

# APEC Climate Symposium 2018

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



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***Sponsored by Central Weather Bureau***

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# Acknowledgements

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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?



Chung-Hua Institution for Economic Research  
<http://www.cier.edu.tw>

- Policy-oriented
- Multidisciplinary
- Global-linkage

Research

Economic

Industry

Trade

China

International

Development

Taiwan

FTA

Asia Pacific

WTO

**CIER**

**Taiwan's Most Prestigious Think Tank**



Chung-Hua Institution for Economic Research

# The introduction of CIER

**Wu Chung-shu , Ph. D.  
President**

**CHUNG-HUA  
INSTITUTION  
FOR  
ECONOMIC  
RESEARCH**

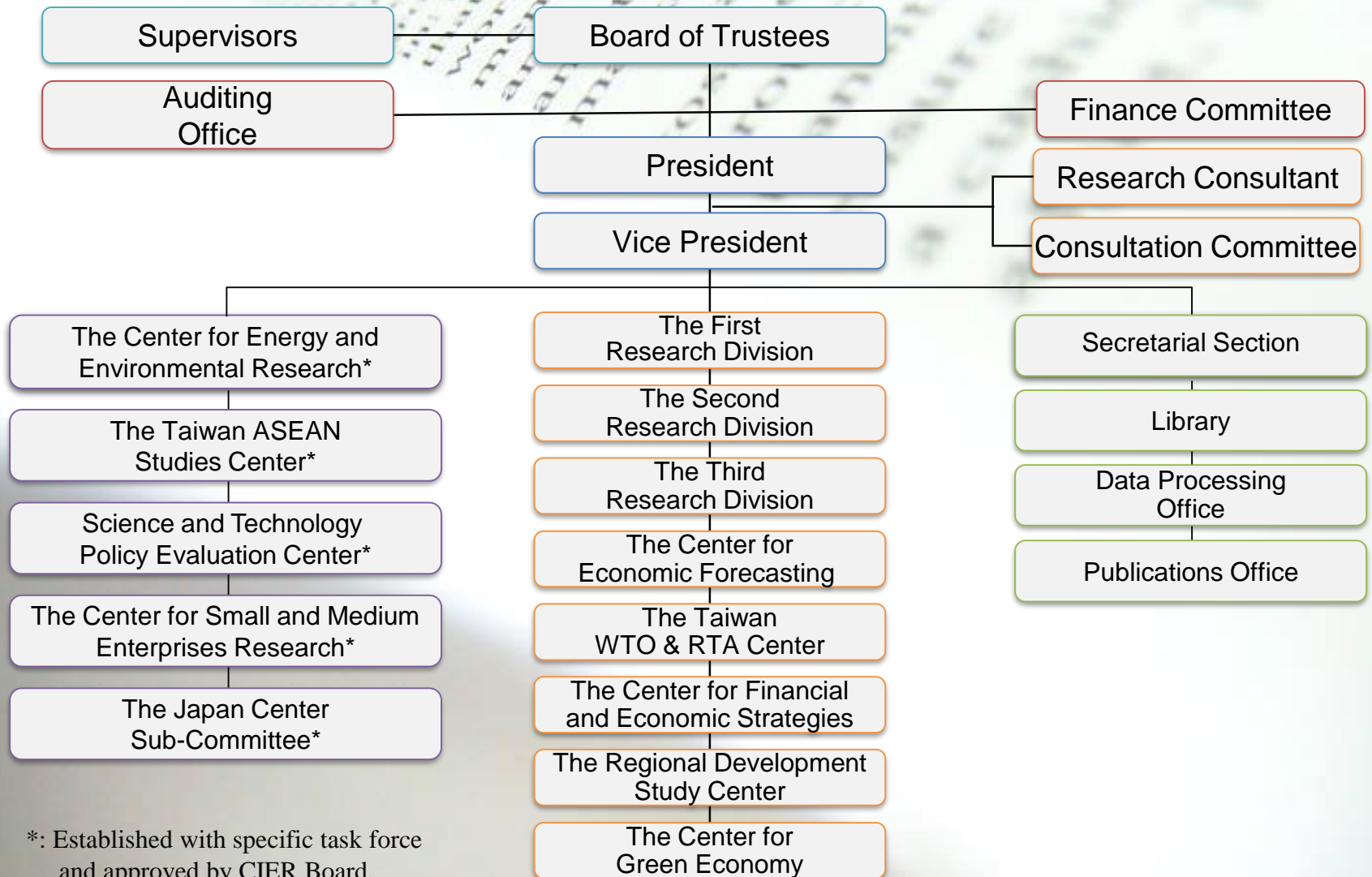


# The **Role** of CIER

- 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



\*: 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

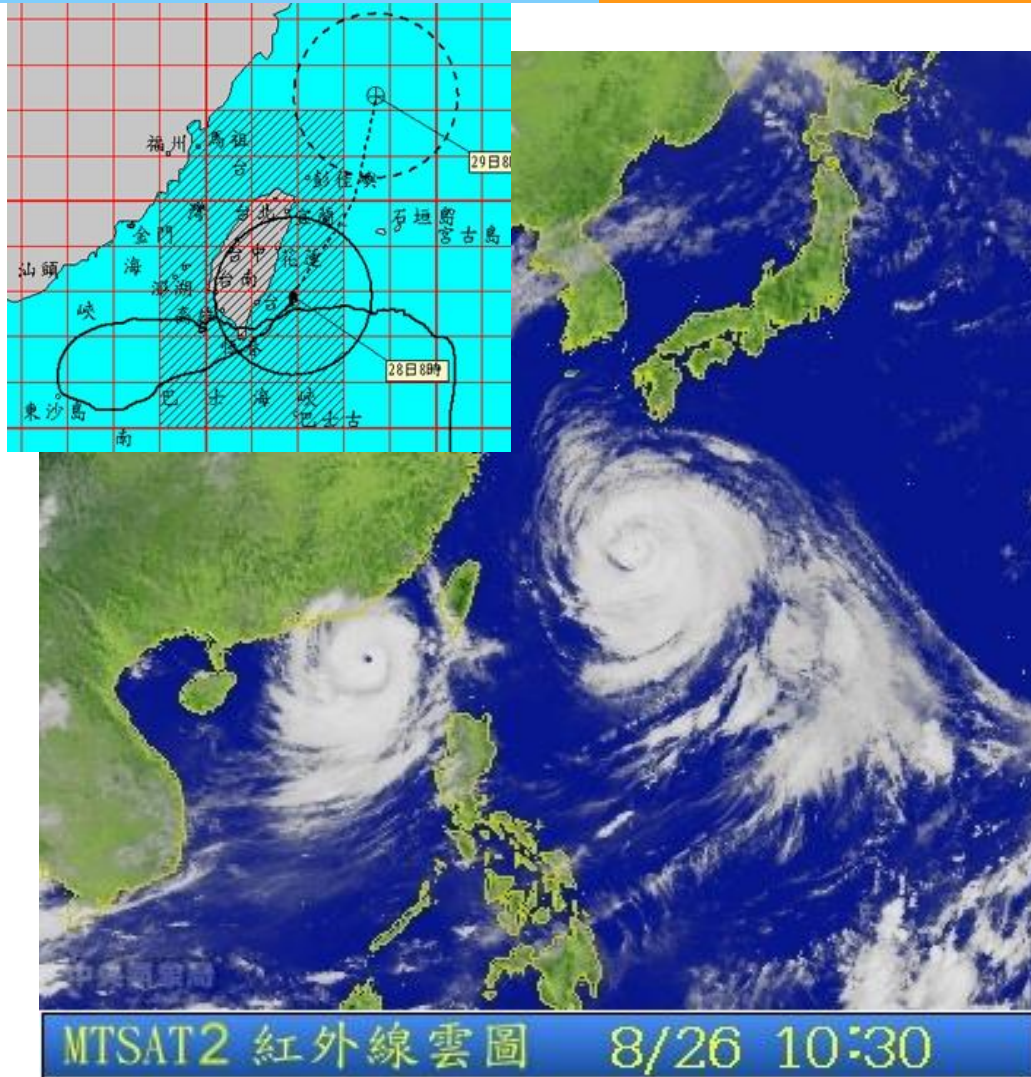




# Background Introduction

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)**  
36,000km<sup>2</sup>
- **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

## 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

# Initiatives of this study

- ▷ 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

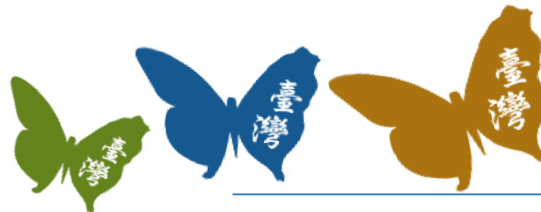
- ▷ Assist CWB to strengthen the collaboration between different government agencies and evaluate the potential economic values of CWB's climate information service
- ▷ Assist CWB to develop seamless weather services
- ▷ Assist CWB to establish a successful pilot case study for domestic end-users in various areas or sectors



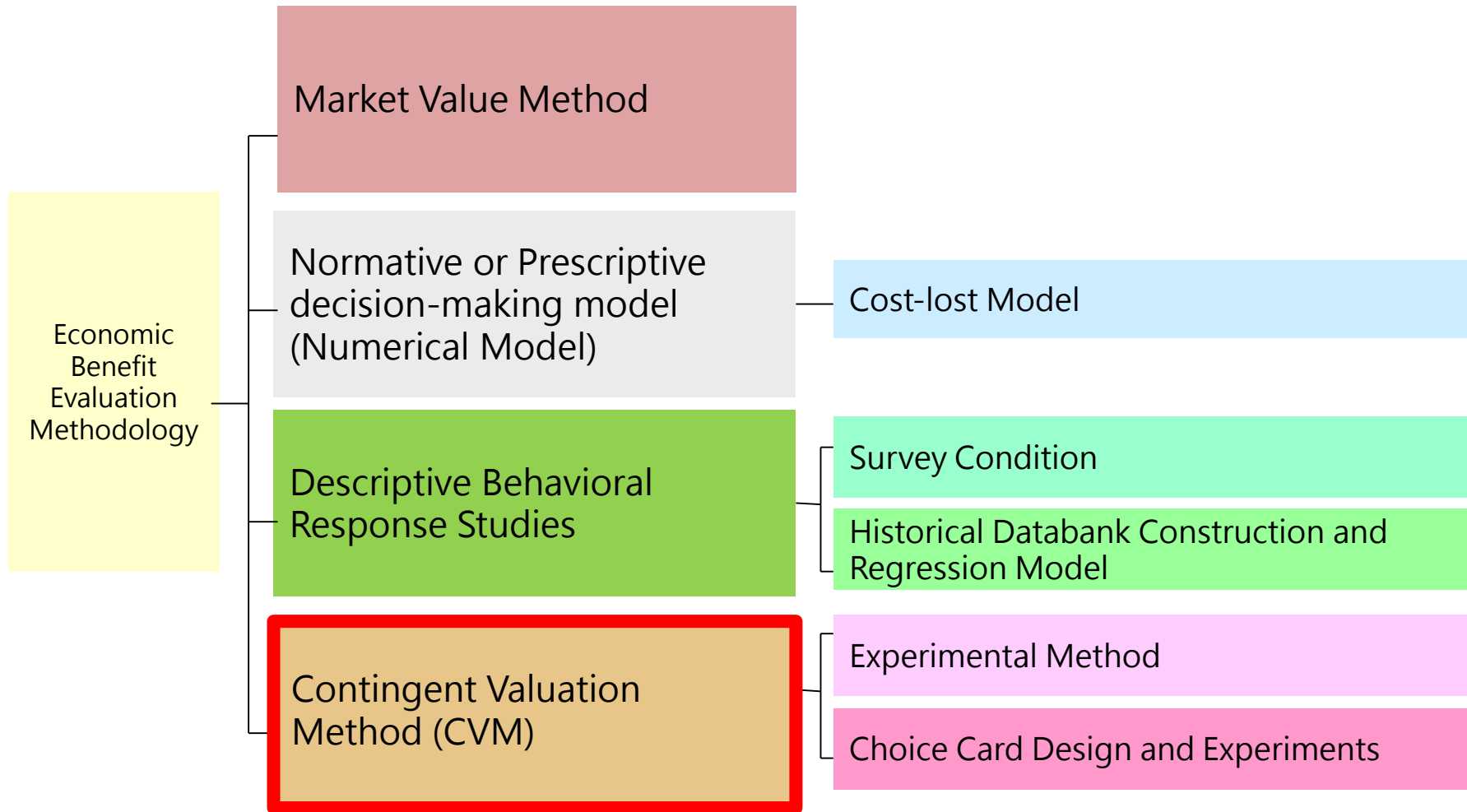
# **A Successful Experience in Agriculture: research findings and policy linkage**

# 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

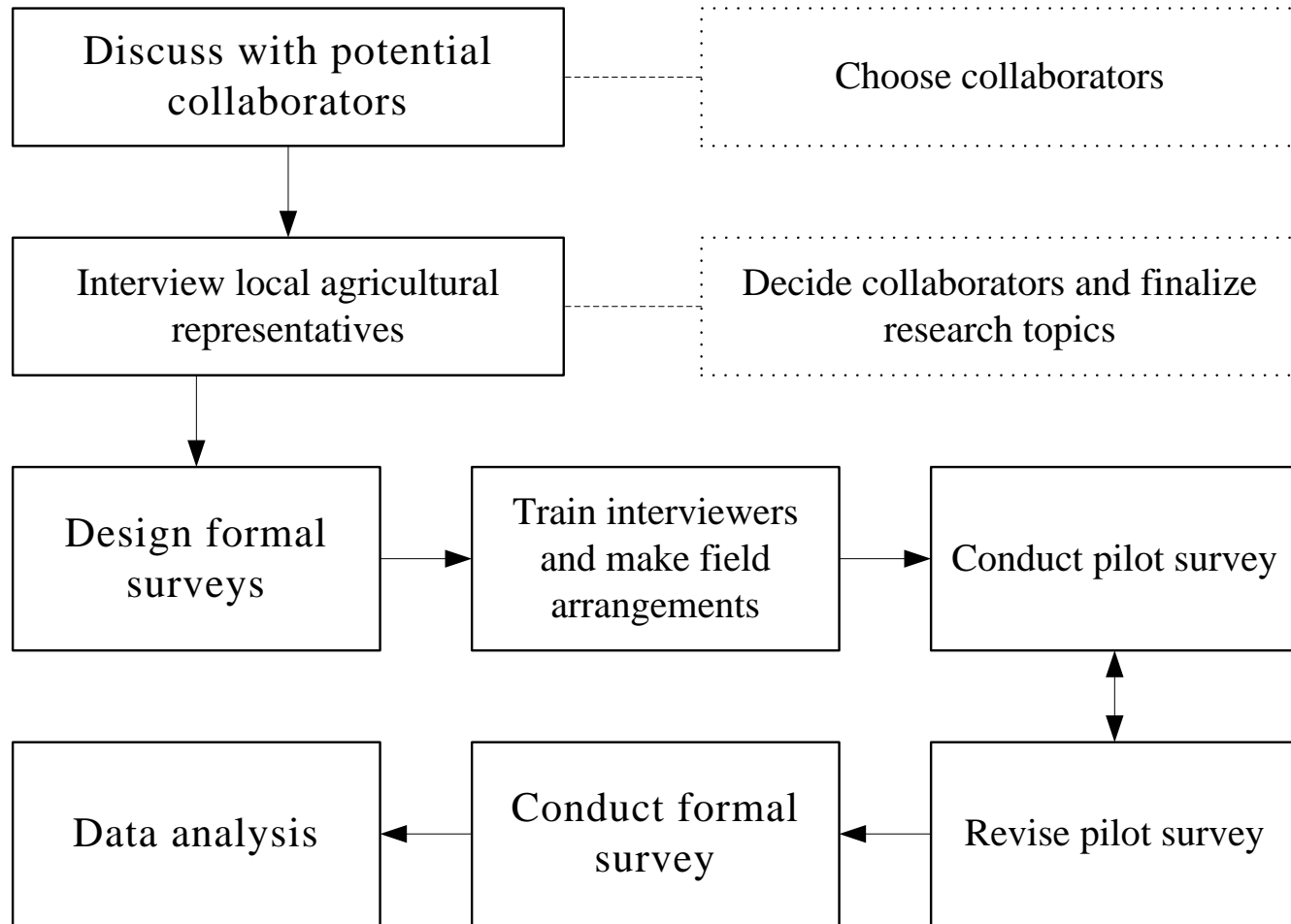


# Economic evaluation methods



Source: Freebarin and Zillman (2002) ; Lu et. al. (2016).

# How we conduct this CVM survey the implementation procedure



# 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)

# CVM in this study (1)

## ▷ *Setting up a hypothetical market:*

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

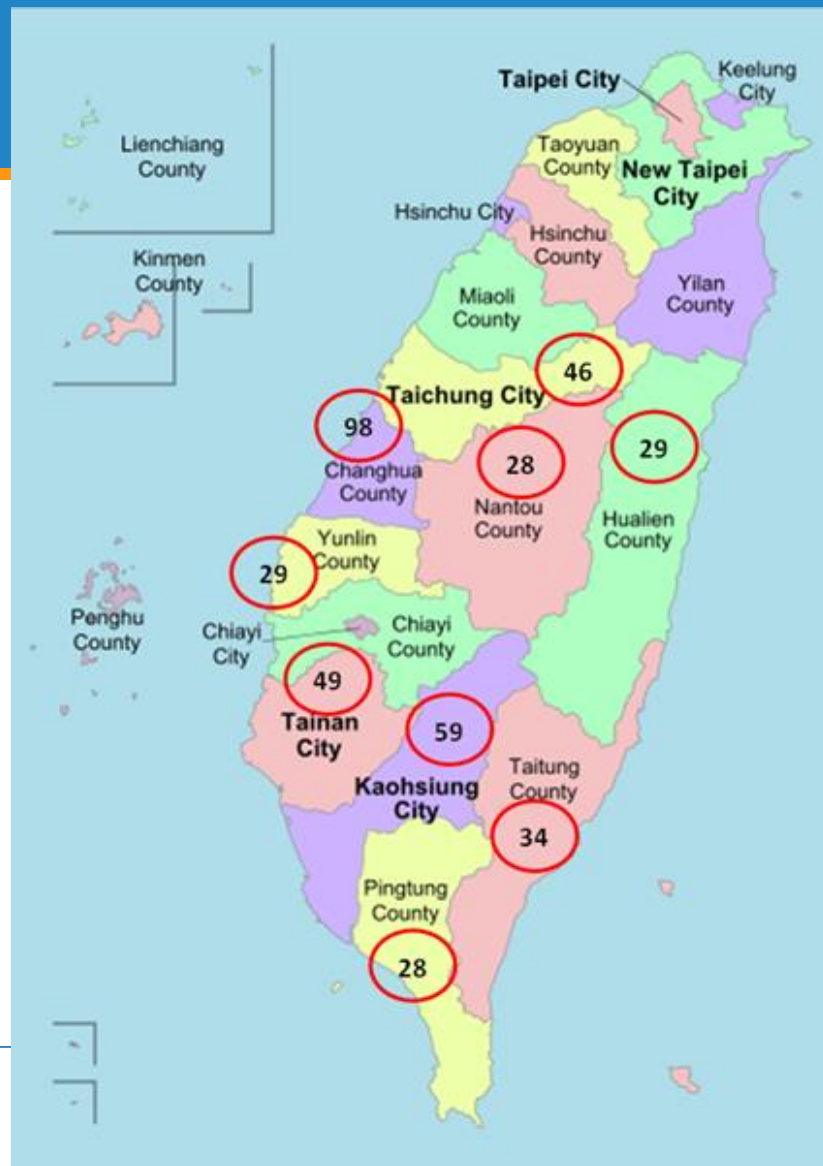
- 1) What is the subjective scores (0~100) of the respondents for the accuracy on weather forecast?
- 2) What are their WTPs for the weather information services provided by CWB based on their subjective forecast accuracy judgments?



# CVM in this study (2)

## ▷ *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)

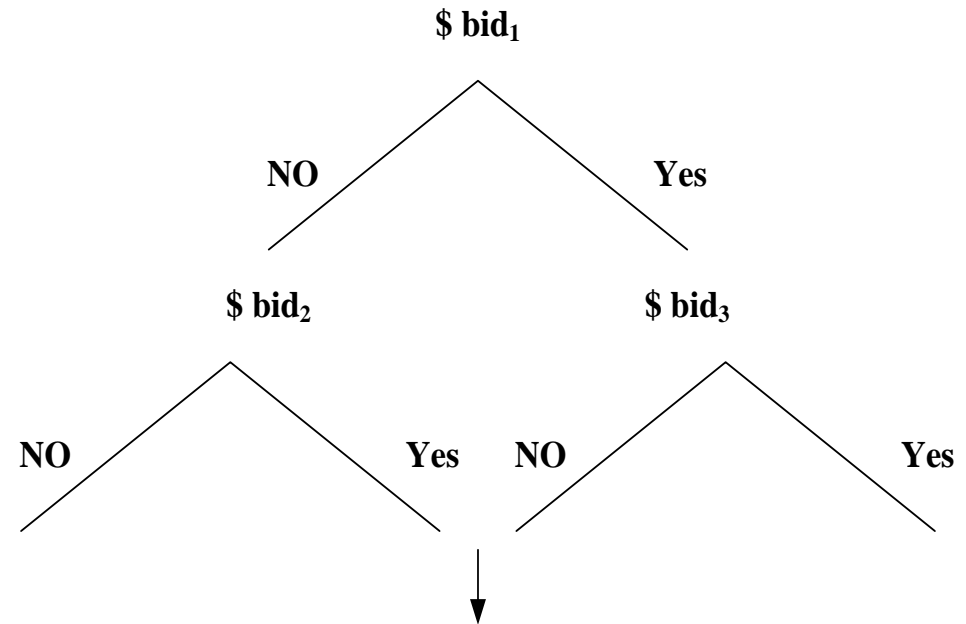


# CVM in this study (3)

▷ *Valuation design question:*

▷ A dichotomous choice model with an open-ended elicitation format

▷ To reduce the strategic bias of respondents



Maxium WTP

Open Answer



# Variable Definition and Statistics (1)

Variables	Definition	Mean	S.D.
bid	First bid price. In this study we have ten sets of different bidding combination.	613.36	361.61
grade	Respondent's subjective score for the weather forecast accuracy (0~100)	74.25	14.1
p_effect	Dummy variable for farm management and production increase with the help of weather information. (yes=1; no=0)	0.41	0.49
n_effect	Dummy variable for loss prevention with the help of weather information. (yes=1; no=0)	0.63	0.49
sex	Dummy variable for gender. (male=1; female=0)	0.66	0.47
farmy	Experience for agricultural activities (in years)	35.5	19.52
edu	Education indicators. (Illiteracy=1; elementary=2; junior high=3; senior high=4; college=5)	2.80	1.23
disaster	Dummy variable for experiences of loss due to weather changes	0.99	0.10
hectare	Plantation Area (in hectare)	0.8	1.24
age	Respondent's age	60.96	12.66
revenue	Annual agricultural revenue (in 10,000 NTD)	22.75	25.42

# Variable Definition and Statistics (2)

Variables	Definition	Mean	S.D.
kind_1	Dummy variable for coarse grain farmers	0.02	0.13
kind_2	Dummy variable for special crops farmers	0.13	0.33
kind_3	Dummy variable for vegetables farmers	0.44	0.50
kind_4	Dummy variable for fruits farmers	0.21	0.41
kind_5	Dummy variable for ornamental plants farmers	0.08	0.27
kind_6	Dummy variable for rice farmers	0.13	0.34
area_1	Dummy variable for southern region	0.33	0.47
area_2	Dummy variable for eastern region	0.20	0.40
area_3	Dummy variable for central region	0.48	0.5

# Our findings in 2013 study (1)

Variables	Coefficients	S.D.	t-value
bid	0.6188***	0.098	6.3
grade	6.2808**	2.714	2.31
p_effect	49.162	68.212	0.72
n_effect	84.059	82.339	1.02
sex	115.311	75.018	1.54
farmy	-0.042	2.312	-0.02
edu	3.026	37.445	0.08
disaster	243.75	210.748	1.16
hectare	103.423***	30.748	3.36
age	-0.048	4.25	-0.01
revenue	-0.954	1.925	-0.5
kind_1	297.285	182.998	1.62
kind_2	-9.201	133.692	-0.07
kind_3	-7.175	121.981	-0.06
kind_4	18.43	131.658	0.14
kind_5	285.459	280.407	1.02
area_1	-39.356	89.425	-0.44
area_2	-8.635	80.552	-0.11
constant	-858.621**	378.245	-2.27
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

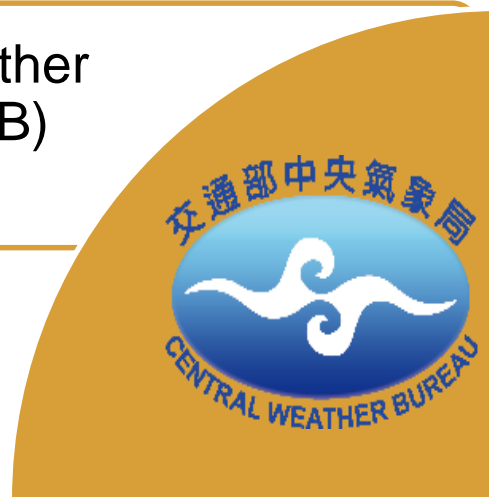


# Partnership with Erlin Farmers Association

- ▷ 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)



- Chung-Hua Institution for Economic Research (CIER)



- Taiwan Agricultural Research Institute (TARI)



- Erlin Farmer's Association (RLFA)





# 2016

**2016**

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.



# 2015

**2015**

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

# 2014

**2014**

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



# 2013

**2013**

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



# 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

## Taiwan Weather



### 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.



Available on the  
Android Market

DOWNLOAD

# The key features of Taiwan Weather app



# Outreach tailored products for RLFA



Cover Page of 2016 Farmer's Calendar



App & website links



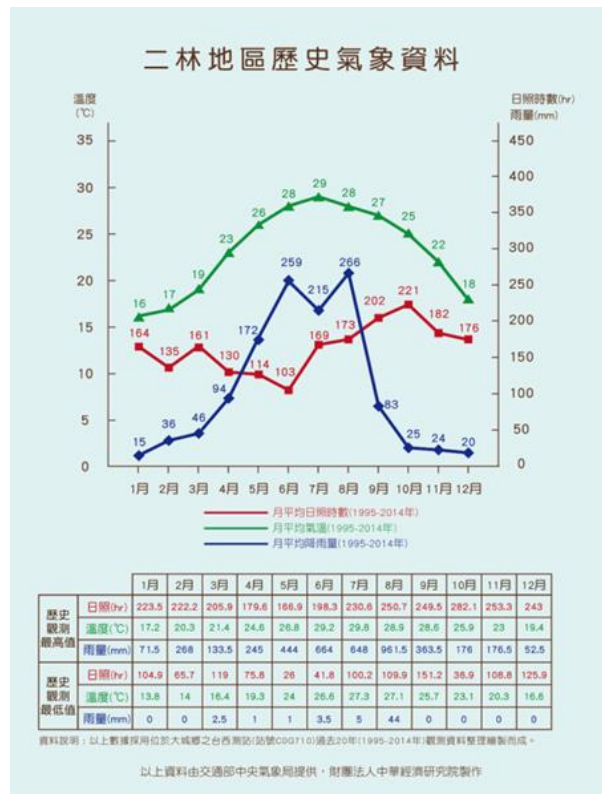
App QR code poster for RLFA

# Outreach tailored products for RLFA

日期	一期作水稻栽培作業曆						二期作水稻栽培作業曆															
	小春	大春	立春	雨水	驚蟄	春分	清明	穀雨	立夏	小滿	芒種	夏至	小暑	大暑	立秋	處暑	白露	秋分	寒露	霜降	立冬	
月份	1	2	3	4	5	6	7	8	9	10	11											
生育日數	0	14	34	45	53	66	75	123	0	5	10	30	45	60	70	70	114					
累積溫度	0	180	700	900	1700	0	200	830	1100	1700												
生育時期	秧苗期	營養生長期	生殖生長期	成熟期	秧苗期	營養生長期	生殖生長期	成熟期														
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施肥用量(公斤/公頃)	氮素120-200	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60	磷素40-60
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附註說明：1. 水稻品種、肥料藥品、病蟲害防治用藥介紹，請參考作物輔導暨生產整合資訊平台(<http://msi.kricas.sin.gov.tw/KISOP/Indonesia/>)；  
2. 農業氣象資料查詢，請參考農業氣象查詢系統(<http://msi.kricas.sin.gov.tw/Weather/>)；  
3. 二林地區氣象資料，請與農業氣象查詢系統/即時資料查詢/台中站相同。  
資料提供：農業委員會農業試驗所作物組生物統計與生物鑑定、呂保潔副研究員、  
圖表繪製：財團法人中華經濟研究院。

## Rice cultivation calendar



## Historical climate information in Erlin



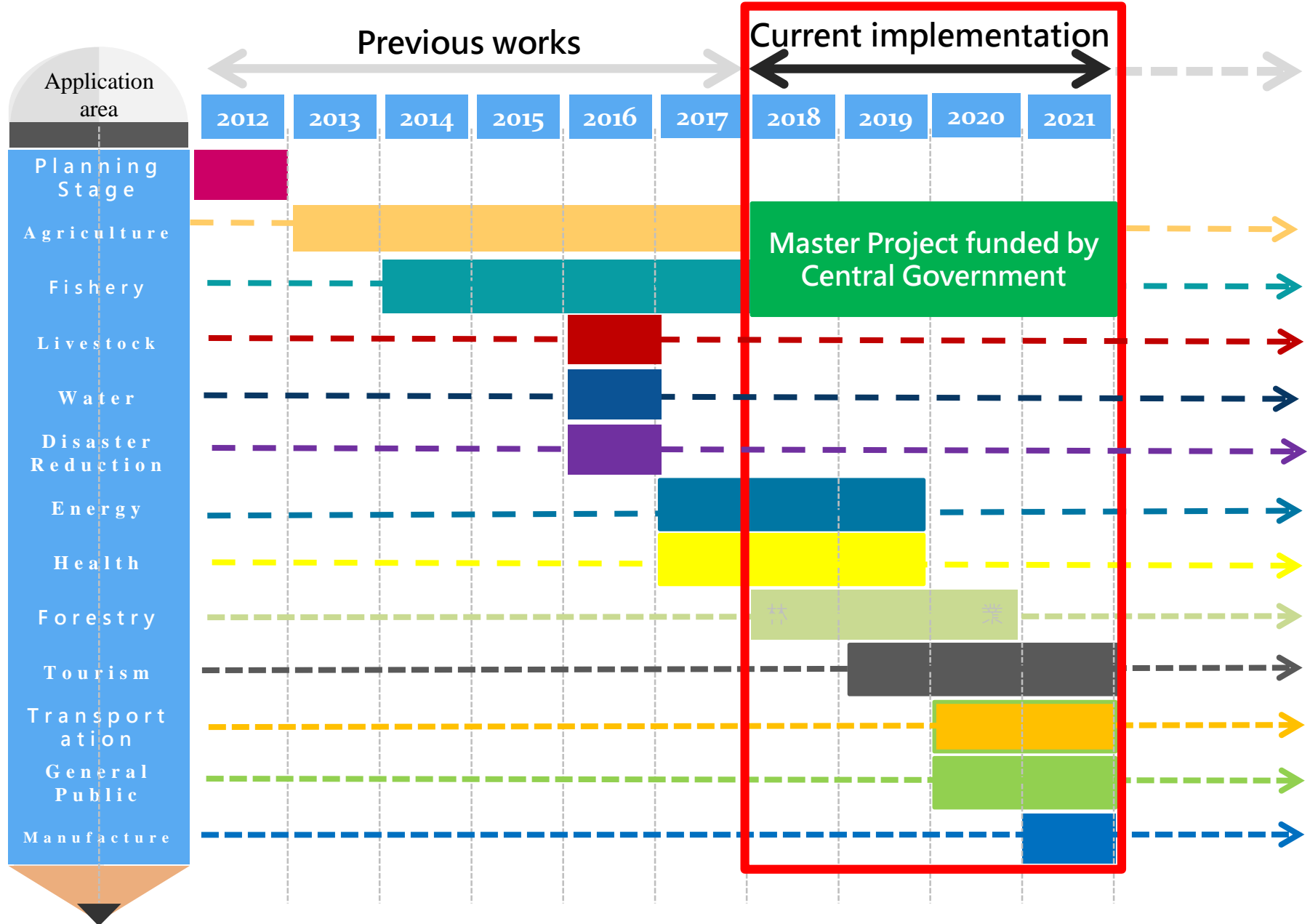
# Recent Development

# 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



**Thank you for your attention!**



**CHUNG-HUA INSTITUTION  
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