Connecting Users’ Needs for Climate Information with Climate Services by Using Economic Benefit Evaluation: the Experiences in Chinese Taipei

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www.cwb.gov.tw

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The conclusions and opinions are those of the authors and not necessarily the sponsors.

Parts of this presentation are collaborative works with current CWB Deputy Director-General Chia-Ping Mark Cheng and CIER Associate Research Fellow Je-Liang Liou.
Who are We?
Taiwan's Most Prestigious Think Tank
The introduction of CIER

Wu Chung-shu, Ph. D.
President

CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH
The Role of CIER

- A policy think-tank for the Taiwan government by making important recommendations
- An autonomous economic research organization
- To represent the country in conducting exchanges with international policy think-tanks
The Structure

Supervisors

- Auditing Office

Board of Trustees

- President
- Vice President

Finance Committee
- Research Consultant
- Consultation Committee

President

- The First Research Division
- The Second Research Division
- The Third Research Division
- The Center for Economic Forecasting
- The Taiwan WTO & RTA Center
- The Center for Financial and Economic Strategies
- The Regional Development Study Center
- The Center for Green Economy

Vice President

- The Center for Energy and Environmental Research*
- The Taiwan ASEAN Studies Center*
- Science and Technology Policy Evaluation Center*
- The Center for Small and Medium Enterprises Research*
- The Japan Center Sub-Committee*

*: Established with specific task force and approved by CIER Board.
The Structure

- Established in 1981 (with initial government endowment and starting fund of 1 billion NTD)
- 90 full-time research staff
- 35 full-time administrative staff
- Project-based staff: 352

The Organization

- CIER’s Board of Trustees consists of 11 to 15 members
- Five of them are appointed by the Premier of the Executive Yuan and the rest are elected
- One chairman, under whom are one president and one or two vice-presidents
Outline

▷ Background Introduction: initiatives and purpose of this economic benefit evaluation project

▷ A Successful Experience in Agriculture: research findings and policy linkage

▷ Recent Development
Background Introduction
initiatives and purpose of this economic benefit evaluation project
Geographical Environment of Taiwan

- **Location**
  - Land-sea boundary (121E, 24N)

- **Population**
  - 23 Million

- **Size** (1/12 of California)
  - 36,000 km²

- **Topography**
  - 32% mountain area > 1,000m
  - Over 100 mountains > 3,000m
  - Strong Orographic Forcing

- **Sever weather phenomena**
  - Spring: Mei-Yu (rainy season)
  - Summer: Typhoon, Thunderstorm
  - Winter: Cold Surge

- **Forecast Challenges**
  - Typhoon & Heavy Rainfall
## CWB’s Roles and Responsibilities

### For Government
- Hazard Mitigation
- Resource Planning
- Environmental Conservation
- Governmental Applications

### For General Public
- Daily Service
- Value Added Applications

### International Collaborations
- International Data Exchange
- International Technical Cooperation
- Climate Services Cooperation

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**Provide Meteorological Service Information Based on Scientific Knowledge to Government and Society for Safer and better Life**

- Enhance the science-based observation and forecast capabilities for delivering accurate and timely service information to all sectors
- Promote weather/climate awareness and knowledge as well as encourage cross-sectoral dialogues for possible value added usages & applications
- Advance the research in meteorological science and technologies to support the CWB operation

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Source: Mark Cheng, CWB.
Due to the characteristics of CWB’s weather services, most people in Taiwan might take the weather information as necessary goods for granted, but most of those services are always free to acquire for general public through many communication sources.

It is necessary to investigate the economic value or social benefit of CWB’s weather information services. The result can be used for the cost-and-benefit analysis of government’s investment in the weather information services.

In addition, the result also can assist our government to make appropriate decision for weather-associated events and future investment.
The role of CIER team for CWB

▷ Assist CWB to strengthen the collaboration between different government agencies and evaluate the potential economic values of CWB’s climate information service

▷ Assist CWB to develop seamless weather services

▷ Assist CWB to establish a successful pilot case study for domestic end-users in various areas or sectors
A Successful Experience in Agriculture: research findings and policy linkage
Purposes of this study

▷ Propose an economic valuation methodology to evaluate weather information services, and estimate the benefits created by the CWB’s weather information services in Taiwan

▷ Use the results of the economic valuation for weather information services to provide policy recommendations for CWB
Economic evaluation methods

Market Value Method

Normative or Prescriptive decision-making model (Numerical Model)

Descriptive Behavioral Response Studies

Contingent Valuation Method (CVM)

Cost-lost Model

Survey Condition

Historical Databank Construction and Regression Model

Experimental Method

Choice Card Design and Experiments

Source: Freebarin and Zillman (2002); Lu et. al. (2016).
How we conduct this CVM survey
the implementation procedure

1. Discuss with potential collaborators
2. Interview local agricultural representatives
3. Design formal surveys
4. Train interviewers and make field arrangements
5. Conduct pilot survey
6. Revise pilot survey
7. Conduct formal survey
8. Data analysis
9. Choose collaborators
10. Decide collaborators and finalize research topics
Questions in the survey

▷ How do you get weather information?
▷ What other weather information services do you think CWB can provide for your regular farm management? For what purpose?
▷ What is the most important lead time of weather forecast for you?
▷ What is your past experience of loss due to natural disaster?
▷ What is your subjective forecast accuracy rate of CWB for you?
▷ How much is your Willingness to Pay (WTP) for this public service currently provided by CWB?
▷ Personal background information (Age, Gender, Education, Work Experience, Major produce, Harvest, Farm size, Income)
Setting up a hypothetical market:

The object in this study is weather information services provided by CWB. The hypothetical key questions include:

1) What is the subjective scores (0~100) of the respondents for the accuracy on weather forecast?

2) What are their WTPs for the weather information services provided by CWB based on their subjective forecast accuracy judgments?
Sampling design:
- assisted by Directorate General of Budget, Accounting and Statistics (DGBAS)

- 400 successful door-to-door survey of registered farmers’ household with 2,000 replacement samples in 2013

- Respondents consisted of six major agriculture farmers (rice, coarse grain, special crops, ornamental plants, vegetables, and fruits)
Valuation design question:
A dichotomous choice model with an open-ended elicitation format
To reduce the strategic bias of respondents
### Variable Definition and Statistics (1)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Mean</th>
<th>S.D.</th>
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</thead>
<tbody>
<tr>
<td>bid</td>
<td>First bid price. In this study we have ten sets of different bidding combination.</td>
<td>613.36</td>
<td>361.61</td>
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<tr>
<td>grade</td>
<td>Respondent’s subjective score for the weather forecast accuracy (0~100)</td>
<td>74.25</td>
<td>14.1</td>
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<td>p_effect</td>
<td>Dummy variable for farm management and production increase with the help of weather information. (yes=1; no=0)</td>
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<td>0.49</td>
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<td>Dummy variable for loss prevention with the help of weather information. (yes=1; no=0)</td>
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<td>Dummy variable for gender. (male=1; female=0)</td>
<td>0.66</td>
<td>0.47</td>
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<tr>
<td>farmy</td>
<td>Experience for agricultural activities (in years)</td>
<td>35.5</td>
<td>19.52</td>
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<td>edu</td>
<td>Education indicators. (Illiteracy=1; elementary=2; junior high=3; senior high=4; college=5)</td>
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<td>Dummy variable for experiences of loss due to weather changes</td>
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<td>hectare</td>
<td>Plantation Area (in hectare)</td>
<td>0.8</td>
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<td>age</td>
<td>Respondent’s age</td>
<td>60.96</td>
<td>12.66</td>
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<td>revenue</td>
<td>Annual agricultural revenue (in 10,000 NTD)</td>
<td>22.75</td>
<td>25.42</td>
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<td>Variables</td>
<td>Definition</td>
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<td>Dummy variable for coarse grain farmers</td>
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<td>Dummy variable for special crops farmers</td>
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<td>Dummy variable for vegetables farmers</td>
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<td>kind_4</td>
<td>Dummy variable for fruits farmers</td>
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<td>Dummy variable for ornamental plants farmers</td>
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<td>Dummy variable for rice farmers</td>
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<td>Dummy variable for central region</td>
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Our findings in 2013 study (1)

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<td>-858.621**</td>
<td>378.245</td>
<td>-2.27</td>
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Sample number: 284  
F value = 6.55  
Pesudo likelihood value: -1961.5823
Policy implications in the 2013 study

▷ Most farmers receive weather information services by television.
▷ Need to establish a pilot study in order to know more details about how farmers use weather information services
▷ Additional investigations on fishery and livestock industry
▷ Identify which measures can improve farmers’ knowledge on using weather information services
▷ Evaluate how much the potential benefits can come from those extension services
Start-up for the pilot program in agriculture

▷ CWB accepts the policy suggestions of establishing a pilot study in order to know more details about how farmers use weather information services.

▷ Following the implementation plan suggested by WMO’s Global Framework of Climate Services (GFCS), a series of better weather information activities are designed to improve end-user’s knowledge and perception.

▷ Cooperating with the experts from Taiwan Agriculture Research Institute (TARI) of Council of Agriculture (COA) to develop further extension services in agriculture, we use previous research outcomes to develop an exemplar for the practice of user interface platform (UIP).

▷ Establish the study panel of developing climate application services in agriculture and future action plans
   ➔ find a partnership and start a WTP survey in the first beginning
Pilot study in Erlin

Taiwan Map

Changhua County

Erlin Township
Partnership with Erlin Farmers Association

- Changhua County has been the most agriculturally productive areas in Taiwan, with Erlin Township as the biggest cultivated and harvested area amidst the county.

- Recently Erlin has produced high-valued crops such as grapes, pearl barley and buckwheat. Hence, such diverse crop options provide a suitable environment for our research team to study agricultural producers’ needs and feedbacks from using meteorological information.

- To evaluate the economic value of meteorological services, we randomly selects 260 out of 595 registered farmers who are also the members of the 23 agricultural production and marketing groups of Erlin Farmers Association.
Partnership in this pilot case study

- Central Weather Bureau (CWB)
- Taiwan Agricultural Research Institute (TARI)
- Chung-Hua Institution for Economic Research (CIER)
- Erlin Farmer’s Association (RLFA)
A national survey of valuing climate service for agricultural producers from 400 randomly selected registered agricultural households

The 2013 Second Short-term Climate Prediction and Application Forum Forecast Conference hosted by CWB with joint efforts of TARI

Select Erlin Farmers’ Association (RLFA) as our pilot project partner, and conduct a baseline WTP survey in the first beginning

Workshops of climate service application in agriculture were organized and held by CIER at two government agencies (TARI and Hualien District Agricultural Research and Extension Station) and two farmers’ organizations (RLFA and Ji’an Farmers’ Association).

Agrometeorology expert meetings organized by CWB, CIER, and TARI

Working with TARI, the climate services application manual for agriculture extension was first drafted.

A training workshop hosted by CWB for agricultural extension officers and seed teachers

Workshops of practicing the drafted manual in RLFA and Ji’an Farmers’ Associations

Rice and dragon fruit farmers at RLFA selected as experimental groups for future study

App software and agricultural application workshops for experimental groups at RLFA

A follow-up user survey of CWB’s climate services was conducted by CIER with more than 120 participants.
Extension and Outreach Activities

Workshop at Erlin (2014)
Extension and Outreach Activities

Workshop at CWB (2015)
Extension and Outreach Activities

Workshop at Erlin (2015)
Extension and Outreach Activities

CWB’s application software workshop (2016)
Taiwan Weather App

Direction

- The Taiwan Weather App for Android (English) offers a practical way for foreign residents and visitors to receive the latest weather information for Taiwan.
- The app can also deliver warnings, advisories and notifications in the case of severe weather conditions, such as typhoons, or earthquakes.
The key features of Taiwan Weather app
Outreach tailored products for RLFA

Cover Page of 2016 Farmer’s Calendar

App & website links

App QR code poster for RLFA
Outreach tailored products for RLFA

Rice cultivation calendar

Historical climate information in Erlin
Recent Development
Recent Development

More economic evaluation works for the potential benefits and economic value are done or in progress now:

▷ Fisheries;
▷ Livestock farmers;
▷ Master government project for agriculture and fishery;
▷ Water resource management;
▷ Disaster reduction;
▷ Energy;
▷ Health;
▷ Forestry;
▷ Tourism;
▷ Transportation.
Overall Outlook of CWB Economic Benefit Evaluation Project

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Master Project funded by Central Government
Thank you for your attention!