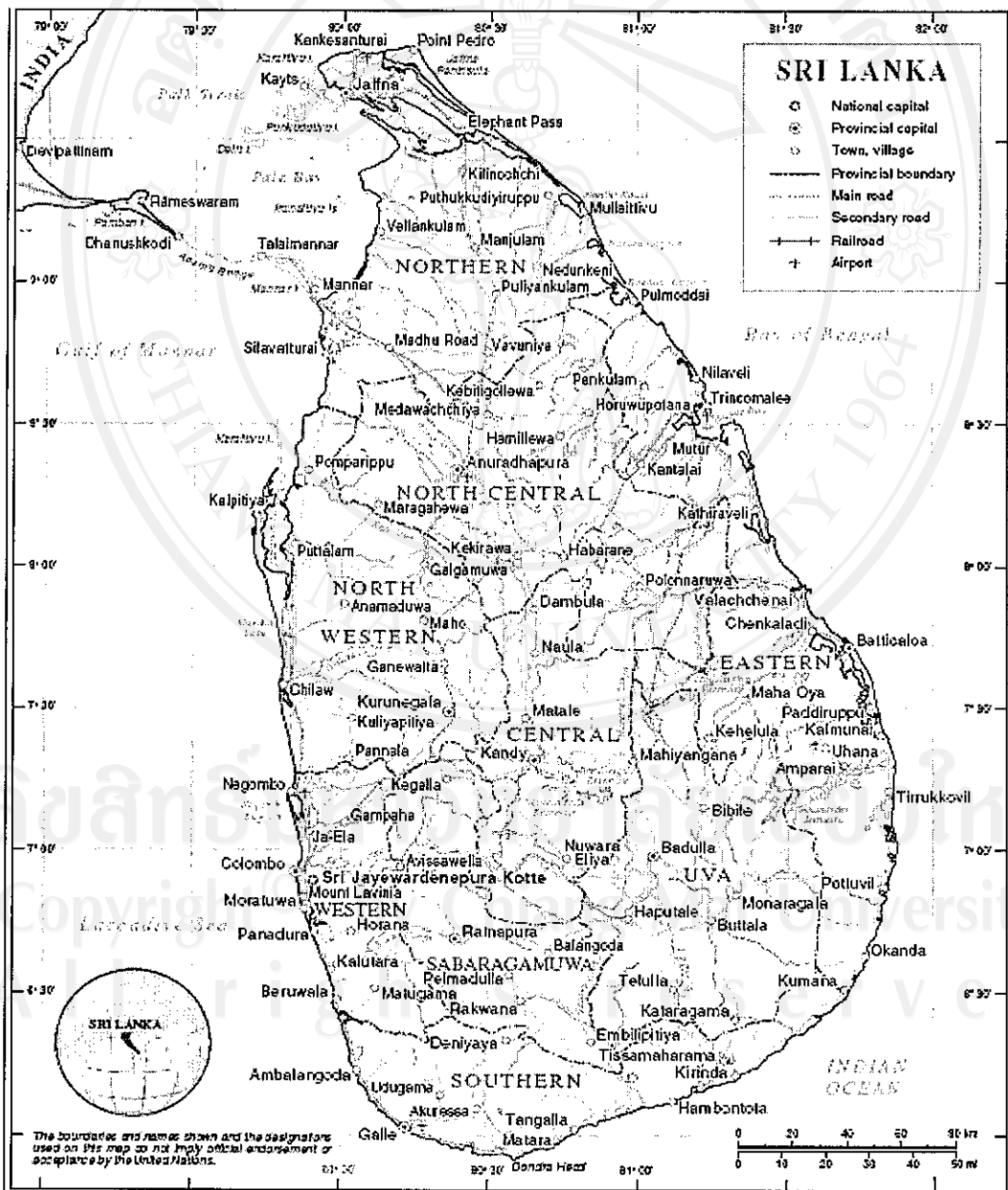


Appendices

Appendix: 1

Geographical situation of Sri Lanka



Source: [www.un.org/Depats/cartographic/map/profile/\\_srilanka.pdf](http://www.un.org/Depats/cartographic/map/profile/_srilanka.pdf)

## Appendix 2

### Interview schedule for household survey

ID

## Sustainability Assessment of Surface and Drip Irrigation for Banana Cultivation in Dry Zone, Sri Lanka.

Name of the interviewer.....

Name of the responder.....

Address .....

Agrarian Division.....

### GENERAL INFORMATION ABOUT FARMER

1. Farmers and family member's age, education, and involvement in banana farming activity

Relation ship	Sex	Age (year)	Education*	Involvement of Banana farm activity **
Head				

\*0-12 According to grade, 13 other Diploma/ degree

\*\* 1= full time, 2= Part times, 3= Not involve

2. Land extend under banana cultivation.....

3 Number of banana bush in the farm.....

4. Average banana plants in the one bush .....

5 Age of the banana cultivation.....

**INFORMATION ON SOCIO ECONOMIC INDICATORS****WATER PRODUCTIVITY**

## 6. Detail on water pump

Type of the pump	.....
Purchase Price of the pump	.....
Year of purchase	.....
Farm life time (year)	.....
model	.....
Trade name	.....
Energy source	.....
Capacity ( CP)** (litters/hours)	.....
Horse power	.....
Head	.....
Maintenance cost per year (Rupees)	.....

## 7. Irrigation methods (Use ✓ in relevant answer)

Drip irrigation	<input type="checkbox"/>
Surface irrigation	<input type="checkbox"/>

8. If surface irrigation- water supplying time and irrigation interval, labor allocation, amount of water used

Month	Irrigation interval (days)	Supplying time (T) (hours)	Amount of water used (Liters) $CP^{**} \times T$	Labor Allocation for irrigation		Electricity Cost (Rupees)	Kerosene /Diesel	
				Man day	cost		Liters	Cost (Rupees)
January				F				
				H				
February				F				
				H				
march				F				
				H				
April				F				
				H				
May				F				
				H				
June				F				
				H				
August				F				
				H				
September				F				
				H				
October				F				
				H				
November				F				
				H				
December				F				
Total								

9. If drip irrigation-Detail of the system

Total cost for system.....

Buying year.....

Farm life time (according to farmer idea).....

Maintenance cost (Rs per year).....

Number of Sub-main.....

Number of lateral.....

Drippers for one bush (n).....

Discharge rate of one dripper (DR)-Litter per hour.....

Number of bush in farm (N).....

Total water discharge during one hour (DR \*N \*n).....

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## 11. Cost of cultivation (For land extend that mentioned in the question no 2)

<b>Activity</b>		<b>Unit</b>	<b>Cost per one Unit (Rupees)</b>		<b>Total cost</b>
<b>Fertilizing</b>	Name of fertilizer	Kg			
Total time allocation for fertilizing		Man days		F H	
<b>Weeding:</b> Number of time manual weeding =		Man days		F H	
Number of time chemical Weeding=	Name of herbicide		Amount		
	Trade	Chemical	Kg or Liters	Active Ingredient	
Labor for application Of herbicide		Man days		F H	
<b>Bush Clearing &amp; sucker removing</b>		Man days		F H	
<b>Insects &amp;</b>	Name of the chemical	Amount			

disease control	Trade	Chemical	Kg or Liters	Active Ingredient			
Labors for pesticide application	Man days					F	
						H	
<b>Harvesting</b>	Man days					F	
						H	
<b>Supply support</b> (prevent lodging)	Material						
	Man days					F	
***	Man days					F	
						H	
<b>Irrigation cost</b> (Q # 8 or 10)	Energy						
<b>Maintenance cost for pump</b> (Q#6 )							
<b>Maintenance cost for well</b> (Q#16)							
<b>Maintenance cost for drip system</b> (Q#9 )							
<b>Maintenance cost for farm hut</b> (Q#17 )							
<b>Maintenance cost for farm Equipment</b> (Q # 17)							
<b>Transport cost</b> (hire)							
<b>Operation cost own vehicles</b> M. bike Tractor (Q #15)							
<b>Other cost</b>							
<b>***Depreciation values of pump</b> (Q# 6 and 8 or 10)							
<b>***Depreciation value of drip system</b> (Q# 9)							
<b>***Depreciation value of Fertigation units</b> (Q#19)							

<b>***Depreciation of value bike (Q#15)</b>				
<b>***Depreciation value of Mo. Bike (Q#15)</b>				
<b>***Depreciation value of other Vehicle (Q#15)</b>				
<b>***Depreciation value of farm hut (Q#18)</b>				
<b>***Depreciation value of well (Q#16)</b>				
Total				

F= family labor, H= hired labor

\*\*\* These values should be calculate using information from other questions

12 According to your experience amount of water supply for your banana during last five years do have changing trend? (Use ✓ in relevant answer)

Yes	
No	

13. If yes detail of change (Use ✓ in relevant answer)

Highly Increased	Moderately Increased	Little Increased	Little Decreased	Moderately Decreased	Highly Decreased



## 14. Banana selling method

Selling method	Use ✓ in relevant answer
At farm(middle men)	
Nearest market	
Whole sale markets	
Others	

## 15 Banana transport methods

Transport method	Use ✓ in relevant answer
Hire vehicle	
Own vehicle	
Other	

## 16 If own vehicle, detail of own vehicles- Detail of the vehicle

Vehicle	Purchase price	Purchase year	Maintenance Cost per year (Rupees)	Time used for banana transport during last year (hours)	Farm Life time	Time used for Input (banana) transport during last year (hours)	Operating cost for transport		Total Time used (hours)
							Banana Transport	Input Transport	
Bike									
M. Bike									
Tractor									

## 17. Detail on shallow well

Constructed year	.....
Total cost for constructed	
Maintenance cost per year	

## 18 Detail on farm hut (if have)

Constructed year	-----
Total cost for constructed	
Maintenance cost per year	

## 19. Detail on other farm equipment that was used for banana cultivation

Name of the Equipment	Purchasing price	Purchasing year	Farm life Time	Maintenance Cost per year	Time used for banana cultivation during past year
Mamorties					
1					
2					
3					
Sprayers					

## 20 Detail on fertigation unit (drip irrigation)

Purchasing Year	Purchasing cost	Farm life Time	Used time During last year(Hours)	Maintenance Cost last year

## 21 Yield and income during last year

Month	Amount of Bunches Soled	Average Kg in one bunch	Total amount of Kg	Price per kg Rupees	Total Income Rupees
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

22. Amount of product used for other purpose (Consumption. Given for relatives friends, etc)

Month	Average Kg in one bunch	Total amount of Kg
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

23. According to your experience, your annual banana yield has changing trend during past five years. (Use ✓ in relevant answer)

Yes	
No	

24. If yeas detail of the change (Use ✓ in relevant answer)

Highly Reduced	Moderately Reduced	Little Reduced	little Increased	Moderately Increased	Highly Increased

## SOCIAL PARTICIPATION OF THE FARMER

25. Derail on social organization in the village, membership and farmer participation

Name of the organization	Member ship		Number of Meeting (last year)	Number of participation
	Yes	NO		

26. Other social activities in the village and farmer participation

Name of the organization	Number of activity	Nature of the activity	Number of participation

27. Do you think your irrigation activity affect on your time allocation of social activities? (Use ✓ in relevant answer).

Yes	
No	

28. If yes detail of the effects (Use ✓ in relevant answer)

Highly Reduced	Moderately Reduced	Little Reduced	little Increased	Moderately Increased	Highly Increased

29. According to your experience, do you have changing trend on proportion of participation on social activities during past 5 year? (Use ✓ in relevant answer)

Yes	
No	

30. If yes, detail of the trend (Use ✓ in relevant answer)

Highly Increased	Moderately Increased	Little Increased	Little Decreased	Moderately Decreased	Highly Decreased

#### INFORMATION ON ECOLOGICAL INDICATORS

31. Do you think your fertilizer usage on banana cultivation has changing trend during past 5 years? (Use ✓ in relevant answer)

Yes	
No	

32. If yes, detail of the trend (Use ✓ in relevant answer)

Increased	
Decreased	

33. If increased (Use ✓ in relevant answer)

Type of fertilizer	Highly Increased	Moderately Increased	Little Increased

34. If decreased (Use ✓ in relevant answer)

Type of fertilizer	Highly Decreased	Moderately Decreased	Little Decreased

35. According to your experience, agro chemical using on your banana cultivation does have changing trend during past 5 year? (Use ✓ in relevant answer)

Yes	
No	

36. If yes, detail of change(Use ✓ in relevant answer)

Name of Agro chemical	Purpose Of used	Highly Increased	Moderately Increased	Little Increased	little Decreased	Moderately Decreased	Highly Decreased

### Soil sample collection for salinity test

37. Number of points that samples were collected

.....

38. Soil texture (feeling by researcher)

Texture feeling	Use ✓ in relevant answer
Heavy clay	
Clay	
Medium clay	
Sandy clay	
Sandy loamy	
Light sandy	

39. Soil salinity level in the fields (result of soil test)

.....

**INFORMATION ON AGRONOMIC SUSTAINABILITY**

**Weed infestation in the field**

40. Number of weeding during past year (Chemical weeding+ manual weeding)

-----

41. Do you think during past 5 years, number of weeding per year has changing trend in your banana field? (Use ✓ in relevant answer)

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

42. If yes, detail of trend number of weeding (Use ✓ in relevant answer)

Highly Increased	Moderately Increased	Little Increased	Highly Decreased	Moderately Decreased	little Decreased
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Lodging tolerance of banana plants**

43. Were banana plants falls down in your cultivation due to wind? (Use ✓ in relevant answer)

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

44. If yes, during last year how many banana plants fall down in your cultivation?

.....

45. According to your experience are any trends to changing lodging of your banana plants during past 5 years (Use ✓ in relevant answer)

Yes	
No	

46. If yes, detail of trend (Use ✓ in relevant answer)

Highly Increased	Moderately Increased	Little Increased	little Decreased	Man days Decreased	Highly Decreased

47 Do you supply support for prevent lodging of banana plant. (Use ✓ in relevant answer)

Yes	
No	

48. If yes, number of plants which were supplied support during last year.

.....

49. According to your experience, does support supplying has changing trend during last 5 year (Use ✓ in relevant answer)

Yes	
No	

50 If yes detail of change (Use ✓ in relevant answer)

Highly Increased	Moderately Increased	Little Increased	little Decreased	Moderately Decreased	Highly Decreased

51. Other information and remarks

.....  
 .....  
 .....



### Appendix 3

#### Weights calculation at AHP workshops

#### Workshop for Drip irrigation system

##### (1) Weights calculation for sustainability criteria at drip irrigated farmer's workshop.

Farmer's priority on sustainability criteria

Socio economic > Agronomic > Ecological

Pairwise comparison matrix on criteria for drip irrigation

	Socio economic	Agronomic	Ecological
Socio	1.00	4.00	8.00
Agronomic	0.25	1.00	4.00
Ecological	0.12	0.25	1.00
Column Total	1.37	5.25	13.00

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix sustainability criteria for drip irrigation

	Socio economic	Agronomic	Ecological	Row sum	Row average
Socio economic	0.729927	0.761905	0.615385	2.1072	0.7024
Agronomic	0.182482	0.190476	0.307692	0.6806	0.2268
Ecological	0.087591	0.047619	0.076923	0.2112	0.0704

Weights vector for criteria on drip irrigation

Socio economic	0.70
Agronomic	0.23
Ecological	0.07

**Consistency checking of decision of rating on sustainability criteria at drip irrigated farmer's workshop**

Original pairwise matrix multiply with vector weight

	Socio economic	Agronomic	Ecological	Weighted sum vector
Socio economic	$1.00 \times 0.70$	$4.00 \times 0.23$	$8.00 \times 0.07$	2.1756
Agronomic	$0.25 \times 0.70$	$1.00 \times 0.23$	$4.00 \times 0.07$	0.6853
Ecological	$0.12 \times 0.70$	$0.25 \times 0.23$	$1.00 \times 0.07$	0.2117

Weighted sum vector divided by vector weights

Socio economic	$2.1756 \div 0.70$
Agronomic	$0.6853 \div 0.23$
Ecological	$0.2117 \div 0.07$

Consistency vector

3.0973
3.0206
2.9941

Total 9.1121

Average ( $\lambda$ ) 3.0373

$$CI = \frac{\lambda - n}{n - 1}$$

Where:

CI= Consistency Index,  $\lambda$  = Average value for consistency vector,

n = Number of element in original pairwise matrix

$$CI = \frac{3.03 - 3.00}{3.00 - 1.00} = 0.01$$

$$CR = \frac{CI}{RI} \quad CI = 0.01 \quad RI = 0.52, \quad CR = 0.01$$

If stakeholder decision has consistency, CR should be smaller than 0.05. Calculated CR for criteria is 0.01. Therefore, stakeholder decision has consistency.

**(2) Weights calculation for sustainability indicator under socio economic criteria at drip irrigation farmer’s workshop**

**Farmer’s priority on sustainability indicator, under socio economic criteria.**

NF>WP>IV>SOP

Pairwise comparison matrix for indicator under socioeconomic criteria

	NP	WP	IV	SOP
NP	1.00	2.00	5.00	7.00
WP	0.50	1.00	3.00	3.00
IV	0.20	0.33	1.00	2.00
SOP	0.14	0.33	0.50	1.00
Column Total	1.84	3.66	9.50	13.00

his pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix for indicator under socioeconomic criteria

	NP	WP	IV	SOP	Row Total	Row Average
NP	0.5434	0.5464	0.5263	0.5384	2.1545	0.5386
WP	0.2719	0.2732	0.3157	0.2307	1.0915	0.2758
IV	0.1086	0.0901	0.1052	0.1538	0.4577	0.1144
SOP	0.0760	0.0901	0.0526	0.0769	0.2956	0.0739

## Weights vector for socio economic indicator

NP	0.54
WP	0.28
IV	0.11
SOP	0.07

**Consistency checking of decision of rating on sustainability indicator under socio economic criteria at drip irrigated farmer's workshop**

Original matrix multiply with vector weight

	NP	WP	IV	SOP	Weighted sum vector
NP	$1.00 \times 0.54$	$2.00 \times 0.28$	$5.00 \times 0.11$	$7.00 \times 0.07$	2.1745
WP	$0.50 \times 0.54$	$1.00 \times 0.28$	$3.00 \times 0.11$	$3.00 \times 0.07$	1.1075
IV	$0.20 \times 0.58$	$0.33 \times 0.28$	$1.00 \times 0.11$	$2.00 \times 0.07$	0.4601
SOP	$0.14 \times 0.54$	$0.33 \times 0.28$	$0.50 \times 0.11$	$1.00 \times 0.07$	0.2966

Weighted sum divided by vector weights

NP	$2.1745 \div 0.54$
WP	$1.1075 \div 0.28$
IV	$0.4601 \div 0.11$
SOP	$0.2966 \div 0.07$

Consistency vector

	4.0268
	3.9553
	4.0183
	4.2371

Total 16.2375

Average ( $\lambda$ ) 4.0593

$$CI = \frac{\lambda - n}{n - 1}$$

$$CI = \frac{4.05 - 4.00}{4.00 - 1.00} = 0.02 \quad CR = \frac{CI}{RI} \quad CI = 0.02 \quad RI = 0.89, \quad CR = 0.02$$

If stakeholder decision has consistency, CR should be smaller than 0.09. Calculated CR for indicator under socio economic criteria is 0.02. Therefore, stakeholder decision has consistency.

### **(3) Weights calculation on indicator under ecological criteria for drip irrigation banana**

#### **Farmer's priority on indicator under ecological criteria**

CFU>AGCU>SS

Pairwise matrix on indicator under ecological criteria for drip irrigated banana

	CFU	AGCU	SS
CFU	1.00	3.00	7.00
AGCU	0.33	1.00	4.00
SS	0.14	0.25	1.00
Column Total	1.47	4.25	12.00

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix

	CFU	AGCU	SS	Row sum	Row average
CFU	0.6802	0.7058	0.5833	1.9693	0.6564
AGCU	0.2244	0.2352	0.3333	0.7929	0.2643
SS	0.0952	0.0588	0.0833	0.2373	0.0791

Weight vector on indicator under ecological criteria for drip irrigation

CFU	0.66
AGCU	0.26
SS	0.08

**Consistency checking of decision of rating on sustainability indicator under ecological criteria at drip irrigated farmer's workshop**

Original metrics multiply with vector weight

	CFU	AGCU	SS	Weighted sum vector
CFU	$1.00 \times 0.66$	$3.00 \times 0.26$	$7.00 \times 0.08$	2.0035
AGCU	$0.33 \times 0.66$	$1.00 \times 0.26$	$4.00 \times 0.08$	0.7975
SS	$0.14 \times 0.66$	$0.25 \times 0.26$	$1.00 \times 0.08$	0.2371

Weighted sum divided by weights vector

CFU	$2.0035 \div 0.66$
AGCU	$0.7975 \div 0.26$
SS	$0.2371 \div 0.08$

Consistency vector

	3.0356
	3.0673
	2.9637

Total 9.0666

Average( $\lambda$ ) 3.0222

$$CI = \frac{\lambda - n}{n - 1}$$

$$CI = \frac{3.02 - 3.00}{3.00 - 1.00} = 0.01 \quad CR = \frac{CI}{RI} \quad CI = 0.01, \quad RI = 0.52, \quad CR = 0.01$$

If stakeholder decision has constancy, CR should be smaller than 0.05. Calculated CR for indicator under socio economic criteria is 0.01. Therefore, stakeholder decision has consistency.

#### (4) Weights calculation for indicator under agronomic criteria

##### Farmer's priority on indicator under agronomic criteria

WI>LT

Pairwise matrix on indicator under agronomic criteria

	WI	LT
WI	1.00	2.00
LD	0.50	1.00
Column sum	1.50	3.00

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix

	WI	LT	Row total	Row average
WI	0.6666	0.6666	1.3332	0.6666
LD	0.3333	0.3333	0.6666	0.3333

(11) Weight vector on indicator under ecological criteria for drip irrigation

WI	0.67
LT	0.33

This matrix has only two elements. Therefore, consistency checking is not necessary.

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Calculated Final weights for Sustainability indicator for drip irrigated banana cultivation

Calculated weights for sustainability criteria at workshop		Calculated weights for sustainability indicator at workshop		Final weights for sustainability indicator	
Criteria	Weights	Indicator	Weights	Indicator	Weights
Socio economic	<b>0.70</b>	NP	0.54	NP	<b>0.38</b>
		WP	0.28	WP	<b>0.19</b>
		IV	0.11	IV	<b>0.08</b>
		SOP	0.07	SOP	<b>0.05</b>
Agronomic	<b>0.23</b>	WI	0.67	WI	<b>0.15</b>
		LT	0.33	LT	<b>0.08</b>
Ecological	<b>0.07</b>	CFU	0.66	CFU	<b>0.04</b>
		AGCU	0.26	AGCU	<b>0.02</b>
		SS	0.08	SS	<b>0.01</b>

### **Workshop for surface irrigation system**

#### **(5) Weights calculation for sustainability criteria at surface irrigated farmer's workshop**

Farmer's priority on sustainability criteria

Socio economic > Agronomic > Ecological



Pairwise matrix on sustainability criteria for surface irrigated banana farmer's workshop

	Socio economic	Agronomic	Ecological
Socio	1.00	3.00	7.00
Agronomic	0.33	1.00	4.00
Ecological	0.14	0.25	1.00
Column Total	1.47	4.25	12.00

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix

	Socio economic	Agronomic	Ecological	Row sum	Row average
Socio economic	0.6802	0.7058	0.5833	1.9693	0.66
Agronomic	0.2244	0.2352	0.3333	0.7929	0.26
Ecological	0.0952	0.0588	0.0833	0.2373	0.08

Weight vector on criteria for drip irrigation

Socio economic	0.66
Agronomic	0.26
Ecological	0.08

**Consistency checking of decision of rating on sustainability criteria at surface irrigated farmer's workshop**

Original metrics multiply with vector weight

	Socio economic	Agronomic	Ecological	Weighted sum vector
Socio economic	$1.00 \times 0.66$	$3.00 \times 0.26$	$7.00 \times 0.08$	2.0042
Agronomic	$0.33 \times 0.66$	$1.00 \times 0.26$	$4.00 \times 0.08$	0.7996
Ecological	$0.14 \times 0.66$	$0.25 \times 0.26$	$1.00 \times 0.08$	0.2371

Row sum divided by vector weights

Socio economic	$2.0042 \div 0.66$
Agronomic	$0.7996 \div 0.26$
Ecological	$0.2371 \div 0.08$

Consistency vector

3.0339
3.0753
2.9637

Total 9.0729

Average ( $\lambda$ ) 3.024

$$CI = \frac{\lambda - n}{n - 1}$$

Where:

CI= Consistency Index,  $\lambda$  = Average value for consistency vector,

$n$  = Number of element in original metrics

$$CI = \frac{3.02 - 3.00}{3.00 - 1.00} = 0.01 \quad CR = \frac{CI}{RI} \quad CI = 0.01 \quad RI = 0.52, \quad CR = 0.01$$

If stakeholder decision has consistency, CR should be smaller than 0.05  
 Calculated CR for criteria is 0.01. Therefore, stakeholder decision has consistency.

**(6) Weights calculation for sustainability indicator under socio economic criteria at surface irrigation farmer's workshop**

Farmer's priority on sustainability indicator, under socio economic criteria.

NF>WP>IV>SOP

Pairwise comparison matrix for indicator under socioeconomic criteria

	NP	WP	IV	SOP
NP	1.00	3.00	8.00	9.00
WP	0.33	1.00	2.00	3.00
IV	0.12	0.5.	1.00	2.00
SOP	0.11	0.33	0.50	1.00
Column Total	1.56	4.83	11.5	15.00

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix for indicator under socioeconomic criteria

	NP	WP	IV	SOP	Row Total	Row Average
NP	0.6410	0.6211	0.69562	0.6000	2.5577	0.6394
WP	0.2115	0.2070	0.1739	0.2000	0.7924	0.1981
IV	0.0769	0.1035	0.08697	0.1333	0.4007	0.1001
SOP	0.0705	0.0683	0.0434	0.0666	0.2489	0.0622

Weights vector for socio economic indicator

NP	0.64
WP	0.20
IV	0.10
SOP	0.06

**Consistency checking of decision of rating on sustainability indicator under socio economic criteria at drip irrigated farmer’s workshop**

Original matrix multiply with vector weight

	NP	WP	IV	SOP	Weighted sum vector
NP	1.00 × 0.64	3.00 × 0.20	8.00 × 0.10	9.00 × 0.06	2.5954
WP	0.33 × 0.64	1.00 × 0.20	2.00 × 0.10	3.00 × 0.06	0.7962
IV	0.12 × 0.64	0.50 × 0.20	1.00 × 0.10	2.00 × 0.06	0.4004
SOP	0.11 × 0.64	0.33 × 0.20	0.50 × 0.10	1.00 × 0.06	0.2480

Weighted sum divided by vector weights

NP	2.5954 ÷ 0.64
WP	0.7962 ÷ 0.20
IV	0.4004 ÷ 0.10
SOP	0.2480 ÷ 0.06

Consistency vector

4.0553
3.9810
4.0040
4.1333

Total 16.1736

Average (λ) 4.0434

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่  
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$$CI = \frac{\lambda - n}{n - 1}$$

$$CI = \frac{4.04 - 4.00}{4.00 - 1.00} = 0.01 \quad CR = \frac{CI}{RI} \quad CI=0.01 \quad RI=0.89, \quad CR=0.01$$

If stakeholder decision has consistency, CR should be smaller than 0.09. Calculated CR for indicator under socio economic criteria is 0.01 Therefore, stakeholder decision has consistency.

### (3) Weights calculation on indicator under ecological criteria for drip irrigation banana

Farmer's priority on indicator under ecological criteria

AGCU > CFU > SS

Pairwise matrix on indicator under ecological criteria for surface irrigated banana

	AGCU	CFU	SS
AGCU	1.00	2.00	9.00
CFU	0.50	1.00	7.00
SS	0.11	0.14	1.00
Column Total	1.61	3.14	17

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix

	CFU	AGCU	SS	Row sum	Row average
CFU	0.6211	0.6369	0.5294	1.7874	0.5958
AGCU	0.3105	0.3184	0.4117	1.0407	0.3469
SS	0.0683	0.0445	0.0588	0.1717	0.0572

Weight vector on indicator under ecological criteria for surface irrigation

AGCU	0.59
CFU	0.35
SS	0.06

**Consistency checking of decision of rating on sustainability indicator under ecological criteria at surface irrigated farmer's workshop**

Original metrics multiply with vector weight

	CFU	AGCU	SS	Weighted sum
CFU	$1.00 \times 0.59$	$2.00 \times 0.35$	$9.00 \times 0.06$	1.8300
AGCU	$0.50 \times 0.59$	$1.00 \times 0.35$	$7.00 \times 0.06$	1.0650
SS	$0.11 \times 0.59$	$0.14 \times 0.35$	$1.00 \times 0.06$	0.1739

Weighted sum divided by weights vector

CFU	$1.8300 \div 0.59$
AGCU	$1.0650 \div 0.35$
SS	$0.1739 \div 0.06$

Consistency vector

	3.1016
	3.0428
	2.8983

Total 9.0427

Average( $\lambda$ ) 3.014

$$CI = \frac{\lambda - n}{n - 1}$$

$$CI = \frac{3.01 - 3.00}{3.00 - 1.00} = 0.005 \quad CR = \frac{CI}{RI} \quad CI = 0.005, \quad RI = 0.52, \quad CR = 0.009$$

If stakeholder decision has consistency, CR should be smaller than 0.05. Calculated CR for indicator under socio economic criteria is 0.009. Therefore, stakeholder decision has consistency.

### Weights calculation for indicator under agronomic criteria

Farmer's priority on indicator under agronomic criteria

WI>LT

Pairwise matrix on indicator under agronomic criteria

	WI	LT
WI	1.00	6.00
LT	0.16	1.00
Column sum	1.16	7.00

This pairwise matrix is normalized by each element in a column dividing using relevant column total.

Normalized matrix

	WI	LT	Row total	Row average
WI	0.8620	0.8571	1.7191	0.8595
LD	0.1379	0.1428	0.2807	0.1403

(11) Weight vector on indicator under ecological criteria for drip irrigation

WI	0.86
LT	0.14

This matrix has only two elements. Therefore, consistency checking is not necessary.

Calculated Final weights for Sustainability indicator for Surface irrigated banana cultivation

Calculated weights for sustainability criteria at workshop		Calculated weights for sustainability indicator at workshop		Final weights for sustainability indicator	
Criteria	Weights	Indicator	Weights	Indicator	<b>Weights</b>
Socio economic	0.66	NP	0.64	NP	<b>0.42</b>
		WP	0.20	WP	<b>0.13</b>
		IV	0.10	IV	<b>0.07</b>
		SOP	0.06	SOP	<b>0.04</b>
Agronomic	0.26	WI	0.86	WI	<b>0.22</b>
		LT	0.14	LT	<b>0.04</b>
Ecological	0.08	CFU	0.35	CFU	<b>0.02</b>
		AGCU	0.59	AGCU	<b>0.05</b>
		SS	0.06	SS	<b>0.01</b>

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## Curriculum Vitae

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**Educational background:**

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**Scholarships**

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