together, these theories provide the conceptual basis for the proposed framework, in which media exposure enhances climate change knowledge, climate knowledge influences risk perception, and climate knowledge and risk perception contribute to adaptive behaviour. These hypothesised relationships were empirically examined using Structural Equation Modelling (SEM).

4.0 Research Gap

Previous studies have examined media exposure, climate change knowledge, risk perception, and adaptive behaviour independently, with evidence showing that media improve climate awareness, climate knowledge strengthens adaptive responses, and risk perception influences behavioural decisions (Moser, 2016; Schäfer & Painter, 2021; Shi et al., 2019). However, relatively few studies have integrated these constructs within a single Structural Equation Modelling (SEM) framework, particularly among rural women in agriculture-dependent regions. Furthermore, empirical evidence on the Cauvery Delta and the Protected Special Agriculture Zone (PSAZ) of Tamil Nadu remains limited. Therefore, the present study develops and validates a Structural Equation Model (SEM) to examine the relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour, providing empirical evidence to strengthen climate communication and adaptation strategies for rural women.

5.0 Research Objectives

The study was undertaken with the following objectives:

- To examine the level of media exposure to climate change information among rural women.
- To assess the relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour.
- To evaluate the structural relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour using Structural Equation Modelling (SEM).

6.0 Research Hypotheses

Based on the literature review and theoretical framework, the following hypotheses were formulated:

H1: Media exposure has a significant positive influence on climate change knowledge among rural women.
H2: Media exposure has a significant positive influence on risk perception.
H3: Climate change knowledge has a significant positive influence on risk perception.
H4: Risk perception has a significant positive influence on adaptive behaviour.
H5: Climate change knowledge has a significant positive influence on adaptive behaviour.

7.0 Materials and Methods

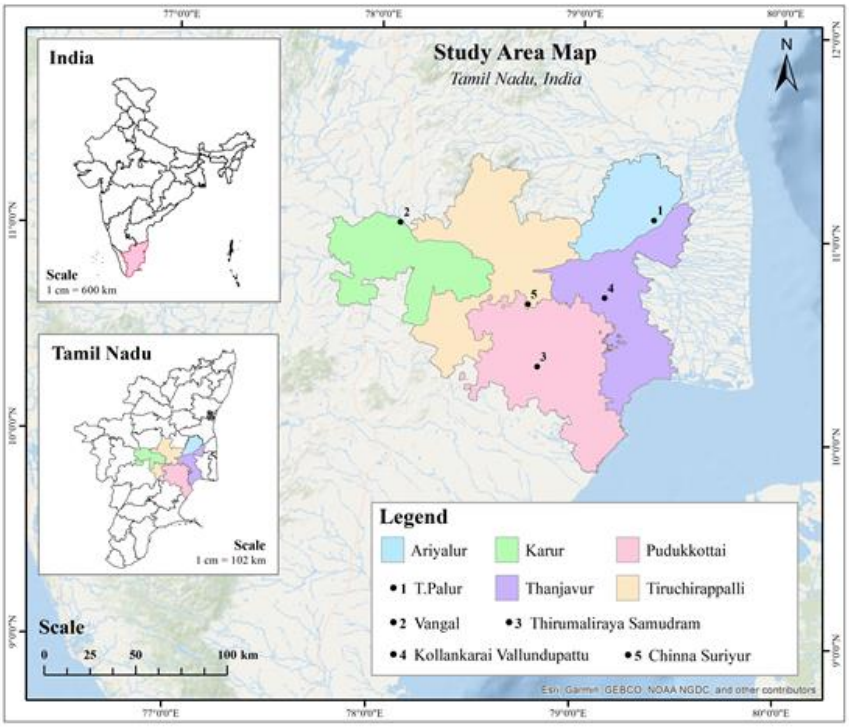
7.1 Research Design

A descriptive cross-sectional research design was adopted to examine the relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour among rural women. Data were collected at a single point in time using a structured questionnaire. Structural Equation Modelling (SEM) was employed to evaluate both the measurement model through Confirmatory Factor Analysis (CFA) and the structural relationships among the latent constructs (Anderson & Gerbing, 1988; Hair et al., 2022).

7.2 Study area

The study was conducted in five climate-sensitive districts of Tamil Nadu - Ariyalur, Karur, Pudukkottai, Thanjavur, and Tiruchirappalli - which were purposively selected because agriculture is the primary livelihood and these districts are frequently affected by irregular rainfall, droughts, floods, and other climate-related events. Within each selected district, one representative village was purposively chosen for data collection.

Figure 1 Study Area



7.3 Sampling Design and Procedure

A multistage sampling procedure was adopted. In the first stage, one village was purposively selected from each climate-sensitive district based on agricultural dependence and exposure to climate variability. In the second stage, household visits were conducted to prepare a list of eligible rural women aged 18–70 years. Respondents were then selected using stratified random sampling to ensure adequate representation across the predefined age groups. Approximately 200 respondents were targeted from each selected village. A total of 1,000 rural women were initially approached, of whom 982 completed the survey and were included in the final analysis, while 18 questionnaires were excluded because of incomplete responses.

7.4 Instrument Development and Measurement of Variables

A structured questionnaire was developed based on an extensive review of the literature on climate change communication, climate knowledge, risk perception, and adaptive behaviour (IPCC, 2022; Moser, 2016). A bilingual (English and Tamil) questionnaire was used to enhance respondents' understanding during the field survey. A pilot study involving 30 respondents was conducted to assess the clarity, relevance, and sequencing of

the questionnaire. Based on the feedback received, minor modifications were incorporated before administering the final survey.

The questionnaire comprised two sections. The first section collected socio-demographic information, including age, education, occupation, farming experience, and landholding. The second section measured the media information source, climate change knowledge, risk perception and adaptive/preventive measures using multiple questionnaire items. The measurement items were developed based on the theoretical framework and previous empirical studies to ensure content validity (Rogers, 2003; Rogers, 1983). All items were measured using a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Adaptive behaviour was operationalised through respondents' adoption of 15 adaptive and preventive measures. These observed measures collectively represented the latent construct of Adaptive Behaviour in the Structural Equation Model.

7.5 Data Analysis

The collected data were coded, verified, and analysed using IBM SPSS Statistics Version 25 and IBM AMOS Version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise the socio-demographic characteristics of the respondents. Reliability of the measurement scales was assessed using Cronbach's alpha, while Pearson's correlation analysis was performed to examine the relationships among the study variables. Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) were subsequently carried out using IBM AMOS to validate the measurement model and test the hypothesised structural relationships among the latent constructs.

7.6 Reliability and Validity Assessment

Internal consistency of the measurement scales was assessed using Cronbach's alpha (Cronbach, 1951). Construct validity was evaluated using Confirmatory Factor Analysis (CFA), and standardized factor loadings were examined before estimating the structural model (Hair et al., 2022).

7.7 Structural Equation Modelling

Structural Equation Modelling (SEM) was employed using IBM AMOS Version 25 to examine the hypothesised relationships among Media Information Source (MIS), Climate Change Knowledge (KNOWCC), Risk Perception Factors (RPF), and Adaptive/Preventive Measures (ADAPMEA). The analysis was conducted in two stages: first, Confirmatory Factor Analysis (CFA) validated the measurement model, followed by estimation of the structural model for hypotheses testing. Model fit was assessed using χ^2/df, GFI, AGFI, CFI, RMR, and RMSEA (Hair et al., 2022; Hu & Bentler, 1999; Kline, 2023).

7.8 Conceptual Framework of the Study

Based on the DOI and PMT, the proposed conceptual framework assumes that media exposure enhances climate change knowledge, which subsequently influences risk perception and adaptive behaviour. In addition, media exposure is hypothesised to directly influence risk perception, while climate change knowledge is expected to directly influence adaptive behaviour. These hypothesised relationships were empirically tested using Structural Equation Modelling.

7.9 Ethical Considerations

The study was conducted in accordance with accepted ethical principles for social science research. Before data collection, the study's purpose and objectives were clearly explained to all respondents. Participation was entirely voluntary, and informed consent was obtained prior to administering the questionnaire. Respondents were assured that their identities would remain anonymous and that the information collected would be treated confidentially and used solely for academic and research purposes.

8.0 Results

8.1 **Socio-demographic characteristics of the respondents**

The socio-demographic profile (Table 1) indicates that the majority of the respondents were native residents (92.7%), suggesting that the sample largely comprised long-term inhabitants with substantial familiarity with local climatic conditions. Agriculture was the principal occupation for 77.5% of the respondents, confirming that the study population primarily depended on climate-sensitive livelihoods. Nearly half of the respondents (47.1%) owned small agricultural landholdings of up to 5 acres, while 38.2% cultivated between 5 and 10 acres,

denoting the predominance of small and medium-scale farming households. Wetland farming (65.2%) was more common than dryland farming (34.8%), reflecting the agricultural characteristics of the selected delta districts. With respect to farming experience, the largest proportion of respondents (26.4%) reported that their families had been engaged in farming for 5–10 years, whereas 15.4% had more than 20 years of farming experience. These characteristics indicate that the respondents possessed substantial agricultural experience and were therefore well positioned to provide meaningful insights into media exposure, climate change knowledge, and adaptive behaviour.

Table 1: Socio-demographic characteristics of the respondents (N = 982)

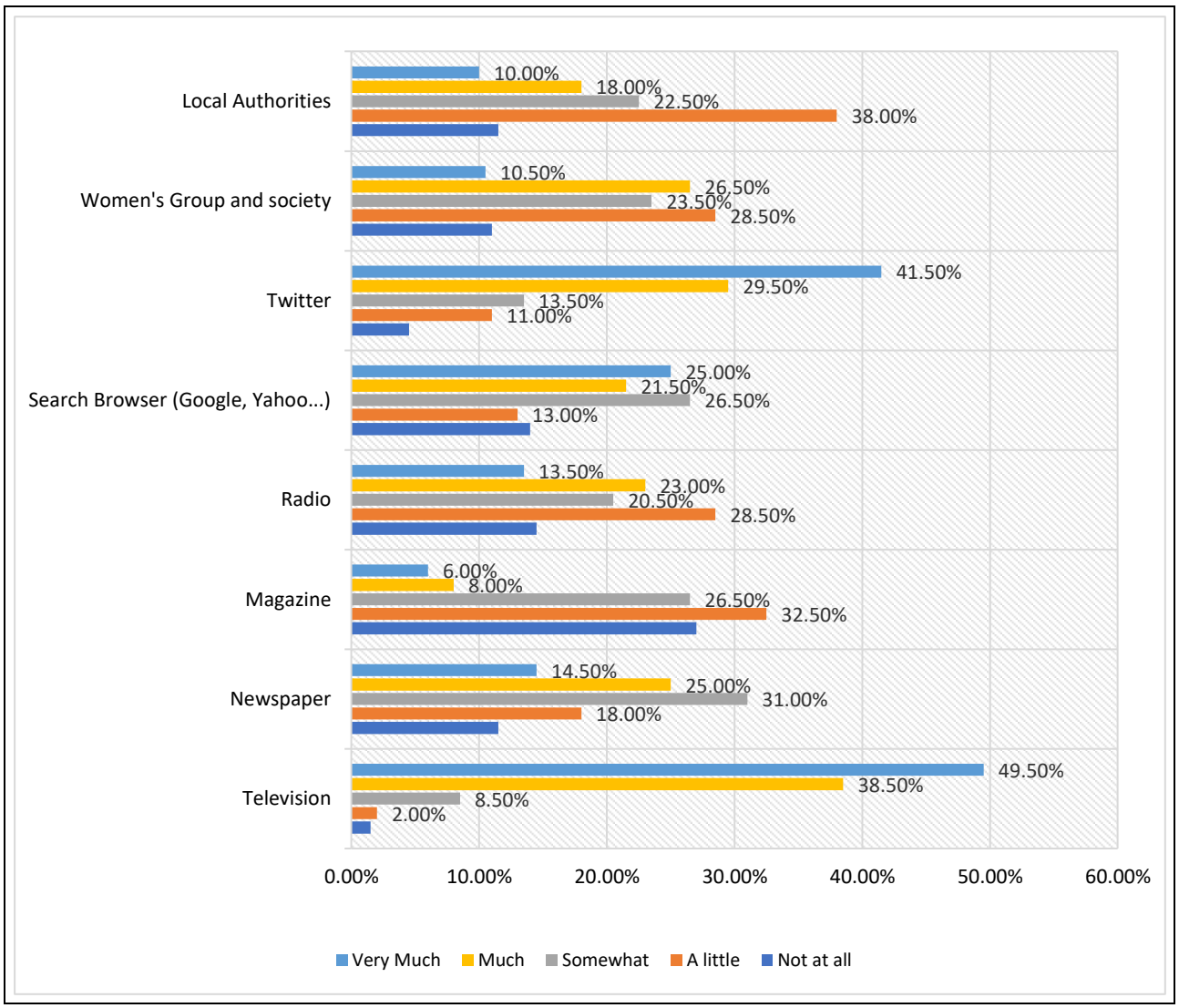
Variables	Category	Frequency	Percentage (%)
Residential status	Native	910	92.7
	Outstation	72	7.3
Occupational status	Agriculture	761	77.5
	Self-employed	29	3
	Employed	192	19.6
Agricultural landholding (acres)	0–5	361	47.1
	5–10	293	38.2
	10–15	68	8.9
	>15	45	5.9
Type of agricultural land	Wetland	501	65.2
	Dryland	267	34.8
Family engagement in farming (years)	0–5	187	24.4
	5–10	202	26.4
	10–15	96	12.5
	15–20	162	21.2
	>20	118	15.4

8.2 Sources of Climate-related News and Information

Figure 2. presents respondents' preferences for different sources of climate-related information. Television emerged as the most frequently used source of climate-related information, confirming its continued importance

in disseminating climate information among rural women. Digital platforms, particularly social media and search browsers, also recorded considerable use. Newspapers, radio, and women's groups showed moderate use, whereas local authorities were consulted less frequently. The pattern shows that respondents relied on both traditional and digital communication channels, with television remaining the dominant source.

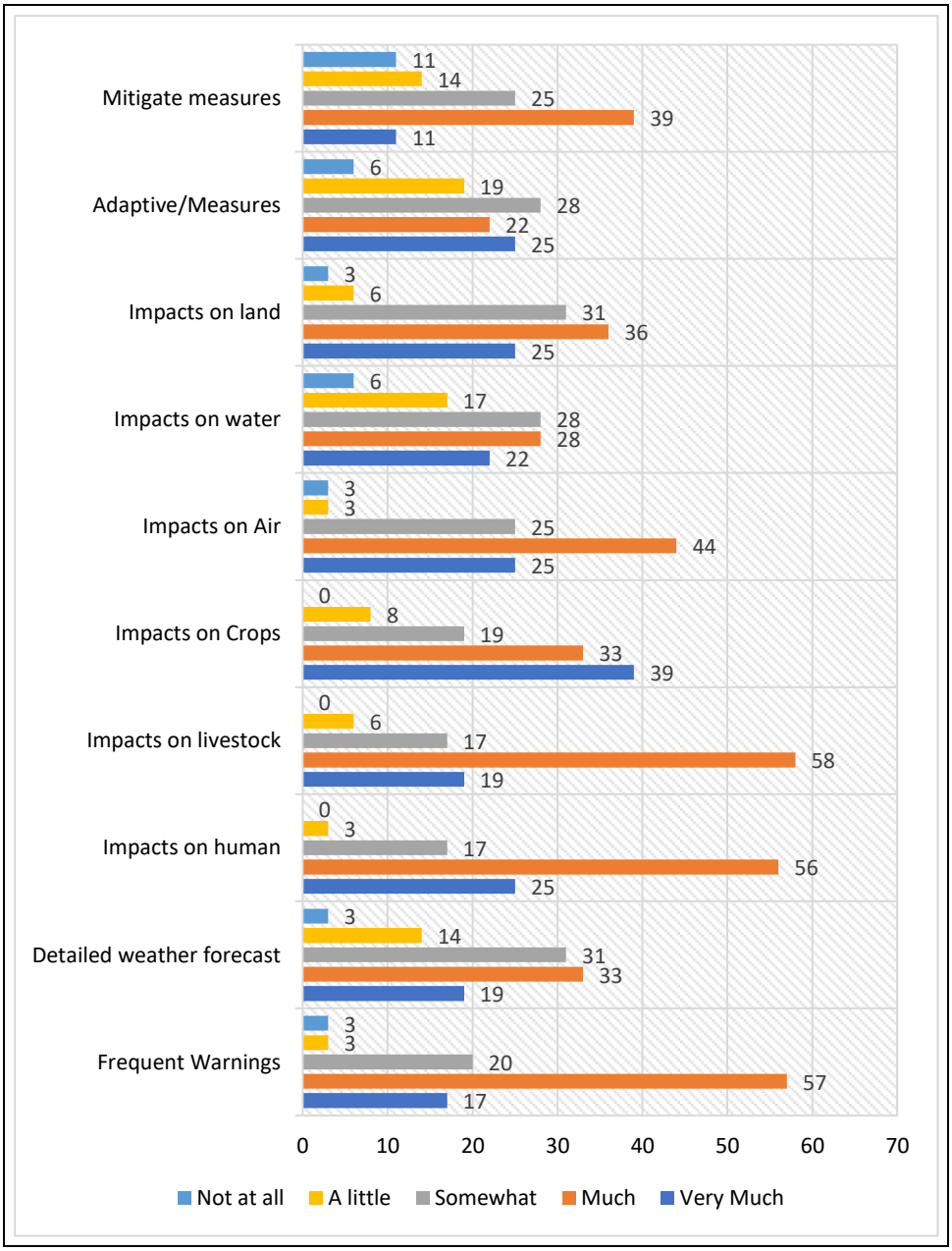
Figure 2 Sources of Climate-related News and Information



8.3 Climate Change Knowledge and Awareness

Figure 3 demonstrates respondents' knowledge and awareness of climate change. Respondents demonstrated moderate to high awareness of frequent weather warnings and the effects of climate change on humans, livestock, and air quality. Awareness of impacts on crops, land, and water was also considerable. Respondents further showed an understanding of adaptive and preventive measures. Overall, these findings indicate that respondents possessed substantial awareness of the environmental and agricultural consequences of climate change.

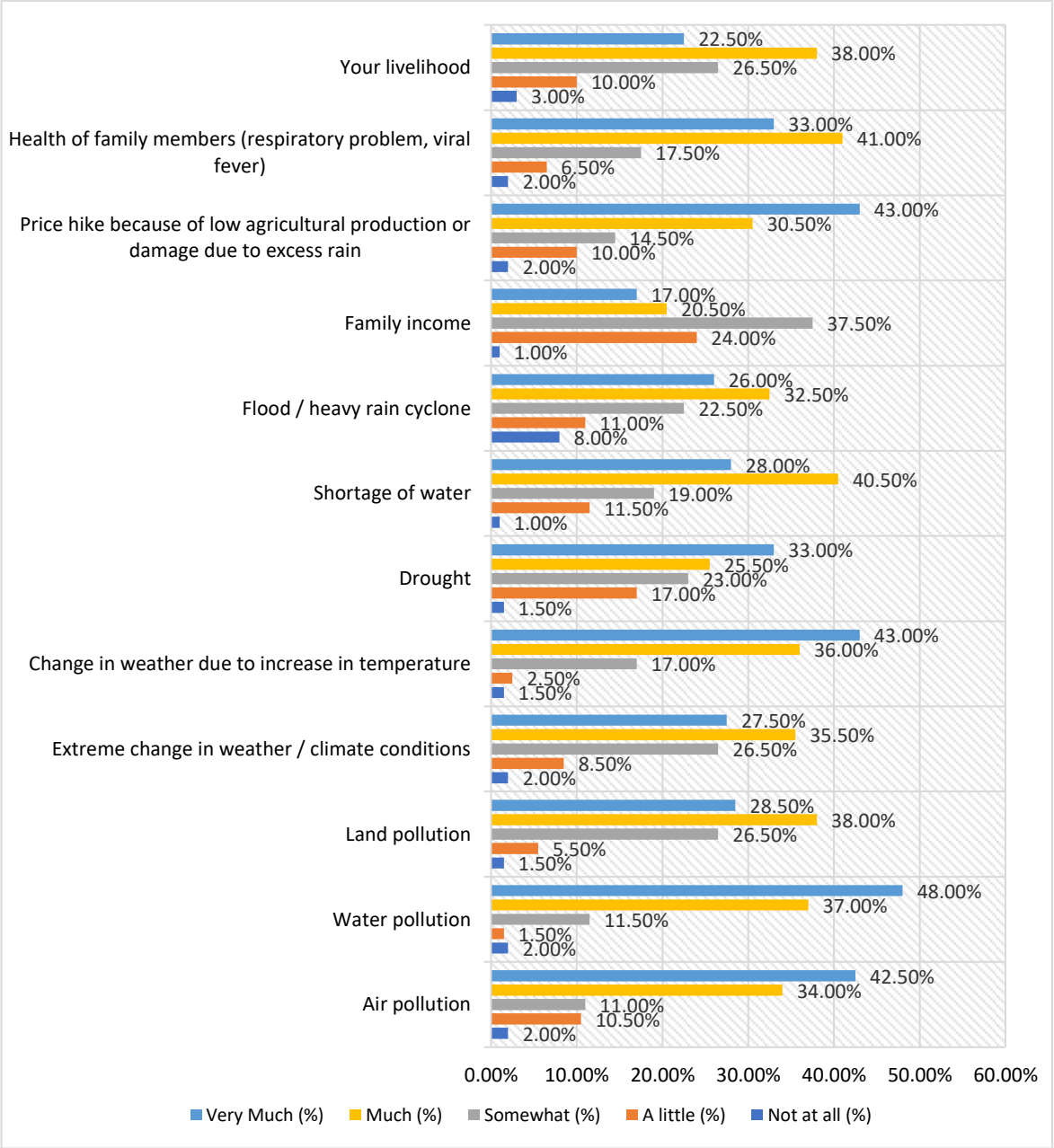
Figure 3 Climate Change Knowledge and Awareness



8.4 Climate Change Risk Perception

Figure 4 illustrates respondents' perceptions of the environmental and socio-economic risks associated with climate change. Air and water pollution, rising temperatures, changing weather conditions, and health effects were widely perceived as important consequences. Respondents also expressed concern about agricultural production, water scarcity, family income, and livelihood security. These findings show that rural women recognised both the environmental and livelihood-related risks associated with climate variability.

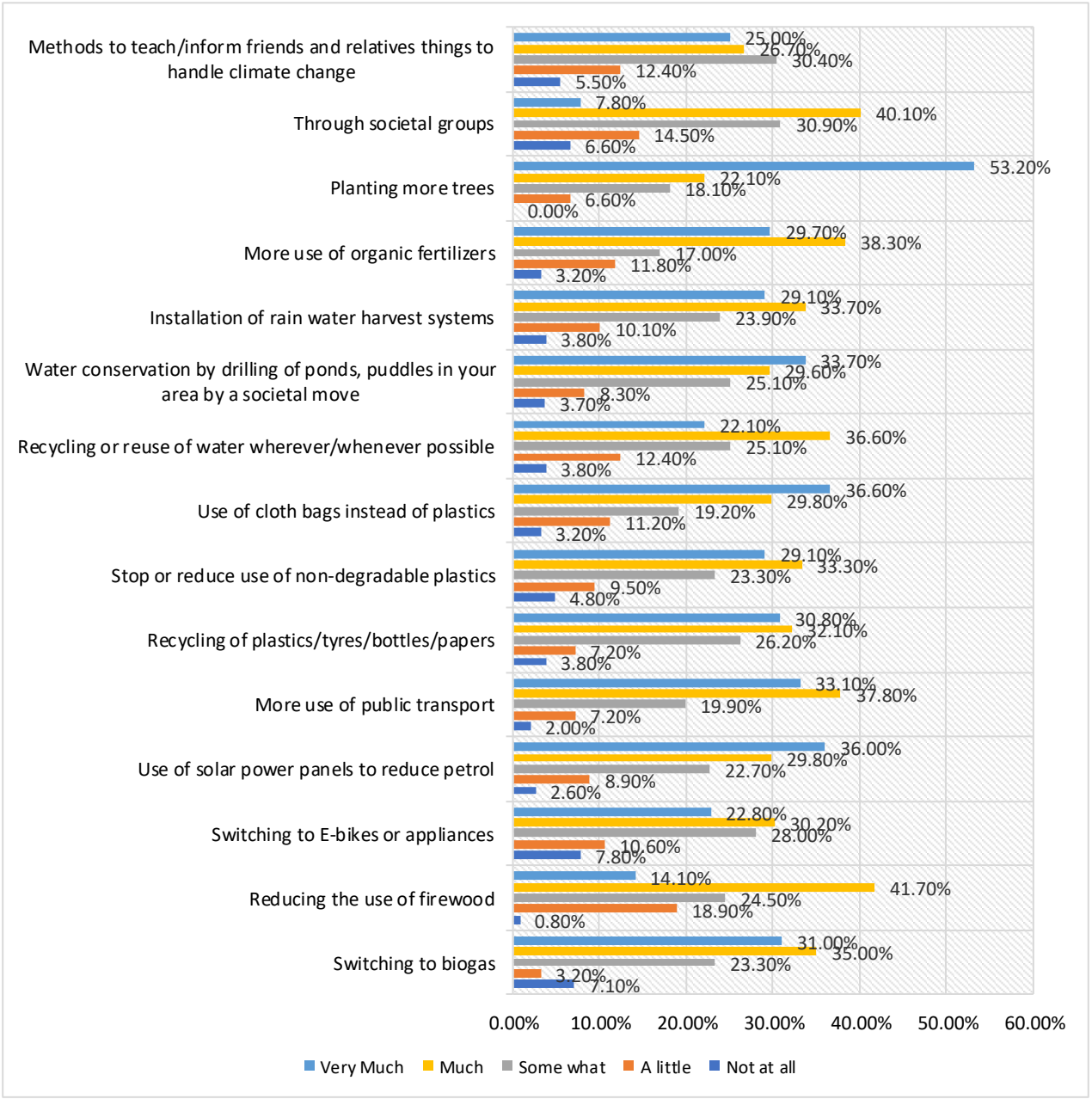
Figure 4 Climate Change Risk Perception Factors



8.5 Adaptive and Preventive Measures Adopted

Figure 5 depicts the adaptive and preventive measures adopted by the respondents. Tree planting, switching to biogas, using solar power, recycling and reusing water, rainwater harvesting, and environmentally sustainable farming practices were among the more frequently adopted measures. Household-level practices were more common than community-based actions involving social groups or institutional support. The pattern reflects a preference for practical, locally feasible, and environmentally sustainable responses to climate change. These descriptive findings are presented separately from the measurement and structural models, in which adaptive and preventive measures were incorporated into the measurement model as a composite measure representing respondents' adaptive behaviour.

Figure 5 Adaptive and Preventive Measures Adopted



8.6 Reliability Analysis

Table - 2 presents the internal consistency of the study constructs. Cronbach's alpha values ranged from 0.643 to 0.841, indicating acceptable to good reliability. Adaptive/Preventive Measures recorded the highest reliability (α = 0.841), followed by Risk Perception Factors (α = 0.811) and Knowledge about Climate Change (α = 0.751). Media Information Source recorded the lowest coefficient (α = 0.643) but remained within the acceptable reliability level for an exploratory scale. These results supported the use of the constructs in the subsequent correlation, confirmatory factor, and structural model analysis.

Table 2 Reliability of the Study Constructs

Construct	Number of items	Mean	Cronbach's α
Media Information Source (MIS)	8.000	2.200	0.643
Knowledge about Climate Change (KNOWCC)	9.000	2.870	0.751
Risk Perception Factors (RPF)	12.000	2.760	0.811
Adaptive/Preventive Measures (ADAPMEA)	15.000	2.700	0.841

8.7. Pearson Correlation Analysis

Table 3 shows the correlations among Media Information Source, Knowledge about Climate Change, Risk Perception Factors, and Adaptive/Preventive Measures. All relationships were positive and statistically significant at the 1% level. Media Information Source was positively correlated with Knowledge about Climate Change (r = 0.232), Risk Perception (r = 0.288), and Adaptive/Preventive Measures (r = 0.304). Knowledge about Climate Change showed the strongest association with Risk Perception (r = 0.631), indicating that greater climate knowledge was associated with stronger perceptions of climate-related risk. The correlations provided preliminary support for examining the proposed relationships through Structural Equation Modelling.

Table 3 Pearson Correlation Between Media Information Source, Knowledge About Climate Change, Risk Perception, And Adaptive/Preventive Measures.

Construct	MIS	KNOWCC	RPF	ADAPMEA
Media Information Source (MIS)	1.000			
Knowledge about Climate Change (KNOWCC)	0.232**	1.000		
Risk Perception Factors (RPF)	0.288**	0.631**	1.000	
Adaptive/Preventive Measures (ADAPMEA)	0.304**	0.258**	0.219**	1.000

Note. Correlation coefficients marked with ** are significant at the $p < 0.01$. (two-tailed)

8.8 Measurement Model (First-order Confirmatory Factor Analysis)

Before estimating the structural relationships among the study constructs, a first-order Confirmatory Factor Analysis (CFA) was performed to evaluate the adequacy of the measurement model. The model examined the relationships among Media Information Source (MIS), Knowledge about Climate Change (KNOWCC), Risk Perception Factors (RPF), and Adaptive/Preventive Measures (ADAPMEA). Figure 6 presents the first-order measurement model, and Table 4 summarises the standardized factor loadings of the observed indicators included in the model.

The standardized factor loadings ranged from 0.150 to 0.723, and all estimated loadings were statistically significant ($p < 0.001$), supporting the adequacy of the measurement model. Among the Media Information Source indicators, Magazine recorded the highest standardized loading (β = 0.723), whereas Search browsers (Google/Yahoo) recorded the lowest loading (β = 0.150). Within the Knowledge about Climate Change construct, Detailed weather forecasts showed the highest loading (β = 0.671). For the Risk Perception construct, Shortage of water exhibited the highest loading (β = 0.591), while Family income showed the lowest loading (β = 0.272). Although some indicators exhibited relatively low standardized loadings, they were retained because they represent conceptually important dimensions of climate communication, climate knowledge, and risk perception in the study context. Overall, the measurement model demonstrated acceptable construct representation and provided an appropriate basis for estimating the structural model.

Figure 6 Measurement Model - First-order Confirmatory Factor Analysis (CFA) Measurement Model for Media Information Sources, Climate Change Knowledge, Risk Perception Factors, and Adaptive / Preventive Measures Adopted

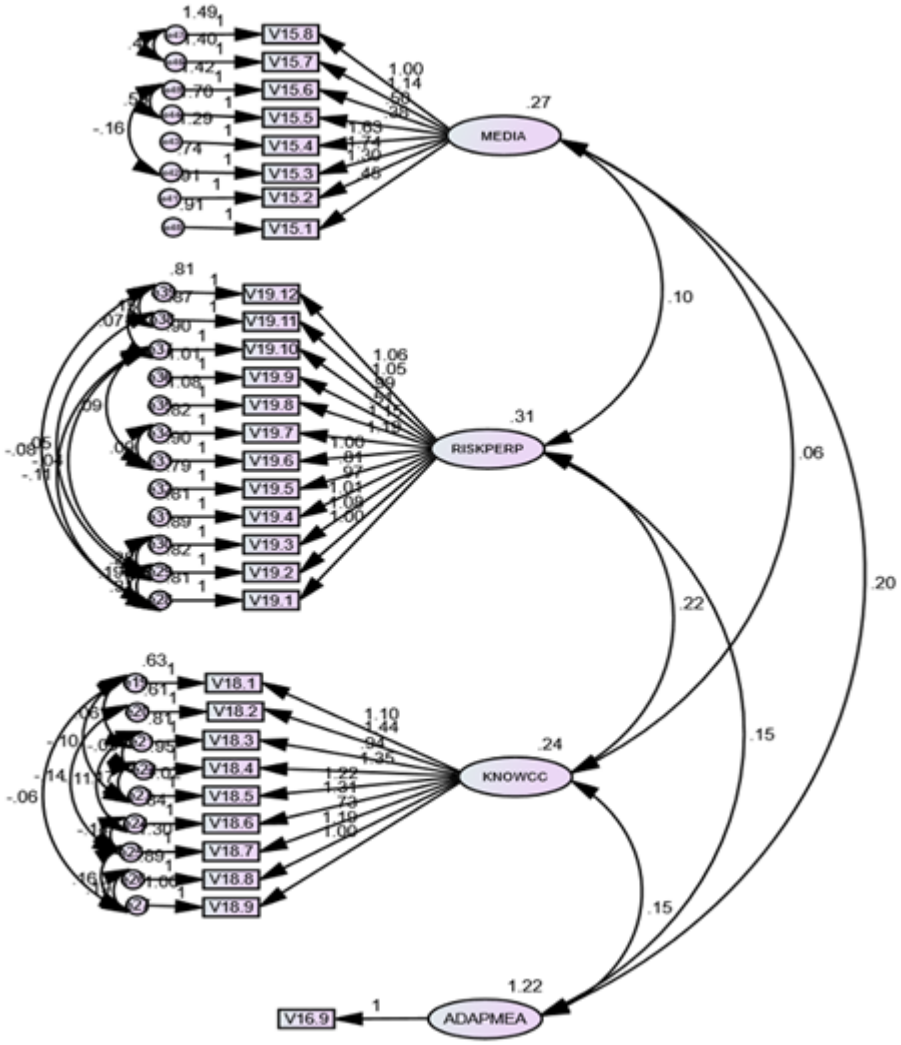


Table 4 Standardised Factor Loadings for the First-order Measurement Model (Confirmatory Factor Analysis)

Construct	Indicators	Unstandardized Loading	S.E.	Standardized Loading (β)	*p*-value
Knowledge about Climate Change (KNOWCC)	Frequent weather warnings	1.100	0.104	0.561	<0.001
	Detailed weather forecasts	1.443	0.123	0.671	<0.001
	Impact on human health	0.937	0.098	0.453	<0.001
	Impact on crops	1.348	0.124	0.561	<0.001

	Impact on farm animals	1.216	0.118	0.507	<0.001
	Impact on air	1.307	0.119	0.571	<0.001
	Impact on water	0.728	0.095	0.298	<0.001
	Impact on land	1.194	0.100	0.527	<0.001
	Adaptive and preventive measures followed†	1.000	—	0.439	Reference
Risk Perception Factors (RPF)	Air pollution†	1.000	—	0.526	Reference
	Water pollution	1.077	0.068	0.553	<0.001
	Land pollution	1.011	0.075	0.512	<0.001
	Extreme weather conditions	0.969	0.081	0.514	<0.001
	Increase in temperature	0.812	0.074	0.453	<0.001
	Drought	0.996	0.086	0.505	<0.001
	Shortage of water	1.194	0.092	0.591	<0.001
	Floods, heavy rainfall and cyclones	1.151	0.095	0.524	<0.001
	Family income	0.510	0.070	0.272	<0.001
	Commodity price increases	0.985	0.090	0.499	<0.001
	Health problems among family members	1.053	0.087	0.532	<0.001
	Livelihood affected	1.058	0.090	0.547	<0.001
Media Information Source (MIS)	Television	0.448	0.080	0.235	<0.001
	Newspaper	1.303	0.138	0.576	<0.001
	Magazine	1.743	0.176	0.723	<0.001
	Radio	1.627	0.171	0.593	<0.001
	Search browsers (Google/Yahoo)	0.383	0.100	0.150	<0.001
	Twitter	0.505	0.104	0.214	<0.001
	Women's Self-Help groups and societies	1.137	0.110	0.443	<0.001

	Local authorities†	1.000	—	0.389	Reference
Adaptive/Preventive Measures (ADAPMEA)	Adaptive measures†	1.000	—	0.669	Reference

Note. β = Standardized factor loading; S.E. = Standard Error. All estimated factor loadings were statistically significant at *p < 0.001*. †Reference indicator with loading fixed to 1.000 for model identification.

8.9 Goodness-of-Fit Indices for the Measurement Model (First-Order CFA)

The goodness-of-fit statistics for the measurement model are displayed in Table 5. The model demonstrated an acceptable fit to the observed data, with a chi-square-to-degrees-of-freedom ratio (χ^2/df = 2.333) below the recommended threshold of 3. The Goodness-of-Fit Index (GFI = 0.942), Adjusted Goodness-of-Fit Index (AGFI = 0.928), and Comparative Fit Index (CFI = 0.919) exceeded the recommended value of 0.90. Similarly, the Root Mean Square Residual (RMR = 0.061) and Root Mean Square Error of Approximation (RMSEA = 0.037) were below the recommended value of 0.08, indicating a satisfactory model fit. Although the chi-square statistic was statistically significant, this is common in studies with large sample sizes. The fit indices suggest that the measurement model adequately represents the observed data and provides a sound basis for estimating the structural model (Hair et al., 2022; Hu & Bentler, 1999; Kline, 2023).

Table 5 Goodness-of-Fit Indices for the Measurement Model (First-Order CFA)

Fit Index	**Obtained Value**	**Recommended Threshold**	**Reference**
Chi-square (χ^2)	877.362	—	—
Degrees of freedom (df)	376.000	—	—
χ^2/df	2.333	< 3.00	Hair et al., (2022)
Goodness-of-Fit Index (GFI)	0.942	> 0.90	Hair et al., (2022)
Adjusted Goodness-of-Fit Index (AGFI)	0.928	> 0.90	Hu &Bentler (1999; Kline, 2023)
Comparative Fit Index (CFI)	0.919	> 0.90	Hu & Bentler (1999)
Root Mean Square Residual (RMR)	0.061	< 0.08	Hair et al., (2022)
Root Mean Square Error of Approximation (RMSEA)	0.037	< 0.08	Hair et al., (2022; Hu &Bentler 1999)

8.10 Structural Equation Model

Following confirmation of the adequacy of the measurement model, Structural Equation Modelling (SEM) was performed to examine the hypothesised relationships among Media Information Sources, Climate Change Knowledge, Risk Perception, and Adaptive Behaviour. The structural model is presented in Figure 7, while the standardized structural path coefficients and hypothesis testing results are reported in Table 6. As shown in Table 6, the structural model revealed several significant relationships among the latent constructs. Media information sources exerted a significant positive influence on Climate Change Knowledge (β = 0.576, p = 0.002), indicating that increased exposure to information through different communication channels enhanced respondents' knowledge regarding climate change. Media information sources also had a significant positive

effect on Risk Perception (β = 0.258, p = 0.016), suggesting that access to media information contributed to greater awareness of climate-related risks.

Climate Change Knowledge demonstrated the strongest positive influence on Risk Perception (β = 0.668, p < 0.001), indicating that respondents with greater climate-related knowledge were more likely to perceive the risks associated with climate change. Furthermore, Climate Change Knowledge significantly influenced Adaptive Behaviour (β = 0.371, p = 0.004), suggesting that increased climate literacy encourages the adoption of adaptive and preventive practices.

However, the direct relationship between Risk Perception and Adaptive Behaviour was not statistically significant (β = 0.076, p = 0.544). This finding indicates that although respondents recognised climate-related risks, risk perception alone was insufficient to promote adaptive behaviour without adequate climate knowledge.

Overall, the structural model supported four of the five hypothesised relationships, with Climate Change Knowledge emerging as the principal determinant of adaptive behaviour among rural women.

Figure 7 Full-order model for media information source, knowledge about climate change, risk perception, and adaptive/preventive measures.

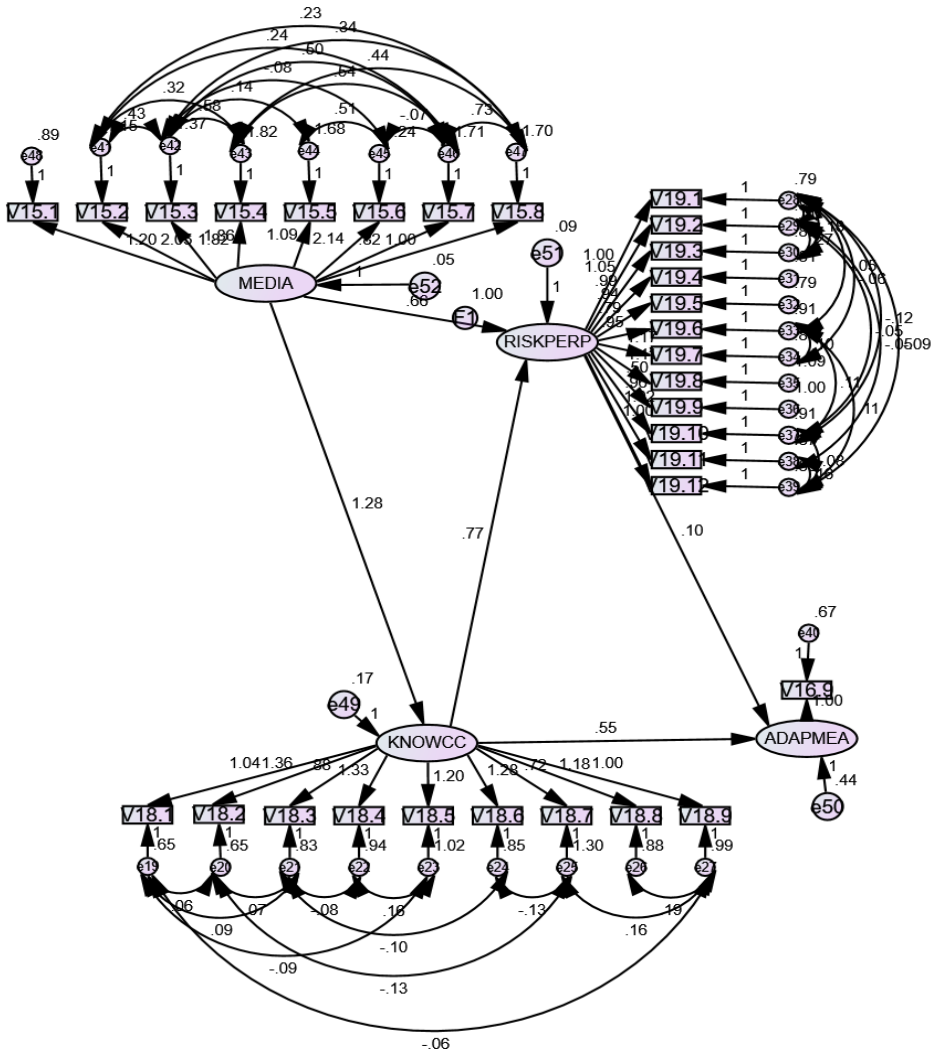


Table 6 Structural Model and Hypothesis Testing

Structural Path	Standardized Coefficient (β)	S.E.	p-value	Decision
Climate Change Knowledge ← Media Exposure	0.576	0.409	0.002	Supported
Risk Perception ← Media Exposure	0.258	0.272	0.016	Supported
Risk Perception ← Climate Change Knowledge	0.668	0.096	< 0.001	Supported
Adaptive Behaviour ← Risk Perception	0.076	0.161	0.544	Not Supported
Adaptive Behaviour ← Climate Change Knowledge	0.371	0.191	0.004	Supported

Note: β = Standardized path coefficient; S.E. = Standard Error. Statistical significance was assessed at $p < 0.05$.

8.11 Goodness of Fit indices for the Structural model

The structural model demonstrated a satisfactory fit to the observed data (Table - 7). The chi-square to degrees of freedom ratio ($\chi^2/df = 2.294$) was below the recommended threshold of 3.0. The goodness-of-fit indices, including GFI (0.944), AGFI (0.928), and CFI (0.924), exceeded the recommended value of 0.90, while the RMR (0.054) and RMSEA (0.036) values were below the recommended threshold of 0.08. These results indicate that the proposed structural model adequately represented the observed relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour.

Table 7 Goodness-of-Fit Indices for the Structural Model

Model Fit Index	Obtained Value	Recommended Value
Chi-square (χ^2)	828.216	–
Degrees of Freedom (df)	361.000	–
χ^2/df	2.294	< 3.00
GFI	0.944	> 0.90
AGFI	0.928	> 0.90
CFI	0.924	> 0.90
RMR	0.054	< 0.08
RMSEA	0.036	< 0.08

9. Discussion

The measurement and structural models demonstrated satisfactory reliability, construct validity, and model fit, providing a robust basis for interpreting the hypothesised relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour. The structural model demonstrated satisfactory model fit (CFI = 0.924; RMSEA = 0.036), supporting the proposed conceptual framework. Media exposure significantly enhanced climate change knowledge ($\beta = 0.576$, $p = 0.002$) and risk perception ($\beta = 0.258$, $p = 0.016$), highlighting the important role of communication channels in improving environmental understanding among rural women. The descriptive findings complement these results, with television emerging as the dominant source of climate-related information, while search browsers and social media increasingly supplemented traditional communication channels. This pattern suggests that although digital communication is expanding,

television remains the most accessible and trusted source of environmental information in rural communities. Similar observations have been reported by Tume et al. (2018) and Schäfer and Painter (2021), who concluded that integrating traditional and digital media strengthens climate communication and public engagement.

Climate change knowledge emerged as the strongest determinant of adaptive behaviour among rural women. The structural model demonstrated that climate change knowledge significantly promoted adaptive behaviour ($\beta = 0.371$, $p = 0.004$), indicating that environmental understanding plays a more important role in encouraging adaptation than information exposure alone. These findings suggest that enhanced climate literacy enables rural women to translate environmental information into practical adaptation strategies. Similar findings were reported by Shi et al. (2016), who observed that greater climate knowledge enhances individuals' confidence in adopting adaptive practices. However, the present study extends previous research by demonstrating these relationships through covariance-based Structural Equation Modelling among rural women in Tamil Nadu, thereby providing stronger empirical evidence for the role of climate literacy in promoting adaptive behaviour. These findings further reinforce recent evidence that climate literacy is a key determinant of adaptive decision-making because it enables individuals to recognise climate risks and implement appropriate mitigation and adaptation strategies (Bagagnan et al., 2019; IPCC, 2022; Newman et al., 2024).

In contrast, the direct relationship between risk perception and adaptive behaviour was not statistically significant ($\beta = 0.076$, $p = 0.544$), indicating that awareness of climate-related risks alone did not necessarily translate into adaptive action among rural women. This finding contrasts with studies that identified risk perception as an important determinant of climate adaptation (van Valkengoed & Steg, 2021). A possible explanation is that respondents relied more on climate knowledge, farming experience, and practical adaptation options than on perceived risk alone. Similar observations have been reported by Siegrist and Árvai (2020), Thaker et al. (2020), and van Valkengoed and Steg (2022), who found that climate knowledge and adaptation efficacy exert a greater influence on adaptive decisions than risk awareness alone. Collectively, these findings highlight the importance of strengthening climate literacy alongside risk communication to encourage adaptive behaviour.

The descriptive analysis further indicated that respondents more frequently adopted practical household-level adaptation measures than community-based initiatives involving women's groups and local authorities. Household-level measures, such as tree planting, rainwater harvesting, recycling, renewable energy use, and water conservation, were more commonly adopted because they could be implemented using locally available resources. In contrast, lower participation in institutional and community-based initiatives may reduce opportunities for collective learning, resource sharing, and coordinated climate adaptation. Similar observations were reported by Jannat and Kusakabe (2024), who emphasised that strengthening institutional support and women's participation enhances the effectiveness of community-based climate adaptation programmes.

Overall, the findings provide empirical support for the proposed conceptual framework and its underlying theoretical foundations. Consistent with the Diffusion of Innovation Theory (Rogers, 2003), media exposure facilitated the dissemination of climate-related information and enhanced environmental understanding among rural women. The findings also support the Protection Motivation Theory (Rogers, 1983) by demonstrating that greater climate literacy significantly promotes adaptive behaviour, suggesting that individuals are more likely to adopt preventive actions when they possess adequate knowledge of climate-related threats and effective coping strategies. Collectively, the findings indicate that climate communication programmes should move beyond information dissemination and place greater emphasis on strengthening climate literacy and practical adaptation skills. Integrating traditional media, digital communication platforms, self-help groups, agricultural extension services, and local institutions can substantially improve environmental awareness and strengthen climate resilience among vulnerable rural communities.

10. Conclusion

This study examined the relationships among media exposure, climate change knowledge, risk perception, and adaptive behaviour among rural women in climate-sensitive districts of Tamil Nadu using Structural Equation Modelling. The findings demonstrated that media exposure significantly enhanced both climate change

knowledge and risk perception, while climate change knowledge emerged as the strongest predictor of adaptive behaviour. In contrast, risk perception alone did not directly influence adaptive behaviour, indicating that awareness of climate-related risks is insufficient without adequate climate knowledge.

The study provides empirical support for the Diffusion of Innovation Theory and Protection Motivation Theory by demonstrating that effective climate communication and improved climate literacy encourage adaptive decision-making. These findings highlight the importance of integrating traditional media, digital communication platforms, agricultural extension services, self-help groups, and local institutions to strengthen climate literacy and promote practical adaptation strategies among rural communities.

The current analysis contributes to the growing literature on climate communication by providing empirical evidence from rural women in Tamil Nadu using covariance-based Structural Equation Modelling. However, the findings are limited to the selected study districts and the cross-sectional nature of the data. Future research should include longitudinal studies, broader geographical coverage, and additional behavioural and socio-economic variables to improve understanding of climate adaptation processes in rural communities.

11. Highlights

- Media exposure significantly enhanced climate change knowledge among rural women.
- Climate change knowledge emerged as the strongest predictor of adaptive behaviour.
- Television remained the primary source of climate information, while digital media complemented traditional communication.
- Integrated climate communication strategies can strengthen climate resilience in rural communities.

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13. Conflict of Interest

The authors declare that there is no conflict of interest.

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