

**A STUDY ON IMPACT OF  
WATER USERS ASSOCIATIONS  
IN KRISHNA DELTA OF  
ANDHRA PRADESH**

**D. MEENA**

**M.Sc. (Ag.)**

**DOCTOR OF PHILOSOPHY IN AGRICULTURE  
(Agricultural Extension)**



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WATER USERS ASSOCIATIONS  
IN KRISHNA DELTA OF  
ANDHRA PRADESH**

**By**  
**D. MEENA**  
M.Sc. (Ag.)

**THESIS SUBMITTED TO THE  
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FOR THE AWARD OF THE DEGREE OF**

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**CHAIRPERSON: Dr. B. MUKUNDA RAO**



**ANGRAU**

**DEPARTMENT OF AGRICULTURAL EXTENSION  
AGRICULTURAL COLLEGE, BAPATLA  
ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY  
LAM, GUNTUR – 522 034, ANDHRA PRADESH  
2019**

## **DECLARATION**

I, Mrs. **D. MEENA**, hereby declare that the thesis entitled, “**A STUDY ON IMPACT OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA OF ANDHRA PRADESH**” submitted to the **Acharya N.G. Ranga Agricultural University** for the degree of **Doctor of Philosophy in Agriculture** is the result of original research work done by me. Part of the thesis has been published by me as “Meena, D., Rao, B.M and Rao, V.S. 2019. Opinion of the Functionaries towards Water Users Associations in Krishna Delta of Andhra Pradesh. *International Journal of Agriculture Sciences*. 11 (12) : 8684-8686.”

Date:

Place: Bapatla

**(D. MEENA)**

**I.D. No. BAD-16-23**

## **CERTIFICATE**

Mrs. **D. MEENA** has satisfactorily prosecuted the course of research and that thesis entitled “**A STUDY ON IMPACT OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA OF ANDHRA PRADESH**” submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that neither the thesis nor its part thereof has been previously submitted by her for a degree of any university.

Date:

**(B. MUKUNDA RAO)**  
**Chariperson**  
Professor (Polytechnics)  
Administrative Office, ANGRAU  
Lam, Guntur.

# CERTIFICATE

This is to certify that the thesis entitled “**A STUDY ON IMPACT OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA OF ANDHRA PRADESH**” submitted in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY IN AGRICULTURE** of the **Acharya N.G. Ranga Agricultural University**, Lam, Guntur is a record of the bonafide original research work carried out by Mrs. **D. MEENA** under our guidance and supervision.

No part of the thesis has been submitted by the student for any other degree or diploma. The published part and all assistance and help received during the course of the investigation have been duly acknowledged by the author of the thesis.

## **Thesis approved by the Student’s Advisory Committee**

- Chairperson : **Dr. B. MUKUNDA RAO** \_\_\_\_\_  
Professor (Polytechnics)  
Administrative Office  
ANGRAU, Lam, Guntur – 522 034
- Member : **Dr. P. RAMBABU** \_\_\_\_\_  
Director of Extension  
Administrative Office  
ANGRAU, Lam, Guntur – 522 034
- Member : **Dr. V. RADHAKRISHNA MURTHY** \_\_\_\_\_  
Professor  
Department of Agronomy  
Agricultural College  
Bapatla – 522 101
- Member : **Dr. V. SRINIVASA RAO** \_\_\_\_\_  
Professor & University Head  
Dept. of Statistics and Computer Applications  
Agricultural College  
Bapatla – 522 101
- External Examiner for viva-voce : **Dr. C. KARTHIKEYAN** \_\_\_\_\_  
Professor and Head  
Department of Social Sciences  
Agricultural College and Research Institute  
Tamil Nadu Agricultural University  
Vallanad, Killikulam, Thoothukudi– 628 252

**Date of final viva-voce:**

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Date :

Place :

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## LIST OF SYMBOLS AND ABBREVIATIONS

%	:	Percentage
&	:	and
*	:	Significant
A P	:	Andhra Pradesh
ADA	:	Assistant Director of Agriculture
AE	:	Assistant Engineer
AEE	:	Assistant Executive Engineer
AELP	:	Agricultural Experiential Learning Programme
AEO	:	Agriculture Extension Officer
ANGRAU	:	Acharya N G Ranga Agricultural University
ANTWA	:	Andhra Pradesh Training for Women in Agriculture
APFMIS	:	Andhra Pradesh Farmers' Management of Irrigation Systems
APWSIP	:	Andhra Pradesh Water Sector Improvement Project
ATMA	:	Agricultural Technology Management Agency
CD-ROM	:	Compact Disc-Read Only Memory
CDs	:	Compact Discs
cu. m.	:	Cubic meters
DC	:	Distributory Committee
DEE	:	Deputy Executive Engineer
DVDs	:	Digital Versatile Discs
DWCRA	:	Development of Women and Children in Rural Areas
EE	:	Executive Engineer
<i>et al.</i>	:	and other people
F	:	Frequency
FFS	:	Farmer Field School
Fig	:	Figure

H <sub>0</sub>	:	Null Hypothesis
H <sub>1</sub>	:	Emperical Hypothesis
Ha	:	Hectare
I&CAD	:	Irrigation & Command Area Development
IAMWARM	:	Irrigated Agriculture Modernization and Water bodies Restoration and Management
ICT	:	Information and Communication Technology
KVK	:	Krishi Vigyan Kendra
MAO	:	Mandal Agricultural Officer
MGNREGS	:	Mahatma Gandhi National Rural Employment Guarantee Scheme
Mm	:	Millimeter
MPEO	:	Multi Purpose Extension Officer
NATP	:	National Agricultural Technology Project
NGO	:	Non Governmental Organization
no. of	:	Number of
NREGA	:	National Rural Employment Guarantee Act
NREGS	:	National Rural Employment Guarantee Scheme
NS	:	Non-Significant
NWDPRA	:	National Watershed Development Project for Rainfed Areas
OFWM	:	On Farm Water Management
P	:	Probability
PACS	:	Primary Agricultural Co-operative Societies
PC	:	Project Committee
PIM	:	Participatory Irrigation Management
PRA	:	Participatory Rural Appraisal
Qt	:	Quintal
RARS	:	Regional Agricultural Research Station
S. No.	:	Serial Number
SE	:	Superindent Engineer
SGSY	:	Swarnajayanthi Gram Swarojgar Yojana

SHG	:	Self Help Group
SRI	:	System of Rice Intensification
SRSP	:	Sri Ram Sagar Project
SWOC	:	Strengths Weaknesses, Opportunities and Challenges
SWOT	:	Strengths Weaknesses, Opportunities and Threats
TANWA	:	Tamil Nadu Women in Agriculture
TN-IAMWARM	:	Tamil Nadu Irrigated Agriculture Modernization and Water bodies Restoration and Management
TV	:	Television
<i>viz.,</i>	:	Namely
<i>Vs</i>	:	Versus
WALAMTARI	:	Water and Land Management Training And Research Institute
WAPDA	:	Water and Power Development Authority
WUAs	:	Water Users Associations
WUOs	:	Water Users Organizations
YMV	:	Yellow vein Mosaic Virus

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## ABSTRACT

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The shortage of water has raised due to the unbalances between the precipitation distribution and population and improper management practices. This situation has resulted in the need of the collective efforts of the farmers, intellectuals and other stakeholders to ensure store and distribute the water as efficiently as lead to the sustainable development in both agricultural and industrial sectors, these call for participatory approaches. So the government of Andhra Pradesh has introduced the participatory irrigation management as “The Andhra Pradesh Farmers Management of Irrigation Systems (APFMIS) Act” in 1997. The legal framework created out of the APFMIS Act resulted in creation of farmers’ organizations at different levels of irrigation system like Water User Associations (WUA), Distributory Committee (DC) and Project Committee (PC). The main role of Water Users Associations is to regulate and distribute water within its command area.

A study on Impact of Water Users Association in Krishna delta of Andhra Pradesh was carried out during 2016 by selecting 240 respondents from Krishna delta region on proportionate random basis for the study.

The dependent variables considered were opinion, direct and indirect changes. The Ex-post facto research design was followed to conduct the study and the data was collected using pre-tested schedule then followed by interview schedule. For the purpose of statistical analysis appropriate statistical tools were used and interpreted the data.

The profile of the respondents revealed that majority of the respondents were middle aged, educated up to high school, having 4-10ha of land holding, medium in extension contact, high social participation and trained. Majority of the respondents were medium in perceived workload, information and communication behaviour, depends on WUA members, friends, irrigation officials and mobile phones for getting information regarding WUAs.

Coming to psychological characteristics majority of the respondents were under medium level of decision making, innovativeness, risk orientation, achievement motivation, management orientation and high level of economic orientation.

The major functions performed by the Project Committee, Distributory Committee and Water Users Associations were maintain an inventory of irrigation system, resolve disputes, organization of meetings, water budgeting, social audit, preparation and implementation of warabandhi schedule, monitoring the flow of irrigation.

The opinion scale was constructed with 22 statements by using summated rating scale developed by Likert. Majority of the respondents were having favourable opinion towards WUAs. Majority of the respondents had strong favourable opinion towards performance of WUAs in terms of increased crop yield, helps in restoring the confidence of farmers in the irrigation system and there was a need for conducting technical training programmes, particularly on efficient and effective water application practices and their impacts on environment.

The study also focused on the impact of water users associations in Krishna delta in terms of direct and indirect changes. Majority of the respondents had medium level of direct changes. Availability of sufficient irrigation, water during crop growth period, creation of employment, implementation of warabandhi system, rehabilitation of water courses, equidistribution of irrigation water among head, middle and tail-end farmers, reduction of conflicts among farmers, maintaining good relations with irrigation and revenue officials, practicing avenue plantation along the bunds of the canals, enhancement of yields of paddy, sugarcane, turmeric, maize and pulses, magnification of average income, introduction of less water use rice production technologies like Direct Sown Rice (DSR) were the major direct changes as perceived by the farmers due to implementation of WUAs.

The study revealed a detailed analysis on indirect changes were majority of them had medium level of indirect changes. Mechanization, increased wage rates, enhancement of land values, positive change in attitude, improved land use pattern, increased knowledge on water use efficiency, less water theft, change in knowledge, increased credit needs, increased fish/aquaculture, change in social life, improved communication behaviour and increased personal empowerment, enhancement of availability of water, autonomy in decision making, conjunctive use of canal water, ground water and drain water, change in skill, decrease in migration of farmers and development of self respect.

The chi square tests revealed that variables such as social participation, perceived workload, information and communication behaviour, cropping pattern, decision making, achievement motivation and management orientation showed significant association with the opinion of the respondents. In case of direct changes the variables such as source of information, information and communication behaviour, cropping pattern, decision making and innovativeness showed significant association with the direct changes. Regarding indirect changes the variables such as social participation, source of information, information and communication behaviour, cropping pattern, decision making, innovativeness, achievement motivation and management orientation showed significant association with the indirect changes.

The major strengths of WUAs as expressed by the respondents were involvement of water users associations; good support from the irrigation department officials; sufficient water is available during crop season; increased crop yields. Regarding weaknesses as perceived by the respondents were expressed were allocation of insufficient funds; inadequate training facilities; inadequate maintenance of drains;

poor quality of works. The possible opportunities for the WUAs as perceived by the respondents were empowerment of farmers to manage irrigation system; facilitates the effective implementation of warabandhi schedule; resolution of disputes among farmers. The major challenges faced by WUAs as perceived by the respondents were management of aquatic weeds; equal distribution of water among head middle and tail-end areas; improving the drainage networks.

The prime strengths of WUAs as perceived by the irrigation officials were involvement of WUAs in water management; good support from irrigation department official; improved the efficiency and performance of irrigation systems; sufficient water is available during crop season; increase in social relations among farmers. The major weaknesses as perceived by the irrigation officials were allocation of insufficient funds; non involvement of members of WUA in management of water users associations; inadequate maintenance of drains. The opportunities as perceived by the irrigation officials were WUAs facilitates the effective implementation of warabandhi schedule; improved decision making based on local knowledge; empowerment of farmers to manage irrigation system. The major challenges faced by WUAs as perceived by the irrigation officials were improving the drainage networks; equal distribution of water among head middle and tail-end areas; weak institutional set up; development of friendly relationship among water users associations;

Finally the hypothetical strategies were developed for the sustainability of water users associations based on strengths, weaknesses, opportunities and challenges (SWOC) perceptions in which Garrett ranking technique was followed for SWOC and other results obtained from the study. The government should release sufficient funds timely, regular monitoring should be done during construction of works, to motivate all the members by conducting more trainings and meetings, institutional set up for irrigation department, WUAs should get their share of funds from water tax collected by revenue department and irrigation officials should take proper action to enhance the strengths and opportunities and to resolve the weaknesses and challenges of water users associations.

The suggestions offered through the study, if followed, there would be possibility of improving the efficiency of water users associations and thereby socio-economic conditions of farmers of Krishna delta of Andhra Pradesh.

## Chapter – I

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### *Introduction*

# CHAPTER I

## INTRODUCTION

India is endowed with plenty of water and land resources. India's land area is about 2.50 per cent of the world, water resources is 4.00 per cent of the global availability and the population is about 17.00 per cent of the world. The water storage capacity created in India is only 350 cubic meters (cu. m) per person compared to United States of America 5961 cu. m. and China 2486 cu. m. (<https://www.thehindubusinessline.com>). India is blessed with an annual average rainfall of 1100 mm as compared to the world average of 840 mm and 400 mm in Israel. The above facts indicate that India's water storage capacity and irrigation projects constructed are very meager compared to various countries of the world taking into consideration of their population.

Many of the countries with the largest populations also top the list of nations that use the most water. China, India, the United States of America and Brazil used the most, and they are the first, second, third and fifth most populous countries. The amount of water used per person in each country, though, varies significantly. Per capita, the United States used the most water at 2,842 cu. m per annum. People in India use about 1,089 cu. m, while the global average is 1,385 cu. m. (<https://conservationfolks.com/>).

The water shortages are due to the imbalances between the precipitation distribution and population and also due to improper and careless management practices. In India there is vast disparity in per capita availability of water from region to region. India has abundant water resources, but the water problem is very serious in many states. During 2016, water scarcity was noticed in about 10 states. About 32 crores of the population does not have access to drinking water. This precarious situation pressing the need of the collective efforts of the farmers, intellectuals and other stakeholders to ensure store and distribute the water as efficiently as lead to the sustainable development in both agricultural and industrial sectors, these call for participatory approaches.

Over the last two decades, various policy reforms were focused on participatory concept. During these reforms it has been realized that without active participation of end users *i.e.* farmers, irrigation system cannot be managed efficiently. The basic idea behind farmers managed irrigation systems was to improve the overall efficiency of irrigation system and to improve the irrigation revenue recovery rate. This laid the seeds for Participatory Irrigation Management (PIM) programme in India. It was accepted as a policy of the Government of India and concluded in the National Water Policy in 1987.

Keeping in view the growing importance of the farmer's participation in the management of irrigation systems, the Government of Andhra Pradesh in 1997 has canonised the participatory irrigation management as "The Andhra Pradesh Farmers Management of Irrigation Systems (APFMIS) Act 1997", as an initiator in the Indian sub-continent. The Water Users Associations (WUAs) are the grass root level functionaries who draw the water from the Distributory Committee (DC), which in turn sub-ordinate to the Project Committee (PC), an apex body.

Participatory Irrigation Management generally implies participation of irrigators in the management of the irrigation system and is generally interpreted as "the involvement of irrigation users in all aspects of irrigation management, and at all levels" (<http://www.worldbank.org/wbi/pimelg/index.htm>). 'All aspects' includes planning, design, construction, operation and maintenance, financing, decision rules and the monitoring and evaluation of the irrigation system. 'All levels' means the primary, secondary and tertiary levels of water distribution network in the irrigation systems. The empowering of Water Users Associations (WUA) as an institution is necessary to promote Participatory Irrigation Management and devolution of irrigation management authority. Assumption of irrigation management responsibilities only by effective WUAs can result in realization of the Participatory Irrigation Management and objectives.

The act provided the basis for the introduction of Participatory Irrigation Management and constitution of different Farmers' Organisations including WUAs in Andhra Pradesh. The legal framework created out of the APFMIS Act resulted in creation of farmers' organizations at different levels of irrigation system like Water User Associations (WUA), Distributory Committee (DC) and Project Committee (PC). Water Users Associations are the primary structures of irrigation water users. The main role of WUAs is to regulate and distribute water within its command area. A group of WUAs under a distributory or a small group of distributaries comprises a distributory committee. All the WUA Presidents are members of the DC they elect the president of the DC. All the DC Presidents are the members of the project committees and they elect chairman of the project committee. Above all, an apex committee headed by the minister for major and medium projects shall be constituted to formulate broad policy guidelines and to resolve the disputes.

Andhra Pradesh is a riverine state with 40 major, medium and minor rivers. Godavari, Krishna, Vansadhara, Nagavali and Pennar are major interstate rivers. The Prakasam barrage was constructed during 1952-58 across river Krishna to serve an ayacut of 13.09 lakh acres in Krishna, West Godavari, Guntur and Prakasam districts. The Krishna Delta ayacut area under Prakasam barrage is divided into Krishna Western Delta comprises 5,71,351 acres and Krishna Eastern Delta comprises 7,36,969 acres and covers 65 mandals and 938 villages in the 4 districts ([https://\\_guntur\\_.html](https://_guntur_.html)). Paddy is the major crop cultivated in Krishna delta region. The area sown under paddy was in 11, 07,590 acres, sugarcane was sown in 24,213.8 acres and aquaculture was taken up in 1, 69,570 acres during karif 2017 (<https://www.thehindu.com>).

The water users associations play a key role in integrated approaches to water management that seek to establish a decentralized, participatory, multi-sectoral and multi-disciplinary governance structure. The water user associations involve in management and maintenance of the irrigation system for efficient and equitable supply and distribution of water ensuring optimum utilization for improvement of agricultural production, systematic development and

maintenance of irrigation infrastructure at the grass root level. All these activities could be possible only with the effective functioning of WUAs. For sustainable development of Water Users Associations, there is a need to know the opinion of the functionaries towards WUAs, impact of WUAs and also the strengths, weakness, opportunities and challenges of Water Users Associations. So with all this background the present study has been formulated with the following objectives.

### **OBJECTIVES OF THE STUDY**

1. To study the Personal, Socio- economic and Psychological characteristics of the functionaries.
2. To know the functioning of the project committees, distributory committees and Water Users Associations.
3. To study the opinion of the functionaries towards Water Users Associations.
4. To know the impact of Water Users Associations in Krishna delta in terms of direct and indirect changes.
5. To study the relationship between Personal, Socio- economic and Psychological characteristics of the functionaries with their opinion and direct and indirect changes.
6. To elicit the strengths, weakness, opportunities and challenges of Water Users Associations as perceived by the functionaries of Water User Association and Irrigation Department.
7. To develop strategies for sustainability of Water Users Associations in Krishna delta of Andhra Pradesh.

## **SCOPE OF THE STUDY**

The present study “**A study on Impact of Water Users Association in Krishna delta of Andhra Pradesh**” is carried out to measure the opinion of functionaries of water users associations and also the direct and indirect changes that have been taken place due to establishment of water users associations. The study would also reveal the relationship between personal socio- economic and psychological characteristics of the functionaries with their opinion and impact in terms of direct and indirect changes due to WUAs and their strengths, weaknesses, opportunities and challenges.

The findings of the study will help the administrators and policy makers to know about the existing condition of WUAs and the strengths, weaknesses, opportunities and challenges faced by them. So that the policy makers can make necessary plans and formulate actions for the enhancement of WUAs and also to face the future challenges in its functioning.

## **LIMITATIONS OF THE STUDY**

- The study was confined to a restricted operational area as it is a student research, the results of the study cannot be widely generalized.
- There is a limitation for time, finance, resources and other facilities for the investigation as it has been conducted by the single investigator.
- The data collected was purely based on the opinion expressed by the functionaries the study cannot be free from its usual bias.
- In addition to that, so far very few studies have been conducted on impact of water users associations in Krishna delta.

## **PRESENTATION OF THE STUDY**

The study undertaken is presented in five chapters. The first chapter dealt with the **introduction** which includes its need and importance, objectives, scope and limitations of the study. The second chapter includes **review of literature** collected from different sources related to the study. The third chapter dealt with the **materials and methods** which include the aspects like research design, location of the study, sampling procedure, selection and empirical measurement of variables, devices used for data collection and statistical tools used for analysis. The fourth chapter includes the **results and discussions** of the study. The fifth chapter dealt with the **summary and conclusion** includes the implications of the study and suggestions for future studies. The **literature cited** was presented by following the guidelines of ANGRAU on thesis presentation and appendices were included at the end.

## Chapter – II

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## *Review of Literature*

## **CHAPTER II**

# **REVIEW OF LITERATURE**

The prime focus of this chapter is to analyze theoretical and empirical information concerning the present study. Review of literature helps to identify the research gaps in research and to document the events related to particular aspects of investigation. The systematic presentation of the relevant aspects drawn from various literatures not only provides strong base for the empirical investigation but also facilitates to arrive at a proper understanding of the different components of the problem under study. Hence, in this chapter an effort was made to acquaint with the available literature having direct and indirect bearing on the present research study. The present study is concerned with **“A Study on Impact of Water Users Associations in Krishna Delta of Andhra Pradesh”** The review of literature is presented under the following headings.

- 2.1 Personal, Socio- economic and Psychological characteristics of the functionaries.
- 2.2 Functioning of the project committees, distributory committees and Water Users Associations.
- 2.3 Opinion of the functionaries towards Water Users Associations.
- 2.4 Impact of Water Users Associations in Krishna delta in terms of direct and indirect changes.
- 2.5 Relationship between Personal, Socio- economic and Psychological characteristics of the functionaries with their opinion and direct and indirect changes.
- 2.6 Strengths, weakness, opportunities and challenges of Water Users Associations as perceived by the functionaries of Water User Association and officials of Irrigation Department.
- 2.7 Strategies for sustainability of Water Users Associations in Krishna delta of Andhra Pradesh.

## **2.1 PERSONAL, SOCIO- ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE FUNCTIONARIES**

### **2.1.1 Age**

El-Zanaty (2001) reported in his study on water resources that about 11 per cent of the men and women farmers are under age 35, around 55.00 per cent are in-between age 35 and 54, and around 36.00 per cent are of age 55 and above.

Raghunandan (2004) in his study on knowledge and adoption level of soil and water conservation practices by farmers in northern Karnataka reported that 45.00 per cent of the respondents belonged to the middle age group, followed by old age (36.25 %) and young age group (18.75 %).

Charan (2005) in his study on profile of Sujala watershed project beneficiary farmers revealed that majority (46 %) of respondents were middle age.

Reddy (2005) in his study on knowledge, extent of participation and benefits derived by participant farmers of the watershed development programme in Raichur district of Karnataka reported that majority (75.33 %) of the respondents belonged to the middle age group followed by old age (16.67 %) and young age group (08.00 %) category.

Mini (2006) in her study on WUAs reported that majority (48.90 %) of the respondents belonged to the age group between 41 and 60 years, followed by (40.3 %) the age group of 26-40 years, then followed by (6.4 %) the age group of 61 and above, followed by (04.30 %) the age group of -up to 25 years.

Chackacherry and Chandran (2008) in his study on WUAs reported that 71.8 per cent of the members were between 20-50 years age group and 28.2 per cent of the members were more than 50 years age group.

Rathode and Mandve (2012) in their study on paddy farmers reported that 45.00 per cent of the paddy farmers belonged to middle age group followed by those belonged to young age (37.50 %) and 17.50 per cent belonged to old age group.

Adeppa (2014) observed that the MGNREGS respondents of Anantapuram district were about 35.66 per cent hailed from age group of 26-40 years, while 34.65 per cent hailed from 18-25 years and 18.58 per cent from teenage group of 15-18 years. Only 11.11 per cent were aged above 40 years.

Mekonnen *et al.* (2014) reported that the average age of the respondents was 50 years in the study area.

Reddy *et al.* (2014) observed that majority (53.30 %) of the respondents of Andhra Pradesh Water Management Project belonged to middle age followed by those belonged to young age (32.20 %) and old age (14.44 %) categories.

Patel (2015) in his study on PIM reported that 38.00 per cent respondents of PIM were from age group of 41 to 50 years, followed by 31 to 40 years with 26 per cent, 51 to 60 years with 24 per cent, 61 to 70 years with 7 per cent, less than 30 years with 4 per cent and more than 70 years was 1 per cent.

### **2.1.2 Education**

El-Zanaty (2001) in his study on water resources reported that majority (90.70 %) of the farmers had never attended school followed by 5 per cent of them had primary school education, 1.8 per cent with secondary school education, 1.4 per cent with university education, 0.7 per cent with upper intermediate and 0.4 per cent with preparatory level of education.

Starkloff (2001) in his study on Water Users organizations reported that 37.04 per cent of the members had primary school education followed by illiterate (14.81 %), others (14.81 %), metric (11.11 %), F.A/F. Sc. (11.11 %), M.A./M. Sc. (0.00 %) middle (7.41 %) and B.A./ B. Sc. (3.70 %).

Kutty (2002) in his study on WUAs reported that 40.70 per cent of the respondents were educated upto 5<sup>th</sup> to 10<sup>th</sup> standard, followed by 32.7 per cent upto 5<sup>th</sup> standard, 13.3 per cent of the respondents were uneducated, 8.00 per cent were educated upto 10<sup>th</sup> to +2, followed by 7.00 per cent of the respondents had completed post graduation and 4.00 per cent had completed their under graduation.

Mini (2006) in her study on WUAs reported that 42.60 % per cent of the respondents were illiterate followed by 25.5 per cent of the respondents were educated up to 5<sup>th</sup> standard, 23.4 per cent of the respondents were from 6<sup>th</sup> to 10<sup>th</sup> standard, only 8.5 per cent of the respondents were above matriculation and there were no graduates.

Chackacherry and Chandran (2008) in their study on PIM reported that 64.7 per cent of the members were below 10<sup>th</sup> standard and 35.3 per cent of the members were above 10<sup>th</sup> standard.

Badatya and Mohapatra (2010) in their study on WUA reported that 31.10 per cent of the respondents had the secondary school education level followed by primary school (28.90 %), illiterate (20.00 %), higher secondary school (13.30 %) and graduate or post graduate (6.7 %) from canal irrigation respondents.

Mekonnen *et al.* (2014) in his study on WUAs reported that about 58 per cent of the respondents had attended school in the study area.

Zareii Dastgerdi (2014) in his study on WUAs reported that the education level of farmers at the water-user association was as follows Illiterate (32.70 %), reading and writing (22.00 %), elementary (10.00 %), secondary (8.70 %), high-school (5.90 %), diploma (14.60 %), associate degree (4.00 %), bachelor's and higher (2.70 %).

Patel (2015) in his study on PIM reported that illiterate respondents were 22 per cent, respondent taken education up to 5<sup>th</sup> were 31 per cent and education up to 7<sup>th</sup> standard were 8 per cent, respondent taken education up to 10<sup>th</sup> standard were 21 per cent, education up to 12<sup>th</sup> were 6 per cent and more than 12<sup>th</sup> standard were 12 per cent.

Ashraf *et al.* (2016) in their study on irrigation scheme reported that majority (75.00 %) of the members were illiterate followed by F.A (13.00 %), others (14.81 %), primary and metric level of education were about (6.00 %).

### **2.1.3 Land holding**

Starkloff (2001) in his study on Water Users organizations reported that 29.60 per cent of the members had 21-50 acres of land holdings, followed by 51-100 acres (22.20 %), below 10 acres (14.80 %), 11-20 acres (11.11 %) no answer (11.11 %), 101-200 acres (7.40 %), 201-500 acres (3.70 %) respectively and no one from above 500 acres.

Kutty (2002) in his study on WUAs reported that 31.3 per cent of the respondents owned less than 2.5 acres, 22.7 per cent of the respondents owned less than 1 acre, 18.7 per cent of them owned less than 5 acres, 16.7 per cent of them owned less than 0.5 acres and 10.6 per cent of them owned more than 5 acres of the land.

Mahapatra (2006) in his study on WUA stated that 34 per cent of the farmers belonged to marginal farmers, 29 per cent belonged to small farmers, the medium farmers constituted 14 per cent of the farm households, and the large farm households constituted 13 per cent of farm households and 10 per cent belonged to landless.

Mini (2006) in her study on WUAs in reported that 42.6 per cent of the respondents were large land holders, followed by 34.00 per cent of the respondents were small land holders and 23.6 per cent of the respondents were medium land holders.

Kumar (2009) in a study on technological gap in recommended soybean cultivation practices reported that 45.33 per cent of farmers belonged to medium land holding category (10.01-25.00 acres) followed by 22.67 per cent of them belonged to semi-medium land holding category (5.01-10.00 acres), 16.67 per cent of them were small farmers (2.51-5.00 acres) and 4.66 per cent were big land holding farmers.

Badatya and Mohapatra (2010) in his study on WUAs reported that 35.50 per cent of the respondents had the land holding size of 2.51-5.0 ha followed by the land holding size of more than 5.0 ha (26.70 %), 1.1-2.5 ha (20.00 %) and less than one acre (17.80 %) from canal irrigation.

Badatya and Mohapatra (2010) in their study on WUAs reported that 41.60 per cent of the respondents had the land holding size of 1.1-2.5 ha followed by less than 1 acre (26.7 %), 2.51-5.0 ha (23.80 %) and more than 5.0 ha (7.90 %) from tank irrigation.

Singh and Prakash (2010) in his study on socio-economic impact of watershed development project in Manipur revealed that the distribution of land holdings in Khamenlok watershed was highly skewed. Majority of the farmers in the watershed were either landless or having holding less than 1 ha. About 3 per cent of the house hold occupied 25 per cent of total holdings.

Boruah and Borua (2013) in his study on SHGs revealed that majority (44.44 %) of the respondents had small land holding (1-2 ha) followed by 35.56 % who had marginal land holding (<1 ha). There were 11.11 % respondents who had medium land holding while very few (08.89%) had big land holding (>3 ha).

Rathode and Mandve (2014) in their study on paddy farmers reported that more than two thirds (67.50 %) of the respondents belonged to small farm size category followed by 32.50 per cent belonged to medium farm size and none of the respondents had a large size land holding.

Reddy *et al.* (2012) observed that majority (56.70 %) of the respondents of APWMIP belonged to marginal farmers, followed by those to small farmers (35.50 %) and large farmers (07.80 %).

Patel (2015) in his study on PIM reported that respondents with less than 1acre land were 26.00 per cent, land between 1 to 2 acre were 26.00 per cent, between 2 to 3 acre 21.00 per cent, 3 to 4 acre land were 11.00 per cent, 4 to 5 acre land were 4.00 per cent. Respondents with 5 to 7.5 acre land were 7.00 per cent and respondents those with more than 7.5 acre land and up to 10 acre were 4.00 per cent.

#### **2.1.4 Extension contact**

Sridhar (2002) in his study on watersheds revealed that 35.33 per cent of the farmers regularly contacted Assistant Agricultural Officer, while 32.00 and 32.67 per cent of them occasionally and never contacted Assistant Agricultural Officer and Agricultural Officer, respectively. Forty two per cent of the farmers regularly contacted Raita Samparka Kendras, while 29.33 and 28.66 per cent of them occasionally and never contacted Raith Samparka Kendra, respectively.

Prasad (2004) in his study on linkage mechanisms stated that majority (75.20 %) of the respondents had medium extension contact followed by high (12.80 %) and low (12.00 %) extension contact.

Shilpashree (2004) in her study on SHGs revealed that all the sample respondents of NGO promoted SHGs were contacted officers of sponsoring organisation followed by 66 per cent and 66 per cent respectively had contacted Assistant Agricultural Officer and Agricultural Officer for seeking guidance. In Sree Shakthi Groups all the sample respondents contacted anganawadi workers frequently followed by Assistant Agricultural Officer (68.00 %) and Agricultural Officer (46.00 %).

Reddy (2005) in his study on knowledge, extent of participation and benefits derived by participant farmers of the watershed development programme in Raichur district of Karnataka reported that 68.00 per cent regularly contacted Associate Agriculture officers followed by 60.00 per cent of them contacting Assistant Agriculture Officers regularly, also 54.67 per cent of them regularly contacted NGO officials.

Radhakrishna (2005) in his study on SHGs reported that about 41 per cent of the SHG respondents had high contact with extension personnel followed by medium level 38 per cent and 21 per cent of them had low level of extension contact.

Manoj (2008) reported that more than two thirds (70.00 %) of farmers of KVK adopted villages had medium extension contact followed by 15.00 per cent of each with high and low extension contact.

Badatya and Mohapatra (2010) stated that the water users had extension contact with various state departments such as the I&CAD Department, Agriculture Department, Revenue Departments etc.

Kalyan (2011) in her study on Groundnut farmers revealed that 56.66 per cent of the respondents were having medium extension contact followed by low (26.66 %) and high (16.66 %) extension contact.

Mahesh *et al.* (2011) revealed that Subject Matter Specialists from Krishi Vigyan Kendra were the major (100.00 %) source of information among the rice growers followed by pesticide dealers and traders (80.00 %), personal experience (76.00 %) neighboring farmers (72 %) and village level agricultural workers (68.00 %).

Kumar *et al.* (2012) in his study on hybrid rice farmers revealed that more than three fifth (63.12 %) of the paddy growers belonged to medium extension contact, followed by high (24.38 %) and low (12.50 %) extension contact.

Patel (2015) in his study on PIM reported that 22 per cent of the respondents had regular contact with NGO & Government representatives, 40 per cent of the respondents had regular contact with operator, 12 per cent of the respondents said that they meet the Chairman regularly and 26 per cent of the respondents would meet secretary regularly.

### **2.1.5 Social participation**

Starkloff (2001) reported that the members had their participation in governmental and non-governmental organizations for institutional support. Especially in the Irrigation Department, OFWM, WAPDA and other government departments concerned with natural resource management, private agencies, such as farm input suppliers *etc.*

Gayathri *et al.* (2004) opined that majority (68.00 %) of the respondents had low level of participation in the extension programmes followed by 30.00 per cent with medium level and the rest (02.00 %) with high level of participation.

Sandesh (2004) found that, 39.17 per cent of the respondents were members cooperative societies only 3.33 per cent of the respondents were members of Taluka panchayat and 0.83 per cent are members of zilla panchayata, among these 57.50 per cent of the respondents regularly participating in cooperative societies.

Milkha (2006) conducted a study on gender equity and empowerment in Andhra Pradesh and revealed that majority (44.79 %) of the selected respondents had medium social participation followed by low (41.67 %) and high (13.54 %) social participation.

Vennila (2006) had reported that nearly half (49.52 %) of the SHG members belonged to medium level of extension participation category followed by high (26.44 %) and low (24.04 %) level of extension participation.

Pankaj and Tankha (2010) conducted a study on empowerment effects of MGNREGS on women and concluded that participation of women was increased in Gram Sabha meetings. Women's participation in Gram Sabha was the highest in Kangra (89.00 %), followed by Dungarpur (55.00 %), Ranchi (26.00 %) and Gaya (14.00 %).

Kantharaju (2011) in his study on impact of MGNREGS on employment generation in Tumkur district of Karnataka identified that 14.17 per cent of the MGNREGS beneficiaries were the members of Self Help Groups followed by Gram Panchayat (04.17 %), Co-operative Society (07.50 %), Farmers Association (02.50 %) and Taluk Panchayat (01.67 %).

Abirami *et al.* (2013) stated that more than half (54.17 %) of the Irrigated Agriculture Modernization and Water bodies Restoration and Management (IAMWARM) project beneficiaries had same level of social participation followed by increased level of social participation (25.00 %) and decreased level of social participation (20.83 %) respectively.

Kumar *et al.* (2013) stated that nearly two-third (64.44 %) of the Chickpea farmers had low level of social participation, followed by those with medium (24.45 %) and high (11.11 %) levels of social participation.

Verma *et al.* (2013) stated that the majority (68.89 %) of the respondents had medium level of extension participation, followed by low (18.89 %) and high (12.22 %).

Zareii Dastgerdi (2014) reported that the social participation of farmers in social institutions indicated that 70.60 per cent of farmers were members in rural production cooperatives. Moreover, 29.40 per cent of farmers were not participants in any of the social institutions.

### **2.1.6 Source of information**

Jyothi (2000) reported that input dealers were the most frequently consulted information sources followed by progressive farmer, Television (TV), Extension personnel of private organization, friends, radio and Assistant Agriculture Officers.

Raju (2000) reported that the information for the Water Users Associations was obtained through the local and state level news papers in local language in Andhra Pradesh.

El-Zanaty (2001) reported that 52.80 per cent of the respondents get information by their own experience, 32.6 per cent from other farmers, 29.7 per cent from *bahar*, 23.40 per cent from friends and relatives, 16.5 per cent from Agriculture employee or agriculture cooperative, 9.3 per cent from Irrigation engineer and 4.5 per cent from T.V. and radio.

Asokhan (2006) opined that majority (92.33 %) of the respondents shared the information with medium to high level, where as one-tenth (7.67 %) of them shared information with low level.

Kantharaju (2011) in his study on impact of MGNREGS in Tumkur district of Karnataka indicated that about 39.17 per cent of the beneficiaries often contacted to Gram Panchayat Secretary, Gram Panchayat President (42.50 %) and Panchayat Development Officer (34.17 %). Regarding mass media, television was possessed by 65.00 per cent of the beneficiaries who were regular viewers and 35.83 per cent of the beneficiaries were occasional viewers of TV programmes. Newspaper was subscribed by 14.17 per cent of the beneficiaries. Magazines were subscribed by only 2.50 per cent of the beneficiaries.

Roy *et al.* (2013) studied profile of MGNREGS beneficiaries in Dhalai district of Tripura state and reported that majority of the beneficiaries had medium level of source of information (45.30 %) followed by high (31.30 %) and low (23.40 %) categories.

Verma *et al.* (2013) found that the majority of the respondents (73.33 %) had medium level of mass media (Television, Radio, Newspaper and Magazine) participation followed by low (15.56 %) and high (11.11 %).

Krishnapriya *et al.* (2014) reported that majority of paddy farmers in Guntur district had got information through newspaper (50.00 %) followed by farm magazine (40.0 %), television (33.33 %), radio (26.67 %) and internet (6.67 %). In relation to personal locality sources 70.00 per cent of the respondents seek information from their friends followed by neighbours (63.33 %) and relatives (50.00 %).

Rao and Satyanarayana (2014) observed that majority (73.57 %) of KVK adopted trainees got the information from television and 72.86 per cent from newspaper followed by radio (70.00 %) and farm magazines (56.43 %) for updating their agricultural knowledge.

### **2.1.7 Training received**

Usha Devi (2000) revealed from her study on Impact of ANTWA project in Prakasam District that majority (54.35 %) of the respondents were medium training received followed by high (45.65 %)

Basawarajaiah (2001) stated that majority (69.18 %) of the farmers received medium training followed by high (21.66 %) and low (09.16 %).

Krishna (2001) reported that only 40 per cent of the WUA farmers received training.

Starkloff (2001) reported that majority (30.77 %) of the members had undergone training on Piezometer Reading followed by Walk thru maintenance survey (11.54 %), Financial management (07.69 %), Organizational Management, Operation and Maintenance and improved agricultural practices (03.85 %).

Bhusan and Grewal (2007) in this study on human resource development in integrated watershed development project in Punjab revealed that training is essential for capacity building of project staff, Para professional NGOs and stake holders and also indicated that participation in training programme was more during initial years but decreased during the subsequent years of project implementation.

Mani and Rajeshwari (2009) in their study on people's participation in watershed projects revealed that farmers attended awareness programme (87.00 %), PRA meetings (65.00 %) and training programme (30.00 %).

Nayak (2009) showed that 58.34 per cent of respondents had high level of FFS training received followed by those received training upto medium (24.16 %) and low (17.50 %) levels.

Sisodia *et al.* (2009) in his study on impact of training on natural resource management in charana watershed of Rajasthan revealed that training on soil and water conservation aspect has made them to realize that it improves water holding capacity of soil, improves soil fertility and productivity.

Vinay Kumar (2009) observed that majority (55.83 %) of women beneficiaries of DWCRA received training. However, 44.17 per cent of beneficiaries have not received any training.

Badatya and Mohapatra (2010) stated that the agriculture department had conducted training to the members as per the list given by the I &CAD for 3 days. During the training along with the concept of PIM and APFMIS Act, class room training on efficient agricultural practices as relevant to the area like, land development, crop management, seed treatment, *etc.*, are imparted and the participants were taken for a field trip on the third day.

Lalitha and Prasad (2011) reported that women from SHG have mainly to improve their economic status but no training was provided for 82.3 % of the respondents. Only a few respondents have attended training programmes like packaging of groceries (7 %) preparation of food items (4.7 %), preparation of facilities (3.3 %) and all other works (0.3 %).

Agrar-und Hydrotechnik (AHT) Group AG Management and Engineering (2013) reported that from 2003 through mid-2009, WUA Support Unit provided over 60,000 training days to the staff members and farmers in Kyrgyzstan.

### **2.1.8 Perceived work load**

Manimegalan (1990) observed that majority (59.98 %) of Associate Director of Agriculture had perceived that their work load was manageable in nature and rest of them (40.02 %) indicated that it was too much.

Meti (1992) stated that majority (92.00 %) of the respondents belonged to medium category of perception of work load followed by light (5.00 %) and heavy (3.00 %).

Reddy and Marty (2003) reported that majority (62.00 %) of the scientists felt their workload as medium followed by high (22.00 %) and low (16.00 %).

Reddy and Marty (2007b) reported that majority (61.34 %) of the researchers felt their workload as medium followed by high (22.00 %) and low (16.66 %).

Sandika (2006) revealed that majority (80.00 %) of the Veterinary Officers felt their workload as medium followed by high (20.00 %) and none of them felt low workload.

Selviya and Reddy (2008) reported that majority (43.76 %) of the respondents belonged to medium category of perception of work load followed by low (28.12 %) and high (28.12 %).

Krishna (2001) reported that there is a heavy work load on Assistant Engineers or Assistant Executive Engineers leading to high stress and poor quality of work output.

Raju *et al.* (2006) reported that WUAs feel their powers come from funds they handle to do physical works in their jurisdiction. No money is no power, according to several WUA presidents. If they have money, they can show, they are providing lining works, outlets, desiltation.

### **2.1.9 Information and communication behaviour**

Ramasamy and Sathagovind (2002) reported a little more than two fifth of the women Farm Science Centre members belonged to medium ( 43.33 %) category of information seeking behaviour followed by low (42.69 %) and high (13.98 %) categories.

Prasad (2004) stated that majority (64.50 %) of the respondents had medium communication behaviour followed by high (18.40 %) and low (17.60 %) communication behaviour.

Sajithkumar (2004) reported more than half of the coconut farmers belonged to medium (52.67 %) category of information seeking behaviour followed by high (26.00 %) and low (21.33 %) categories.

Manohari and Kareem (2005) stated that more than half (54.55 %) of the respondents belonged to low information and communication behaviour followed by medium (27.27 %) and high (18.18 %).

Reddy and Reddy (2005) reported that a little more than three fourth of the agricultural scientists belonged to medium (79.27 %) level of information seeking behaviour followed by low (12.59 %) and high (7.69 %) categories.

Leelavani (2011) stated that 68.33 per cent of the respondents belonged to medium information and communication behaviour followed by high (16.67 %) and low (15.00 %).

Patel (2015) reported that the Information and communication behaviour from top to bottom between water user association and farmers about 26 per cent of them were informed by operator, 48 per cent were informed in meeting, 6 per cent were informed by local person call “Vethiya” and 20 per cent were informed by individuals.

Patel (2015) reported that the Information and communication behaviour from bottom to top between water user associations. About 13 per cent of them approached to chairman, 38 per cent of them raised their point in meeting, 13 per cent of them approached to secretary, 28 per cent of them approached to water operator and 8 per cent of them individually approached directly to the water user association.

### **2.1.10 Cropping pattern**

Raju (2000) reported that the cropping in Emani-WUA in Krishna delta, during kharif season was rice in 5700 acres, groundnut in 200 acres, in rabi season was rice in 3700 acres and blackgram in 2000 acres.

Kutty (2002) reported that paddy occupied the major crop pattern for the farmers in Kedar tank. Groundnut was cultivated as commercial crop to extract oil. In the same way, Sugarcane growers had made contract with crushing mills for regular supply of sugarcane. The other crops were mainly grown for local consumption.

Dhyani *et al.* (2006) in this study on impact of watershed development and land use dynamics on agricultural productivity and also socio-economic status of farmers in central Himalayas indicated that after implementation of the project significant change in the land use pattern had taken place, cash crops replaced coarse millets while, increased irrigation facilities and improved crop demonstrations encouraged the farmers to adopt new crop production technologies.

Mahapatra (2006) reported that only one crop is produced that is paddy, the farmers grow paddy in both the Kharif and Rabi seasons, since through the formation of pani panchayat water is provided throughout the year.

Mini (2006) reported that cropping pattern was paddy in 762.04 acres followed by garden in 2.20 acres and cotton in 2.00 acres.

Raju *et al.* (2006) stated that paddy is grown in Kharif season, due to less water inflow into the projects water provided to canals is less, in Krishna region water provided is for 105 days instead of 120 days. Initially farmer use to keep 6” standing water but now they keep only 3” water, they realized that providing less water will result in high yield. Earlier it was 20-25 bags/acre but now getting 40 bags/acre.

Mani and Rajeshwari (2009) in her study on impact assessment of farm pond in Dharwad districts revealed that the gross cropped area increased by 22.32 per cent in case of with farm pond over without farm pond and as for as Kharif crops were concerned there was not much change in cropping pattern.

Badatya and Mohapatra (2010) stated that the farmers were mostly following their traditional cropping pattern of mono cropping of paddy. The shift in cropping pattern was also observed from paddy/jowar to sunflower in Ananthapur and Nellore and cotton in Nellore only. In Ananthapur, there were marginal shift in cropping pattern from paddy to groundnut. A few water users introduced fruits as new crops while cultivation of dry crops was discontinued. However, in Warangal district cropping pattern remained the same.

Singh and Prakash (2010) in their study on socio-economic impact of watershed development project in Manipur found that the watershed project altered the land use system favorable to horticultural crops, mostly fruits with little attention to the development of field crops and livestock including fisheries.

### **2.1.11 Decision making**

Shivaraj (2001) indicated that majority of the farm decisions were mainly influenced by the availability of the inputs such as irrigation, labour, credit, seeds, fertilizers and market situations, almost half of the paddy farmers were influenced by the home needs.

Starkloff (2001) reported that majority (74.07 %) of the members take decision from consensus, followed by leader's decision (11.11 %), then majority vote (7.41 %) and others (7.41 %).

Ahire and Thorat (2007) stated that nearly half of the respondents (45.85 %) took independent decisions followed by more than one third of the respondents (35 %) took joint decisions by consulting with family members where as 19.5 per cent found in other categories of decision making.

Gandhi and Namboodiri (2002) reported that 78.3 per cent of the decisions were made by the WUAs or jointly with the Government and only 21.7 per cent of the decisions were made by the Government.

Kaushalkumar (2009) revealed that majority (53.33 %) of the pineapple growers had medium level of farm decision making ability followed by high (27.78 %) and low (18.89 %) level of farm decision making ability.

Badatya and Mohapatra (2010) stated that about 66.70 per cent of the members from Ananthapur district, 68.80 per cent from Nellore and 70 per cent from Warangal districts involved in decision making process of canal irrigation system on maintenance and distribution works.

Patel (2015) reported that 7 per cent of the decisions were taken by Chairman, about 61 per cent of the decisions were taken in meeting and 32 per cent of the respondents had not replied anything.

### **2.1.12 Innovativeness**

Padmavathi and Reddy (2002) inferred that majority (68.89 %) of the Mitra Kisans under NWDPRRA had medium level of innovativeness, followed by those with low (20.00 %) and high (11.11 %) levels of innovativeness.

Obaiah (2004) in his study on capacity building of rice growing farmers of Farmer Field Schools in Krishna–Godavari zone revealed that majority (56.43 %) of the respondents were medium innovativeness followed by high (22.14 %) and low (21.43 %).

Babu and Venkataramaiah (2004) revealed that majority (58.82 %) of the beneficiaries under Indo-Dutch Network Operational Research Project on Drainage and Water Management for salinity control had medium innovativeness, followed by the rest with high (23.53 %) and low (17.65 %) levels of innovativeness.

Charan (2005) stated that majority of the respondents (78.00 %) belonged to medium innovativeness category, whereas 12.67 and 9.33 per cent of them belonged to high and low level of innovativeness category, respectively.

Reddy (2005) revealed that majority of the respondents (82.00 %) belonged to medium innovativeness category, whereas 11.3 and 6.66 per cent of them belong to high and low level of innovativeness categories, respectively.

Premavathi (2005) inferred that majority (64.00 %) of the farm women had high innovativeness followed by the rest with medium (36.00 %) innovativeness.

Vanetha (2006) reported that majority (50.83 %) of the respondents had medium level of innovativeness followed by the rest having low (35.00 %) and high (14.17 %) level of innovativeness.

Sidram (2008) stated that nearly half of the respondents (45.00 %) had medium level of innovativeness, while low innovativeness was exhibited by 32.50 per cent of the respondents, however high innovativeness was noticed among 22.50 per cent of farmers from his study on Analysis of organic farming practices in pigeonpea in Gulbarga district of Karnataka state.

Naik and Babu (2009) reported that more than two-fifth (40.84 %) of the FFS farmers were having high level of innovativeness followed by those with medium (39.16 %) and low (20.00 %) levels of innovativeness.

Raghavendra (2010) reported that about 55.00 per cent of participant farmers belong to medium innovation proneness category followed by high and low (35 and 10 %) innovation proneness, respectively. In case of non-participant farmers 46.67, 35.00 and 18.33 per cent belongs to low, medium and high innovative proneness category, respectively.

Adhoni (2011) stated that, more than half (56.00 %) of FFS participants were found in 'high innovativeness' category, followed by 'low innovativeness categories' (38.00 %) and 'medium innovativeness categories' (26.00 %) from his study on Impact of Farmers Field School (FFS) on cotton crop management practices in Dharwad district.

Gowda *et al.* (2011) reported that more than two-third (68.33 %) of Sugarcane growers had medium innovativeness, followed by the rest coming under low (22.50 %) and high (9.17 %) innovativeness categories.

### **2.1.13 Risk orientation**

Padmavathi and Reddy (2002) specified that majority (63.33 %) of the Mitra kisans under NWDPRRA had medium risk orientation, followed by the rest with low (20.00 %) and high (16.67 %) levels of risk orientation.

Suneetha (2004) conducted a study on knowledge and opinion of women about self employment and inferred that selected women respondents in Visakhapatnam district of Andhra Pradesh were with high risk orientation (40.83 %) followed by low (31.67 %) and medium (27.50 %) risk orientation.

Babu and Venkataramaiah (2004) excavated that 70.59 per cent of the beneficiaries under Indo-Dutch Network Operational Research Project on Drainage and Water Management for salinity control had medium level of risk taking ability, followed by those with high (15.29 %) and low (14.12 %) risk taking ability.

Charan (2005) stated that considerable per cent of the respondents (58.00 %) belonged to medium risk orientation category, followed by high (24.00 %) and low (18.00 %) risk orientation categories.

Reddy (2005) observed that considerable per cent (56.00) belonged to medium risk orientation category followed by high (28.00 %) and low (19.33 %) risk orientation categories.

Vanetha (2006) stated that the majority (36.67 %) of the selected respondents participating in developmental programmes possessed high level of risk orientation followed by medium (35.00 %) and low (28.33 %) risk orientation.

Thiyagarajan (2011) found that 43.30 per cent of the SRI farmers had high level of risk orientation followed by 42.50 per cent with medium and 14.20 per cent with low level of risk orientation

Palanisamy (2011) reported that 45.00 per cent of TN-IAMWARM project beneficiaries had high level of risk orientation. While 42.00 per cent of the beneficiaries had medium level of risk orientation and rest of 13.00 per cent of the beneficiaries had low level of risk orientation.

Abirami (2012) indicated that exactly half (50.00 %) of the IAMWARM project beneficiaries in Pudukottai district of Tamil Nadu had medium level of risk orientation followed by high (28.33 %) and low (21.67 %) levels of risk orientation.

Rao *et al.* (2012) reported that majority (47.00 %) of FFS respondents had high risk orientation whereas non FFS respondents (60.00 %) had medium risk orientation

Chinnamnaidu *et al.* (2014) reported that majority of sugarcane farmers in north coastal districts of Andhra Pradesh had medium (58.89 %) risk orientation followed by high (22.78 %) and low (18.33 %) risk orientation categories.

#### **2.1.14 Achievement motivation**

Geetha (2002) in her analytical study on diversified farming in Chittoor District of Andhra Pradesh inferred that majority (37.50 %) of the respondents were high achievement motivation followed by low (32.50 %) and medium (30.00 %).

Selvarani (2006) reported that more than half (51.54 %) of the respondents had high level of achievement motivation. Less than one-fourth of the respondents had medium (24.62 %) level of achievement motivation followed by low (23.84 %) level of achievement motivation.

Manoj (2008) reported that majority (67.50 %) of the farmers of adopted villages were having medium level of achievement motivation followed by the remaining with high (20.00 %) and low (12.50 %) levels of achievement motivation.

Nayak (2009) indicated that 68.33 per cent of the respondents had high achievement motivation followed by those with medium (16.67 %) and low (15.00 %) levels of achievement motivation.

Samatha (2011) stated that majority (71.67 %) of the respondents had medium level of achievement motivation followed by the rest with high (15.00 %) and low (13.34 %) levels of achievement.

Gowda *et al.* (2011) revealed that majority (61.67 %) of sugarcane growers had medium achievement motivation, whereas 24.16 and 14.17 per cent of sugarcane growers having low and high categories, respectively.

Preethi (2011) reported that majority (63.75 %) of the SHG women respondents had high level of achievement motivation while 33.75 per cent had medium and 2.50 per cent with low levels of achievement motivation.

Ashok Kumar (2012) reported that majority (65.00 %) of the respondents had medium achievement motivation followed by the rest with low (19.17 %) and high (15.83 %) levels of achievement motivation.

Roy *et al.* (2013) revealed that 42.00 per cent of the MGNREGS respondents had medium level of achievement motivation, where as 31.30 and 26.60 per cent had high and low levels of achievement motivation respectively.

Chinnamaidu *et al.* (2014) reported that majority of sugarcane farmers in north coastal zone of Andhra Pradesh had medium (65.00 %) achievement motivation followed by high (19.44 %) and low (15.56 %) categories.

### **2.1.15 Economic orientation**

Manjunath (2002) revealed that as high as 53.30 per cent of the Hemavathi project beneficiaries had high economic motivation followed by medium (33.30 %) and less (13.40 %) economic motivation.

Natarajan (2004) reported that 42.22 per cent of beneficiaries of Farmers Field School on rice had medium level of economic orientation followed by high (31.11 %) and low (26.67 %) levels. Whereas in case of non-beneficiaries 45.55 per cent of respondents had low level of economic orientation followed by high (27.78 %) and medium (26.67 %) level.

Gopinath (2005) observed that 67.33 per cent of the bengalgram growers had medium economic orientation followed by those with low (19.33 %) and high (13.34 %) levels of economic orientation.

Meshram *et al.* (2006) revealed that out of the total SGSY beneficiaries, 45.00 per cent had low economic orientation followed by 44.17 per cent and 10.83 per cent having medium and high economic orientation, respectively.

Roy *et al.* (2006) revealed that majority of the respondents (47.37 %) had having high level of economic orientation followed by medium (45.11 %) and low level (7.52 %) of the economic orientation.

Ahire *et al.* (2007) found that majority (40.00 %) of paddy growers belonged to low economic orientation followed by medium (31.67 %) and high (28.33 %) level of economic orientation.

Manoj (2008) indicated that majority of respondents of KVK adopted villages had medium level of economic orientation (65.00 %) followed by high (20.00 %) and low levels of economic orientation (15.00 %).

Gowda *et al.* (2011) indicated that majority (52.50 %) of the Sugarcane growers had medium economic orientation, followed by the rest with low (27.50 %) and high (20.00 %) levels of economic orientation respectively.

Palanisamy (2011) revealed that 46.00 per cent of the TN- IAMWARM project beneficiaries had medium level of economic motivation, while 41.00 per cent of the beneficiaries had high level of economic motivation and remaining 13.00 per cent of the beneficiaries had low level of economic motivation.

### **2.1.16 Management orientation**

Chikhale *et al.* (1996) revealed that majority of the respondents (71.00 %) belonged to medium management orientation category. While 16.5 and 12.5 per cent of them belonged to low and high management orientation categories respectively.

Reddy (2005) in his study on knowledge, extent of participation and benefits derived by participant farmers of the watershed development programme in Raichur district of Karnataka revealed that majority (70.66 %) of the respondents belonged to medium management orientation category, whereas 15.33 and 14.00 per cent of them fall under high and low level of management orientation respectively.

Subramanyeswari *et al.* (2007) observed that majority (77.00 %) of the small and medium farmers had medium management orientation followed by low (18.00 %) and high (5.00 %) management orientation.

Kumar (2013) revealed that majority (58.43 %) of AELP students had medium management orientation followed by high (20.83 %) and low (20.83 %) management orientation.

## **2.2 FUNCTIONING OF THE PROJECT COMMITTEES, DISTRIBUTORY COMMITTEES AND WATER USERS ASSOCIATIONS**

Kutty (2002) reported that the functions of the Kedar tank WUA include decision making in matters of operation, distribution, maintenance and all other water related issues ranging from rendering advice to the farmers on effective and productive marketing of the agricultural products and improving productivity to the resolution of the conflicts that may arise on the question of water sharing and distribution.

Reddy and Reddy (2005) in their study stated the Functions of Water Users Association include preparation of operational plans at the beginning of each season, maintain an inventory of irrigation systems such as tanks, ponds, wells, etc., within the command area, maintenance of records, plan and execute the distributory and drainage systems maintenance, water budgeting, resource mobilization, conflict resolution, etc.

Mahapatra (2006) stated that 62 per cent of the small farmers are not satisfied with the functioning of Pani Panchayat Committee.

Raju *et al.* (2006) reported the functions of WUA such as information on water release passes from officials to farmers, head end farmers are still having upper hand compare to tail end farmers, only in SRSP command 8 per cent WUAs said water is reaching to tail end, in Krishna and Godavari system water availability is abundant and hence WUAs/Department never felt to regulate, in Thandava medium irrigation, ayacut is fixed and hence no regulation, warabandhi is decided by department, only SRSP command WUAs are aware of Joint Azmoish.

Badatya and Mohapatra (2010) functions of these bodies include preparation of operational plans at the beginning of each season, maintain an inventory of irrigation systems such as tanks, ponds, wells, etc., within the command area, maintenance of records, plan and execute the distributor and drainage systems maintenance, water budgeting, resource mobilization, conflict resolution, etc.

International Water Management Institute (2011) reported that both farmers and WUA perceive that WUA functioning should be focused on its ability to deliver sufficient supply of irrigation water to each farmer's fields. At the same time, this ability is not linked to WUA's role to ensure equal water distribution in the irrigation scheme. Rotation can be arranged, if head farmers already received sufficient irrigation water and after tail farmers experience water scarcity problems.

Shaoshu and Yuan (2013) stated the roles of Farmer Water Users Association as fully mobilizing the farmers enthusiasm for investment and working, effectively dealing with water disputes and creating good water use environment, strengthening restriction and supervision of water management department, ensuring the implementation of construction, management and maintenance of small scale irrigation and water conservancy and speeding up the reforms of grass root water service system.

Shivaji Sangle (2016) reported the functions of WUAs as there is an economic and equitable distribution of water, the water is distributed on volumetric basis rather than area basis from tail to head, each and every water users associations are keeping their up-to-date records and publishing their annual reports every year.

## **2.3 OPINION OF THE FUNCTIONARIES TOWARDS WATER USERS ASSOCIATIONS**

Tidke (1995) stated that there has been a significant change in the attitude of farmers. In the past, they routinely bribed the Government patkari to take more water. It was not very uncommon for farmers to steal water from the canal, break and damage the canal etc. all these practices have now come down. A fair amount of discipline is observed in water distribution.

El-Zanaty & Associates (2001) reported that the most positive attitudes toward WUAs were observed in Middle Egypt (89 per cent) and the lowest level in Upper Egypt (58 per cent).

Israel (2003) stated that majority (42.50 %) of the respondents had more favourable attitude towards watershed development project followed by favourable (40.42 %) and less (17.08 %) favourable attitude.

Prasad (2004) in his study reported that majority (74.17 %) of the respondents had favourable attitude towards participation of partners in agricultural research-extension and farmers linkage mechanisms in Krishna Godavari zone of Andhra Pradesh followed by more favourable (23.33 %) and less (2.50 %) favourable attitude.

Kumar *et al.* (2008) showed that a majority of the respondents (74.44 %) had medium favourable attitude towards Rythu mitra programme followed by more favourable (22.22 %) and less favourable (3.34 %) attitudes.

Badatya and Mohapatra (2010) mentioned that about 76 per cent of the water users had opined that there was an improvement in the reliability of water supply after the implementation of Participatory Irrigation Management (PIM). Mostly, tail end farmers opined that not only reliability of irrigation water supply had improved but also received more water through irrigation as compared to the pre-PIM situation.

Meena and Singh (2011) reported that most of SHG members (91 %) had medium favourable attitude towards SHG activities followed by less favourable (6 %) and highly favourable (3 %).

Gebrelibanos and Assen (2013) stated that 62.20 per cent of the respondents had high attitude to the conservation of natural resources, while (32.9 %) had low attitude and only (4.88 %) had moderate attitude towards land resources conservation.

Jayashri (2013) reported that majority of the respondents (74.00 %) had favourable and highly favourable opinion towards the Bhoochetana Programme followed by less favourable opinion (26.00 %).

Nisha *et al.* (2014) revealed that (16.00 %) farmers expressed most favourable attitude towards ATMA, about (71.00 %) farmers showed favourable attitude where as only (13.00 %) were under least favourable attitude towards ATMA.

Patel (2015) reported the opinion of the respondents about satisfaction due to water user association work, about 20 per cent of the respondents opined it was up to 25 per cent of satisfaction, 25 per cent of the respondents opined that success ratio was 25 to 50 per cent, 16 per cent of the respondents opined that the success ratio was 50 to 75 per cent and 39 per cent of them opined that the ratio was more than 75 per cent.

Bagdi and Kurothe (2016) reported that among the overall majority (72.70 %) of the farmers both male and female exhibited moderately favourable attitude followed by 16.07 per cent of them had low favourable attitude and only about 11.23 per cent of them exhibited high favourable attitude towards participation in watershed program.

## **2.4 IMPACT OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA IN TERMS OF DIRECT AND INDIRECT CHANGES**

### **2.4.1 Direct changes**

Kutty (2002) stated that agricultural operations have increased at a very high level as opined by majority (82.7 %) of the respondents income of farmers have increased to a high extent according to majority (74.7 %) of the respondents size of the irrigated land holdings have increased upto 78.7 per cent.

Babu (2004) revealed that, majority (83.53 %) of the Operational Research Project beneficiaries agreed that there was an increase in income. However, (16.47 %) per cent of beneficiaries have disagreed with regard to increase in income due to Indo- Dutch Network operational research project.

Mahapatra (2006) mentioned that 78 per cent of the farmers responded that there was no change in area irrigated after pani panchayat (PP) formation.

Bruns and Taher (2009) reported that more income per drop is feasible through WUAs i.e., investment in improved irrigation equipment was contributing to increased farm level irrigation efficiency, less time required to irrigate and to a lesser extent and savings in energy costs.

Badatya and Mohapatra (2010) mentioned that there was a 5.5 per cent increase in area under irrigation among the sample water users in the post WUA situation. For canal irrigation (16.1 %), the increase was highest as compared to tank irrigation (8.30 %).

Abirami *et al.* (2014) reported that majority (42.50 %) of the IAMWARM beneficiary farmers had moderately increased yield followed by slightly increased yield (29.17 %), highly increased yield (28.33 %) and none of them were in decreased and same level of yield.

Xiaolan and Akter (2014) stated that the amount and quality of the services and the speed of services delivery have been improved significantly as a result of the intervention of Information and Communication Technology (ICT) on Agricultural Extension Services.

Patel (2015) reported the average agricultural income per household before and after Participatory Irrigation Management. It indicate that before PIM in head region farmer per household average income was Rs.36503, in middle region it was Rs.28752 and in tail region it was 18400 Rs. and after PIM in head region it increased from 36503 Rs/- to 176452 Rs/- in middle regions increased from 28752 Rs. to 159432 Rs. and in tail region it is increased from Rs.18400 to 145480 Rs.

Pawariya and Chauhan (2017) stated that in beneficiary farmers the income from grain was highest in large farmers (Rs.53514.54) followed by medium farmers (Rs.49153.34), marginal farmers (Rs.43225.93) and small farmers (Rs.40647.07). The income from byproducts was highest in case of small farmers (Rs.17583.90) and lowest in case of marginal farmers (Rs.13949.54). As regards the gross income from grain and by-product was highest for large farmers (Rs.69263.88) followed by marginal farmers (Rs.66610.08), small farmers (Rs.58230.97) and marginal farmers (Rs.57175.46).

#### **2.4.2 Indirect changes**

Babu (2004) inferred that majority (62.35 %) of the Operational Research Project beneficiaries undergone medium personal changes followed by those under more (20.00 %) and less (17.65 %) personal changes, respectively.

Bharathi (2005) indicated that the before joining National Agricultural Technology Project (NATP), 43.50 per cent of the SHG members had confidence to talk within the family and it was increased to 88.60 per cent after joining NATP. With respect to decision making pattern in the family, the decisions taken by the SHG members during the family and social functions accounts to 41.00 per cent before, which increased to 88.80 per cent after joining the project.

Raju (2000) stated that the tail end deprivation is common to all the Irrigation systems. The additional suffering to the tail end farmers in these two systems is water logging, salinity and exposure to cyclones. To mitigate such

suffering the farmers in the fringes of the two deltas have started converting the irrigated lands into fish ponds from the year 1978. What has started as a fresh water culture has turned into intensive brackish water aqua culture.

Roy (2009) reported the impact of National Rural Employment Guarantee Act (NREGA) in Tripura as National Rural Employment Guarantee Scheme (NREGS) was a means of survival to help old, aged unskilled labourers in rural areas. The NREGS had regenerated self-belief amongst poor that they can earn money for their family. Field study showed that 10.00 per cent of women participating in NREGS had been subscribing to LIC policies/recurring deposits. Majority of women had reported that NREGS had enabled them to be health cautious.

Argade (2010) revealed that majority (70.00 %) of NREGS beneficiaries experienced medium indirect changes followed by those experienced more (15.56 %) and less (14.44 %) indirect changes.

Badatya and Mohapatra (2010) stated that besides, benefits of increase in area under irrigation due to better distribution, adequate and timely availability of water to all the reaches of the canal due to warabandi or turn schedule-wise opening of water in different reaches, increase in water-use-efficiency due to the training received by the WUA members as also the farmers in general, which is reflected in higher yield of crops, etc., other economic and social benefits of organising WUAs were the construction of canal road/road in the tank bunds under food-for-work programme and NREGS which increased motorability of such roads. Roads helped the water users/farmers in transport of farm inputs, harvested outputs as also marketing of outputs in better markets.

Xiaolan and Akter (2014) stated that there are also indirect benefits from this ICT-enhanced services delivery system not only in greater awareness and knowledge in agriculture technology and information but also in terms of farmers' attitudes towards trying new technology and new ways of life in the future.

## 2.5 RELATIONSHIP BETWEEN PERSONAL, SOCIO-ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE FUNCTIONARIES WITH THEIR OPINION AND DIRECT AND INDIRECT CHANGES

### 2.5.1 Relationship between personal, socio- economic and psychological characteristics of the functionaries with their opinion

Association	Significant/ Non- significant	References	Year	Respondents
<b>Age</b>				
Positive	Non-significant	Surekah <i>et al.</i>	1997	Watershed farmers
Negative	Significant	Geetha	2002	Diversified farming growers in Chittoor
Negative	Significant	Thaker and Khare	2003	Well recharging
Positive	Significant	Ramakrishnan <i>et al.</i>	2004	TANWA Project
Negative.	Non-significant	Jeeva <i>et al.</i>	2006	Fishery researcher
Positive	Non-significant	Kishore	2006	Sujala watershed project beneficiaries
Negative	Non-significant	Kumar <i>et al.</i>	2008	Rythu mitra T.V Beneficiaries
Negative	Non-significant	Uddin <i>et al.</i>	2008	Modern agricultural technologies
Negative	Significant	Alzaidi <i>et al.</i>	2013	Organic agriculture
<b>Education</b>				
Negative	Non significant	Chandra <i>et. al.</i>	2000	Watershed farmers
Positive	Significant	Geetha	2002	Diversified farming growers
Positive	Significant	Israel	2003	Watershed farmers in Anantapur
Negative	Non-significant	Ramakrishnan <i>et al.</i>	2004	TANWA Project
Positive	Non-significant	Jeeva <i>et al.</i>	2006	Fishery researcher
Positive	Significant.	Meshram <i>et al</i>	2006	SGSY Beneficiaries
Positive	Significant	Kumar <i>et al.</i>	2008	Rythu mitra T.V Beneficiaries
Positive	Significant	Arifullah	2014	Extension activities of rural elite farmers

Association	Significant/ Non- significant	References	Year	Respondents
<b>Land holding</b>				
Positive	Significant	Surekha <i>et al.</i>	1997	Watershed farmers
Negative	Significant	Chandra <i>et. al.</i>	2000	Watershed farmers
Positive	Significant	Geetha	2002	Diversified farming growers
Positive	Significant	Israel	2003	Watershed farmers
Positive	Non-significant	Thaker and Khare	2003	Well recharging
Negative	Non-significant	Ramakrishnan <i>et al.</i>	2004	TANWA Project
Positive	Significant	Kishore	2006	Sujala watershed project beneficiaries
Positive	Non-significant	Meshram <i>et al.</i>	2006	SGSY Beneficiaries
Positive	Non-significant	Uddin <i>et al.</i>	2008	Modern agricultural technologies
<b>Extension contact</b>				
Positive	Non-significant	Reddy	2003	Eco-friendly technologies.
Positive	Significant	Naik	2009	FFS farmers
Positive	Significant	Rajanna <i>et al.</i>	2009	Sustainable farming practices
Positive	Significant	Okoedo-Okojie and Aphunu	2011	Use of chemical fertilizers
Positive	Significant	Kitturmath <i>et al.</i>	2013	Rural youth
Positive	Significant	Arifullah	2014	Extension activities of rural elite farmers
<b>Social participation</b>				
Negative	Significant	Chandra <i>et. al.</i>	2000	Watershed farmers
Negative	Significant	Rama murthy	2000	Janmabhoomi farmers of Chittoor
Positive	Significant	Israel	2003	Watershed farmers
Positive	Significant	Arifullah	2014	Extension activities of rural elite farmers
Positive	Significant	Shojae and Tahmasb	2014	Trade system of agricultural tasks
<b>Source of information</b>				
Positive	Significant	Ramakrishnan	1999	TANWA beneficiaries in Madhurai
Positive	Non-significant	Chandra <i>et. al.</i>	2000	Watershed farmers

Association	Significant/ Non- significant	References	Year	Respondents
Positive	Significant	Geetha	2002	Diversified farming growers in Chittoor
Positive	Significant	Israel	2003	Watershed farmers
Negative	Non-significant	Mini	2006	Water Users Association and Irrigation Management
Positive	Significant	Balasubramanya <i>et al.</i>	2016	Water Users Associations
<b>Training received</b>				
Positive	Significant	Ramakrishnan	1999	TANWA beneficiaries in Madurai
Positive	Significant	Raju	2000	Participatory Irrigation Management in Andhra Pradesh A.P.
Positive	Significant	Israel	2003	Watershed farmers in Anantapur
Positive	Significant	Ramakrishnan <i>et al.</i>	2004	TANWA Project
Positive	Non-significant	Jeeva <i>et al.</i>	2006	Fishery researcher
<b>Perceived work load</b>				
Positive	Significant	Raju	2000	Participatory Irrigation Management in A.P.
<b>Information and communication behavior</b>				
Positive	Significant	Samatha	2011	Information and Communication Technologies (ICTs) used by farmers
<b>Cropping pattern</b>				
Positive	Significant	Raju	2000	Participatory Irrigation Management in A.P.
Positive	Significant	Mahapatra	2006	Functioning of Water Users Associations
Negative	Non-significant	Mini	2006	Water Users Association and Irrigation Management
Positive	Significant	Badatya and Mohapatra	2010	Participatory Irrigation Management (WUA in A.P.)
Positive	Significant	Balasubramanya <i>et al.</i>	2016	Water Users Associations

Association	Significant/ Non- significant	References	Year	Respondents
<b>Decision making</b>				
Positive	Significant	Kumar	2013	AELP
<b>Innovativeness</b>				
Positive	Significant	Obaiah	2004	Rice FFS farmers in Krishna-Godavari zone
Positive	Significant	Thaker and Khare	2003	Well recharging
Negative	Non-significant	Ramakrishnan <i>et al.</i>	2004	TANWA Project
Positive	Significant	Reddy <i>et al.</i>	2006	Rice farmers
Positive	Significant	Kumar <i>et al.</i>	2008	Rythu mitra T.V Beneficiaries
Positive	Significant	Obaiah and Raju	2008	Rice FFS farmers
Positive	Significant	Samatha	2011	Information and Communication Technologies (ICTs) used by farmers
<b>Risk orientation</b>				
Positive	Significant	Surve <i>et al.</i>	2005	National Agricultural Insurance Scheme farmers
Positive	Significant	Kunchala <i>et al.</i>	2012	Towards private extension services
Positive	Non-significant	Jasvinder <i>et al.</i>	2014	Privatization of agricultural extension services.
<b>Achievement motivation</b>				
Positive	Significant	Geetha	2002	Diversified growers in Chittoor
Positive	Significant	Obaiah	2004	Rice FFS farmers in Krishna-Godavari zone
Negative	Non-significant	Ramakrishnan <i>et al</i>	2004	TANWA Project
Positive	Significant	Reddy <i>et al.</i>	2006	Rice farmers
Positive	Significant	Kumar <i>et al.</i>	2008	Rythu mitra T.V beneficiaries
Positive	Significant	Obaiah and Raju	2008	Rice FFS farmers

<b>Association</b>	<b>Significant/ Non- significant</b>	<b>References</b>	<b>Year</b>	<b>Respondents</b>
Positive	Significant	Samatha	2011	Information and Communication Technologies (ICTs) used by farmers
<b>Economic orientation</b>				
Positive	Significant	Ramakrishnan <i>et al.</i>	2004	TANWA Project
Positive	Significant	Meshram <i>et al.</i>	2006	SGSY Beneficiaries
Positive	Significant	Reddy <i>et al.</i>	2006	Rice farmers
Positive	Significant	Kumar <i>et al.</i>	2008	Rythu mitra T.V Beneficiaries
Positive	Significant	Sravan	2012	Vermicompost Entrepreneurs
<b>Management orientation</b>				
Positive	Significant	Kumar	2013	AELP

## 2.5.2 Relationship between personal, socio- economic and psychological characteristics of the functionaries with their direct changes

Association	Significant/ Non- significant	References	Year	Respondents
<b>Age</b>				
Positive	Non-significant	Kantharaju	2011	MGNREGS beneficiaries
Negative	Significant	Mohanraj	2011	MGNREGS beneficiaries
Negative	Significant	Yadav	2012	Watershed technology
Positive	Significant	Vinay <i>et al.</i>	2013	DWACRA beneficiaries
Positive	Significant	Nayak <i>et al.</i>	2014	Adoption of agricultural technologies
Negative	Significant	Raj Kumar <i>et al.</i>	2014	Pulse production technologies
Negative	Non-significant	Sujaatha <i>et al.</i>	2014	Tribal SHG beneficiaries
Negative	Non-significant	Sumathi	2014	Precision farming technologies
<b>Education</b>				
Positive	Significant	Saxena and Singh	2000	Organic farming farmers
Positive	Significant	Ramesh babu	2002	Operational research project beneficiaries
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Jaganathan <i>et al.</i>	2012	Organic farmers
Positive	Significant	Bhagwan Singh	2013	Improved production technology of rabi crops
Positive	Significant	Vinay <i>et al.</i>	2013	DWACRA beneficiaries
Negative	Non-significant	Kakati and Behera	2014	MGNREGS beneficiaries
Positive	Significant	Singh <i>et al.</i>	2014	Rural women
Positive	Significant	Sujaatha <i>et al.</i>	2014	Tribal SHG beneficiaries

Association	Significant/ Non-significant	References	Year	Respondents
<b>Land holding</b>				
Positive	Significant	Natarajan	2004	FFS farmers
Positive	Significant	Premavathi	2005	Farm women
Positive	Significant	Prasad <i>et al.</i>	2007	rice farmers
Positive	Significant	Manoj <i>et al.</i>	2009	KVK adopted farmers
Positive	Significant	Singh and Varshney	2010	Rice production technology
Negative	Significant	Yadav	2012	Watershed technology
Negative	Significant	Kumawat and Bhati	2013	Agricultural aspects
Negative	Non-significant	Sumathi	2014	Precision farming technologies
<b>Extension contact</b>				
Positive	Significant	Tripathi	2006	Chickpea production technology
Positive	Non-significant	Tiwari <i>et al.</i>	2007	Pea growers
Positive	Significant	Thiyagarajan	2011	SRI farmers
Positive	Significant	Bhagwan Singh	2013	Improved production technology of rabi crops
Positive	Significant	Ambedkar <i>et al.</i>	2013b	Bengalgram farmers.
Positive	Significant	Kumawat and Bhati	2013	Agricultural aspects
Positive	Significant	Sumathi	2014	Precision farming technologies
<b>Social participation</b>				
Positive	Significant	Swarooparani	2000	Dry land farmers
Positive	Significant	Manjunath	2002	Hemavathi project Beneficiaries
Positive	Significant	Babu	2002	Operational research project Beneficiaries
Positive	Significant	Singh and Varshney	2010	rice production technology
Negative	Significant	Yadav	2012	Watershed technology
Negative	Non-significant	Kantharaju	2011	MGNREGS beneficiaries
Negative	Non-significant	Punyavathi	2012	MGNREGS beneficiaries

Association	Significant/ Non- significant	References	Year	Respondents
Positive	Significant	Nayak <i>et al.</i>	2014	Adoption of agricultural technologies
<b>Source of information</b>				
Positive	Significant	More <i>et al.</i>	2000	KVK trained farmers
Positive	Significant	Rajaratnam	2000	Sunflower growers
Positive	Significant	Manjunath	2002	Hemavathi project beneficiaries
Positive	Significant	Ravichandraprasad	2002	Rice growers
Positive	Significant	Raja	2004	Rice growers
Positive	Significant	Manoj	2008	KVK trained farmers
Positive	Significant	Badodiya <i>et al.</i>	2011	MGNREGS beneficiaries
Positive	Non- significant	Kantharaju	2011	MGNREGS beneficiaries
Positive	Significant	Singh <i>et al.</i>	2014	Rural women
<b>Training received</b>				
Positive	Significant	Usha Devi	2000	ANTWA beneficiaries
Positive	Significant	Starkloff	2001	Water user organization farmers
Positive	Significant	Israel	2003	NWDPRA beneficiaries
Positive	Significant	Naik and Babu	2009	FFS farmers
Positive	Significant	Thiyagarajan	2011	SRI farmers
Positive	Significant	Yadav	2012	NWDPRA beneficiaries
<b>Perceived work load</b>				
Positive	Significant	Hussain and Langendijk	1994	Self-help rural water supply schemes
Positive	Significant	Grassi <i>et al.</i>	2015	Micro irrigation project
<b>Information and communication behavior</b>				
Positive	Significant	Soto-Garcia <i>et al.</i>	2013	Information and Communication Technologies in WUAs

<b>Association</b>	<b>Significant/ Non- significant</b>	<b>References</b>	<b>Year</b>	<b>Respondents</b>
Positive	Significant	Leshan <i>et al.</i>	2017	Information and Communication Technologies (ICTs) of rural ground water
<b>Cropping pattern</b>				
Positive	Significant	Mahapatra	2006	Functioning of Water Users Associations
Positive	Significant	Mini	2006	Water Users Association and Irrigation Management
Positive	Significant	Gandhi & Namboodiri	2009	Participatory Irrigation Management in India
Positive	Significant	Badatya and Mohapatra	2010	Participatory Irrigation Management (WUA in A.P.)
<b>Decision making</b>				
Positive	Significant	Badatya and Mohapatra	2010	Participatory Irrigation Management (WUA in A.P.)
<b>Innovativeness</b>				
Positive	Significant	Premavathi	2005	Farm women
Positive	Significant	Prasad reddy <i>et al.</i>	2007	Rice farmers
Positive	Significant	Naik <i>et al.</i>	2009	Organic farmers
Positive	Non-significant	Naik and Babu	2010	FFS farmers
Positive	Significant	Thiyagarajan	2011	SRI farmers
Positive	Significant	Jaganathan <i>et al.</i>	2012	Organic farmers
Positive	Significant	Raj Kumar <i>et al.</i>	2014	Pulse production technologies
<b>Risk orientation</b>				
Positive	Significant	Sujata and Annamali	1998	Marginal, small and big farmers
Positive	Significant	Jondhale <i>et al.</i>	2000	KVK trained farmers
Positive	Significant	Manjunath	2002	Hemavathi project beneficiaries
Positive	Significant	Babu and Venkataramaiah	2004	Operational project beneficiaries

<b>Association</b>	<b>Significant/ Non- significant</b>	<b>References</b>	<b>Year</b>	<b>Respondents</b>
Positive	Significant	Manoj	2008	KVK trained farmers
Positive	Significant	Vinay <i>et al.</i>	2013	DWACRA beneficiaries
<b>Achievement motivation</b>				
Positive	Non-significant	Sivanarayana and Jayaramireddy	1994	Small and marginal farmers
Positive	Significant	Adishesaih	1995	Agricultural graduates
Positive	Significant	Reddy	1995	Respondents of farm broadcasts
Positive	Significant	Raja	2004	Rice crop growers
Positive	Significant	Prasad Reddy <i>et al.</i>	2007	Rice farmers
Positive	Significant	Manoj	2008	KVK trained farmers
Positive	Significant	Kalyan	2011	Groundnut technologies
<b>Economic orientation</b>				
Positive	Significant	Raji <i>et al.</i>	1996	KVK trained farmers
Positive	Significant	Chatterjee	2000	NWDPRP farmers
Positive	Significant	Jondhale <i>et al.</i>	2000	Groundnut growers
Positive	Significant	Manjunath	2002	Hemavathi project beneficiaries
Positive	Non- significant	Raja	2004	Rice crop growers
Positive	Significant	Manoj	2008	KVK trained farmers
<b>Management orientation</b>				
Negative	Significant	Alaverdyan and Alaverdyan	2004	Water Users Associations in Armenia
Negative	Significant	Babu and Puttiaha	2011	Decentralization of water resource governance and agricultural performance

### 2.5.3 Relationship between personal, socio- economic and psychological characteristics of the functionaries with their indirect changes

Association	Significant/ Non- significant	References	Year	Respondents
<b>Age</b>				
Negative	Significant	Saraswathi <i>et al.</i>	2000	Tribal farmers
Negative	Significant	Chaudhary and Sangram Singh	2002	farm women
Positive	Non-significant	Babu	2004	Operational research project beneficiaries
Negative	Significant	Gaiha <i>et al.</i>	2010	MGNREGS beneficiaries
Negative	Non-significant	Abirami <i>et al.</i>	2013	IAMWARM beneficiaries
Negative	Non-significant	Chandravari and Badiger	2013	National Rural Health Mission respondents
Positive	Significant	Patilkhede	2014	SHG respondents
Positive	Non-significant	Swetha <i>et al.</i>	2014	Women entrepreneurs
<b>Education</b>				
Positive	Significant	Babu	2002	Operational research project beneficiaries
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Suresh and Babu	2008	Watershed project beneficiaries
Positive	Significant	Abirami <i>et al.</i>	2013	IAMWARM beneficiaries
Positive	Significant	Chandravari and Badiger	2013	National Rural Health Mission respondents
Positive	Significant	Elavarasi <i>et al.</i>	2014	SHG respondents
Positive	Non-significant	Swetha <i>et al.</i>	2014	Women entrepreneurs
<b>Land holding</b>				
Positive	Non-significant	Tasneem	2001	Training programmes on paddy
Positive	Significant	Chaudhary and Sangram Singh	2002	Farm women
Positive	Significant	Ramesh babu	2002	Operational research project beneficiaries
Positive	Non-significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Subrahmanyeswari <i>et al.</i>	2007	Entrepreneurial behaviour

Association	Significant/ Non- significant	References	Year	Respondents
<b>Extension contact</b>				
Positive	Significant	Saraswathi <i>et al.</i>	2000	Tribal farmers
Positive	Significant	Tasneem	2001	Training programmes on paddy
Positive	Significant	Chatterjee	2000	NWDPPRA
Positive	Non-significant	Manoj	2008	KVK adopted farmers
<b>Social participation</b>				
Positive	Significant	Babu	2004	Operational research project beneficiaries
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Elavarasi <i>et al.</i>	2014	SHG respondents
Positive	Non-significant	Swetha <i>et al.</i>	2014	Women entrepreneurs
<b>Source of information</b>				
Positive	Significant	Srinu	1997	PACS beneficiaries
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Abirami <i>et al.</i>	2013	IAMWARM beneficiaries
Positive	Significant	Elavarasi <i>et al.</i>	2014	SHG respondents
Negative	Non-significant	Swetha <i>et al.</i>	2014	Women entrepreneurs
<b>Training received</b>				
Positive	Significant	Israel	2003	NWDPPRA beneficiaries
Negative	Non-significant	Vanitha	2005	Awareness about development programmes
Positive	Significant	Pallavi	2006	Tribal women
<b>Perceived work load</b>				
Positive	Significant	Hussain and Langendijk	1994	Self-help rural water supply schemes
Positive	Significant	Grassi <i>et al.</i>	2015	Micro irrigation project
<b>Information and communication behavior</b>				
Positive	Significant	Soto-Garcia <i>et al.</i>	2013	Information and Communication Technologies in WUAs
Positive	Significant	Leshan <i>et al.</i>	2017	Information and Communication Technologies (ICTs) of rural ground water

Association	Significant/ Non- significant	References	Year	Respondents
<b>Cropping pattern</b>				
Positive	Significant	Mahapatra	2006	Functioning of Water Users Associations
Positive	Significant	Raju <i>et al.</i>	2006	Participatory Irrigation Management in Andhra Pradesh
Positive	Significant	Badatya and Mohapatra	2010	Participatory Irrigation Management (WUA in A.P.)
<b>Decision making</b>				
Positive	Significant	Badatya and Mohapatra	2010	Participatory Irrigation Management (WUA in A.P.)
Negative	Significant	Ahuja	2012	Impact of PIM on economic growth
<b>Innovativeness</b>				
Positive	Significant	Babu	2004	Operational research project beneficiaries
Positive	Non-significant	Vanitha	2005	Development programmes
Positive	Significant	Reddy <i>et al.</i>	2006	Rice farmers
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Obaiah and Raju	2008	FFS rice farmers
Positive	Significant	Nirmala and Hiremath	2011	Rythu Chaitanya Yatra Programme.
<b>Risk orientation</b>				
Positive	Significant	Suneetha	2004	Rural women
Positive	Significant	Manoj	2008	KVK adopted beneficiaries
Positive	Significant	Abirami <i>et al.</i>	2013	IAMWARM beneficiaries
Positive	Non-significant	Elavarasi <i>et al.</i>	2014	SHG respondents
<b>Achievement motivation</b>				
Positive	Significant	Snehalatha and Reddy	1997	Rural women
Positive	Significant	Srinu	1997	PACS beneficiaries
Positive	Significant	Suneetha	2004	Self employed rural women

<b>Association</b>	<b>Significant/ Non- significant</b>	<b>References</b>	<b>Year</b>	<b>Respondents</b>
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Non-significant	Jayabangale and Vishalapatnam	2013	Rural youth
<b>Economic orientation</b>				
Positive	Significant	Snehalatha and Reddy	1997	Women in credit groups
Positive	Significant	Manoj	2008	KVK adopted farmers
Positive	Significant	Abirami <i>et al.</i>	2013	IAMWARM beneficiaries
Positive	Significant	Elavarasi <i>et al.</i>	2014	SHG respondents
<b>Management orientation</b>				
Positive	Significant	Chackacherry	2014	Sustainability of WUAs and PIM
Negative	Significant	Sinha	2014	Sustainability Issues in PIM (India)

## **2.6 STRENGTHS, WEAKNESS, OPPORTUNITIES AND CHALLENGES OF WATER USERS ASSOCIATIONS AS PERCEIVED BY THE FUNCTIONARIES OF WATER USER ASSOCIATION AND IRRIGATION DEPARTMENT**

### **2.6.1 Strengths**

Agenzia Regionale Per La Protezione Dell'Ambiente (2011) mentioned the strengths of the Irminio River Basin i.e., significant Percentage of treated wastewater reused in the basin, high Percentage of permanent population (98 %) served by water supply networks, water availability sufficient to meet irrigation water consumption in the irrigation consortium area, presence of the "Irminio river natural-forest reserve and sites of community importance and availability of a preliminary "master plan", in order to meet of the water demand in the coast areas during summer period by using dam water resources.

"Agrar- und Hydrotechnik (AHT) Group AG Management and Engineering (2013) reported the strengths of Water Users Associations of Kyrgyzstan as they had formed throughout the country covering the main 737,000 irrigated ha in the country, organized according to the law and legally registered, recognized in the country as the administrative body to carry out O&M at on farm level, developed with separation between Governance and Management with Management Board and Representatives elected from members, over past 11 years have paid 92 per cent of their water fees to the DWEM and are self-financing.

### **2.6.2 Weaknesses**

Kazbekov *et al.* (2007) mentioned the SWOT analysis showed that existing WUA structure does not allow water users to actively engage in water management processes. The hierarchical WUA structure offered no place for water users' concerns over water management practices. This had led to frequent conflicts between water users and WUA staff (canal riders, mirabs, and director).

Agenzia Regionale Per La Protezione Dell'Ambiente (2011) mentioned the weakness of the Irminio River Basin as Significant decrease of forest and natural areas and increase of agricultural areas, significant urbanization trend in

the basin, due to the population increase in Ragusa, high temporal variability of precipitation, total annual water consumption and need are satisfied by using almost all the available water resources in the basin, risk of overflows in the lower part of the Irminio, basin due to the potential failure risk of the Santa Rosalia dam, water shortage conditions in touristic areas of the basin, small villages not served by water supply network, lack of adequate metering and tariff systems and high loss of supplied water.

Arun *et al.* (2012) lack of unity, cooperation and interest among users, inadequate water/inequity in water allocation, water availability is not as per crop requirement, lack of communication among water users, lack of money for repair of field channels, users backed out or failed to finance WUAs, rigid procedure in adopting to changing situations, incapable/untrained operator/manager of WUA, unfair procedure for electing officials, high water charges/ low economic gains.

Agrar- und Hydrotechnik (AHT) Group AG Management and Engineering (2013) reported the weakness of Water Users Associations of Kyrgyzstan as on-farm delivery system was not maintained since breakup of Soviet Union makes difficult to manage water deliveries to members, are still learning about participatory farmer association and how to exert their rights as members, association lacks technical machinery, transport and modern water management equipment, technical skills of management staff are weak and with low wage levels difficult to recruit new graduates, water fees are set by Parliament—held too low which sends a negative signal to members, history of “top-down” management hard to overcome.

### **2.6.3 Opportunities**

Agenzia Regionale Per La Protezione Dell’Ambiente (2011) mentioned the opportunities of the Irminio River Basin as Adequate water tariffs in the basin compared with the Italian situation Common Agricultural Policy (CAP) associated with good practice for the maintenance of biodiversity, landscape, soil

protection and water resources, increase of the public interest for the sustainable management of the environmental, sports and recreational aspects, presence of a study for the treated wastewater reuse in Sicily.

AHT Group AG Management and Engineering (2013) reported the opportunities of Water Users Associations of Kyrgyzstan as donor assistance is focused on on-farm rehab and WUAs, along with Department of Water Economy and Melioration (DWEM) WUA support units can develop strong client relationship with DWEM, improvements in agricultural system and markets can increase agricultural returns, formation of WUA Federations to take over management of inter-farm system, with asset transfer can invest in improvement of their irrigation infrastructure, WUA Law gives some tax protection and can start to generate other sources of income, a developing economy, with more opportunities for farming community.

#### **2.6.4 Challenges**

Chandrasekaran *et al.* (2002) stated the problems of Water User Associations like fund constraints, water availability, support from Government, poor attendance of members and unsolved conflicts.

Faysse (2004) revealed some challenges concerning the participation of smallholders in water resource management organizations are the possible discrepancies between the needs of smallholders with regard to water and the functions of these organizations, smallholders need above all funds for investment in waterworks and their operation, they are not directly affected by water resource management issue, a lack of overlap between their needs and the functions of a water resource management organization

Raju (2008) stated the challenges of WUAs as the state government proposes to launch a massive human resource development program for the elected representatives and irrigation agency personnel to help them run the water users associations, training would be a continuous process for skill upgradation, It is proposed to undertake a joint inspection of the irrigation system with the irrigation agency and the water user association to undertake system diagnosis and prioritize the rehabilitation strategy of the irrigation

system, the Water and Land Management Training Institute would be fully involved in undertaking the task of training elected representatives and the agency staff and monitoring and evaluation of the program.

Agenzia Regionale Per La Protezione Dell'Ambiente (2011) mentioned the threats of the Irminio River Basin as Lack of financial resources investments in infrastructure due to economic crisis, no application of spatial or urban planning to prevent urbanization in particular regarding touristic facilities and resorts, ineffective control of water operation works by competent authorities, ineffective control of discharges in the Irminio river, very restrictive approach for treated wastewater reuse.

Rai *et al.* (2012) mentioned the constraints faced by the farmers such as higher irrigation charges recover by the WUAs, lack of finance; time schedule for irrigation was not proper; improper motivation for increasing participation; inadequate supply of irrigation water to tail enders; improper guidance by WUAs for getting maximum benefits from the programme and poor maintenance of field channels.

AHT Group AG Management and Engineering (2013) reported the challenges of Water Users Associations of Kyrgyzstan as poor irrigation infrastructure, poor irrigation water delivery and low farm productivity.

## **2.7 STRATEGIES FOR SUSTAINABILITY OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA OF ANDHRA PRADESH**

Chandrashekar *et al.* (2002) mentioned the strategy for organizing farmers of Water Users Associations in four tanks under a project assisted by the Ford Foundation, India. The approach gave importance to working directly with farmers and gave priority to their concerns rather than implementing a preconceived action plan. Farmers were asked to identify their own priorities and concerns, which were an integral part of the implementation process.

Rakesh (2004) unless major social institutional and HRD support is made available and farmers enabled to successfully manage canals on their own, the sustainability of PIM may not be achieved.

Peter (2004) mentioned that sustainable WUAs require an enabling environment, clear political will with clarity of objects, accountable partnerships, and incentives. Merely creating a legal framework or linking them with rehabilitation projects alone, will not lead to successful WUAs. Nevertheless, empowerment of water users, long term capacity building, financial resources and appropriate incentives with timely monitoring and remedial actions can go a long way in strengthening the WUAs. The sustainability of a WUA clearly depends upon internal factors: farm size, location, social stratification and heterogeneity; and external factors such as the institutional environment, legal framework, staffing, financial and technical assistance, agricultural policies, markets, hydraulics and demography.

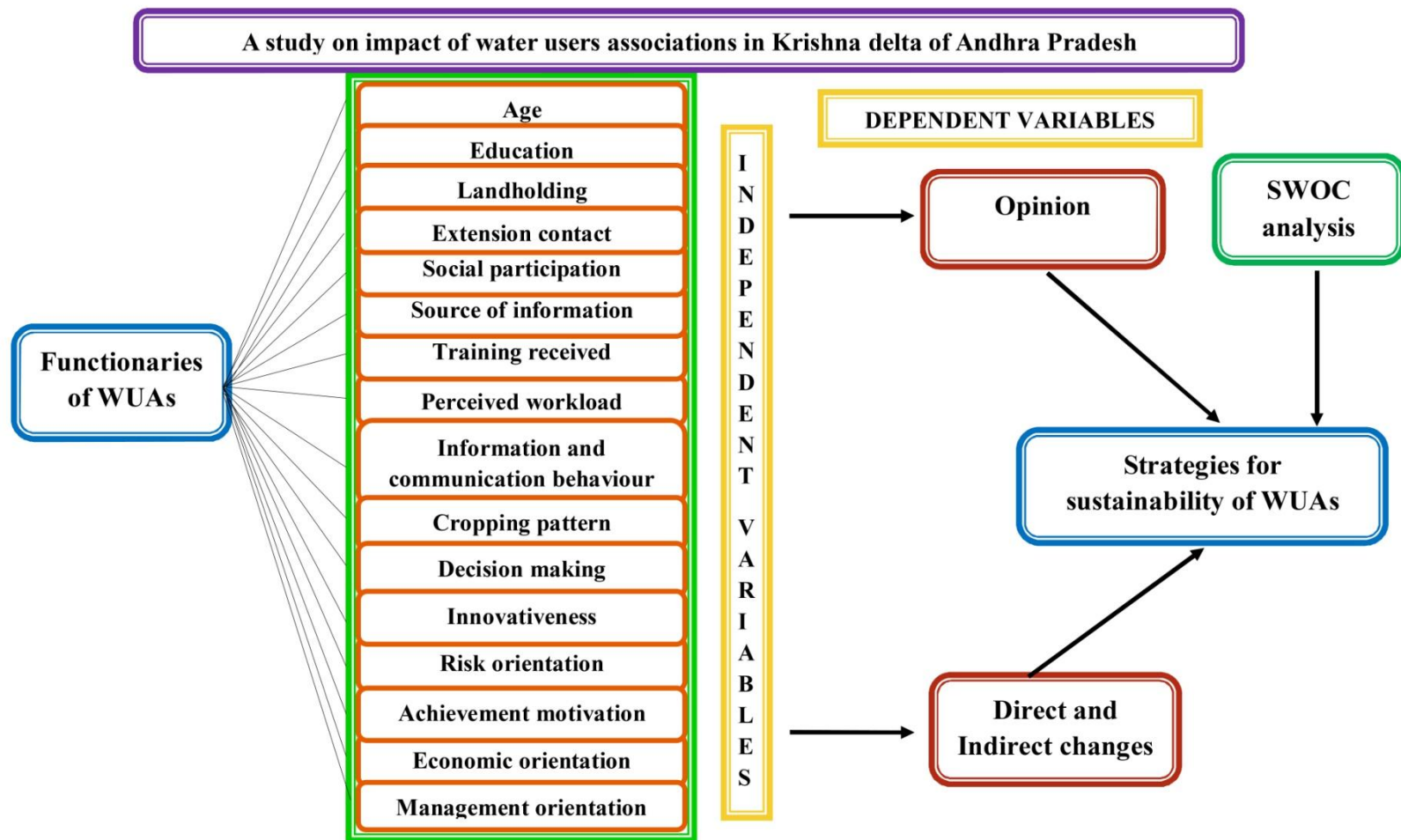
Raju *et al.* (2006) stated the future training strategy should include farmers must be trained in villages, the possible way is grouping farmers in WUA into a smaller groups and train using local resource person, a number of WUA members have already trained, they may appropriately used in future to transfer skill, knowledge and WUA operations, department should play an important role in facilitating local capacity building, they need to identify and involve trained people in the local capacity building, it is not enough to train farmers, there is thus a need to involve GP members, Secretary and revenue members, cooperation between them is needed as there is no proper collection system, the capacities built should also be correlated to the impact developing appropriate indicators.

Bruns and Taher (2009) reported the following for sustainable local water management: learn from local initiatives and successes in water governance and help communities learn from each other, share information with communities and facilitate problem-solving process in which they analyze their situation and find pathways to sustainability, diversify organizations to fit activities, through diverse WUGs, WUOs, and federations fitted to specific

needs and objectives of activities, using a variety of options to customize organizational arrangements to particular circumstances and adjusting them as conditions change over time and weave networks for governance, strengthening horizontal linkages between WUOs and local government and traditional leaders for effective local water governance, including support for enforcement and financing and vertical linkages at district, governorate, sub-basin, basin and national scales to address wider coordination and cooperation, including technical advice, delegation of enforcement authority, and sharing of ideas and experience.

Subramanyan (2011) suggested that government should take up repairs and maintenance of canals, government organizations procure paddy as in Punjab state, MSP to be increased, speedy payment of crop insurance claims, speedy payment of input subsidy, paddy scale of finance to be increased and agricultural works included under MGNREGA.

AHT Group AG Management and Engineering (2013) had recommended the strategies for challenges in Water Users Associations of Kyrgyzstan like to improve main and inter-farm system and on-farm system operation and maintenance, to improve farm productivity, to promote increased use of fertilizers (by provision of credit), to provide training to the on extension services, water management and also to improve agricultural practices.



**Fig. 2.1. Conceptual model of the study.**

## Chapter – III

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# *Material and Methods*

## **CHAPTER III**

# **MATERIAL AND METHODS**

The contents of this chapter deals with the research methods, sampling procedure, variables and their measurements, statistical tests and analytical procedures followed to satisfy the requirements of the objectives of the present study. The details of the methodology followed in this study were presented with the following sub-heads.

- 3.1 Research design
- 3.2 Sampling procedure
- 3.3 Variables and their measurements
- 3.4 Functions of Project Committee, Distributory Committee and Water Users Associations
- 3.5 SWOC analysis of Water Users Associations
- 3.6 Collection of data
- 3.7 Statistical tools used for data interpretation
- 3.8 Hypothesis

### **3.1 RESEARCH DESIGN**

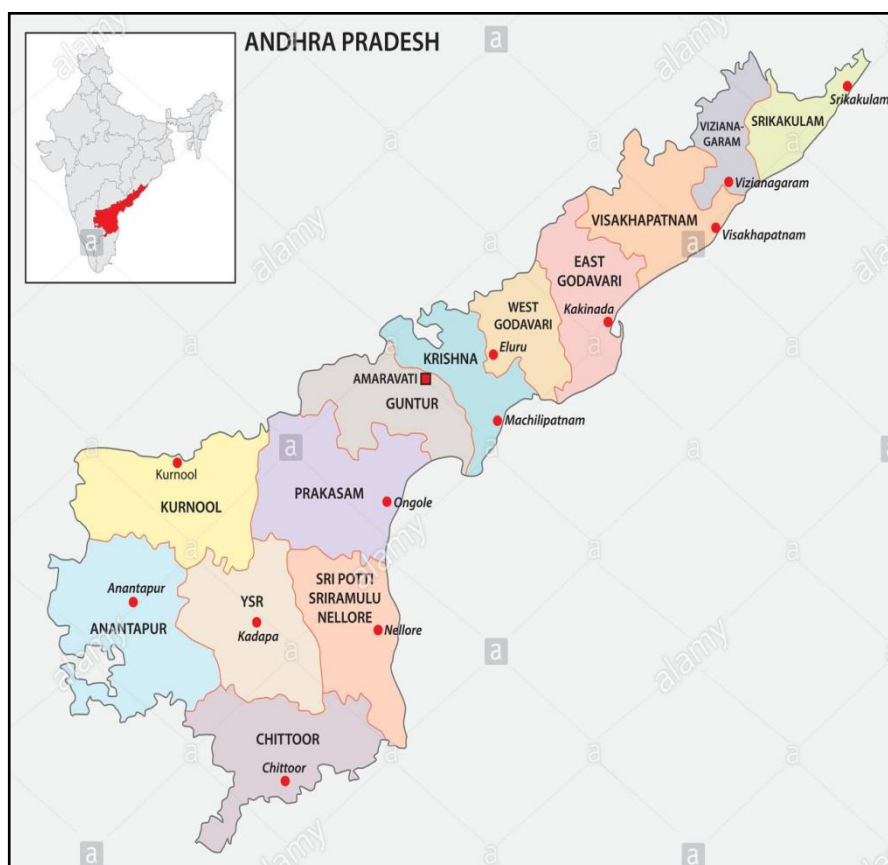
Research design is the process of planning and carrying out research. It is the most important and critical aspect of research methodology. The research design followed in the present study was Ex-post facto design.

Ex-post facto research design is a systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made, with out direct intervention, from concomitant variation of independent and dependent variables.

## 3.2 SAMPLING PROCEDURE

### 3.2.1 Locale of the study

The state, Andhra Pradesh was chosen purposively as the researcher belonged to this state and well acquainted with the regional language i.e., Telugu which would help to build a good rapport with the respondents and also facilitates in depth study through personal observation and interview. The map showing Andhra Pradesh was presented in Fig. 3.1.

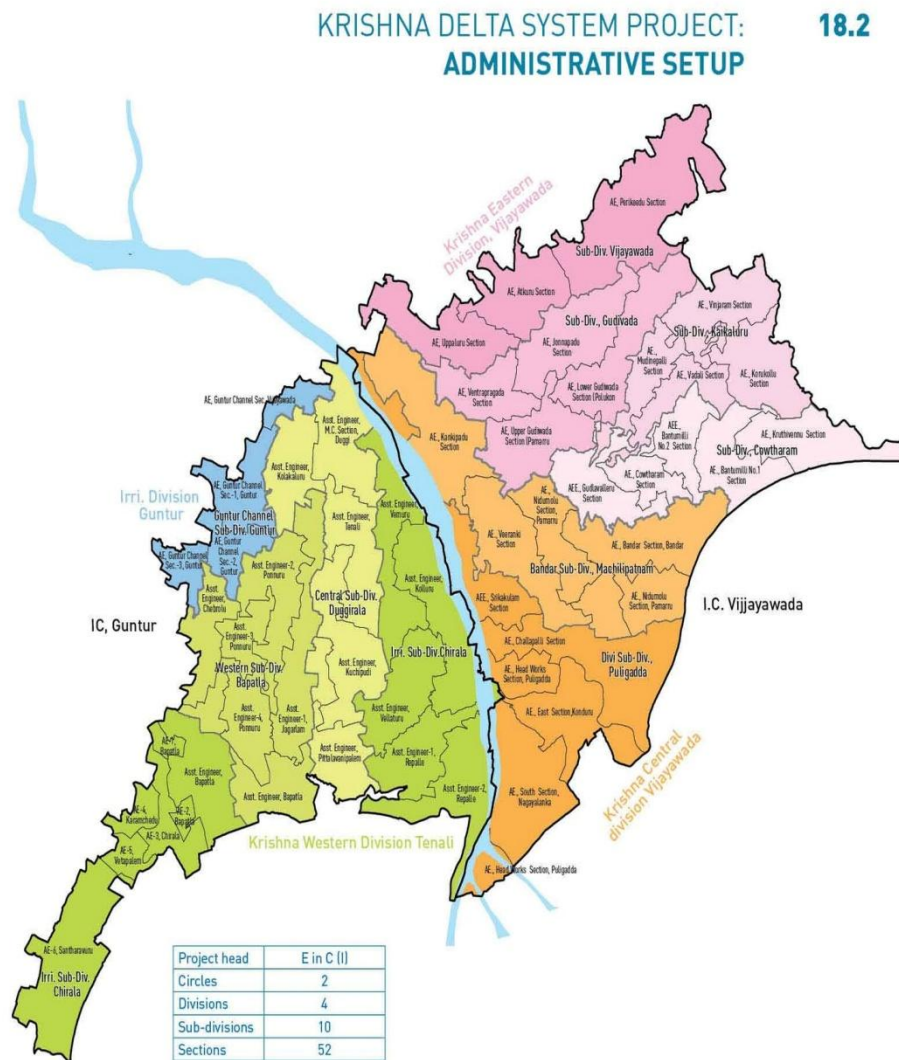


**Fig. 3.1. Map of Andhra Pradesh.**

### 3.2.2 Selection of delta

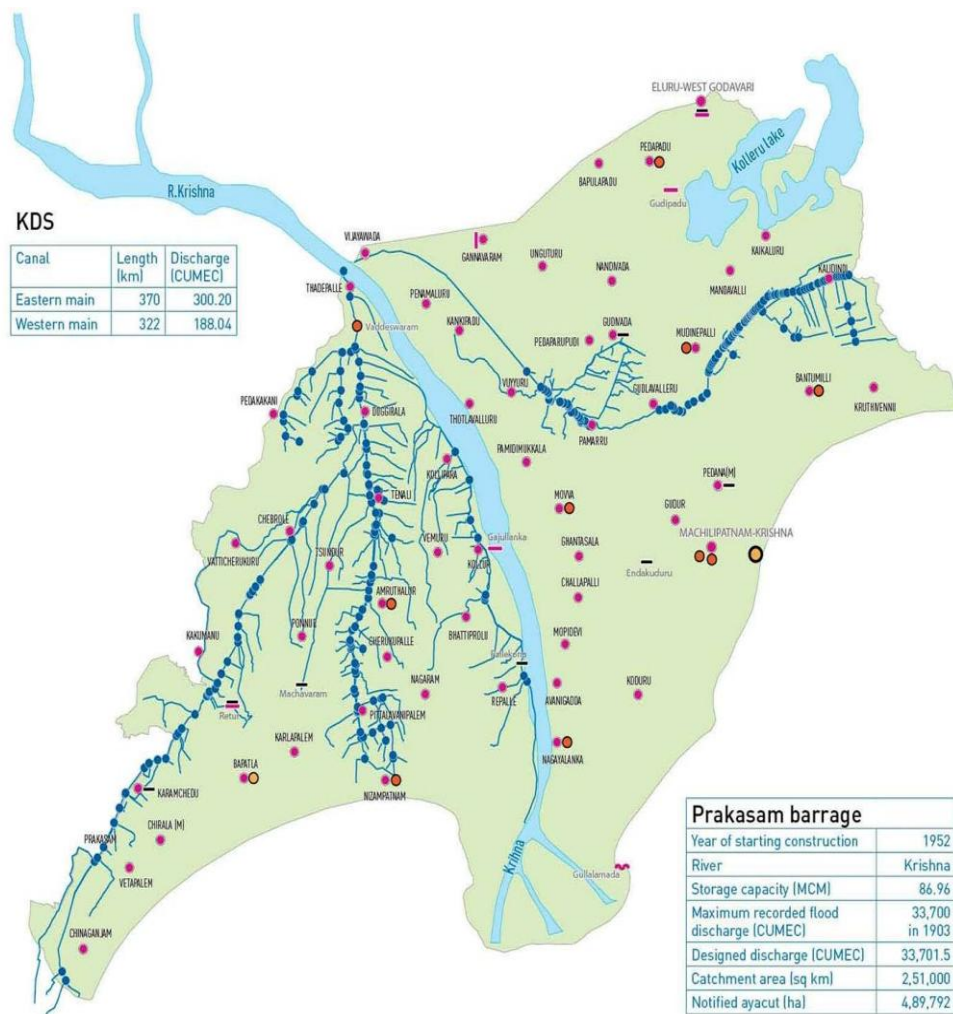
Krishna Delta region was purposively selected because it is the major delta contributing a large portion of the food production of the state. The delta area is located in four districts of the state namely Krishna, West Godavari, Guntur and Prakasam. The Krishna Delta region is mainly separated into Krishna Eastern Delta which includes parts of Krishna district and few parts in

West Godavari district and the other is Krishna Western Delta includes parts of Guntur district and few parts of Prakasam district. The map showing Krishna delta system and canal networking and monitoring is presented in Fig. 3.2 and 3.3 respectively.



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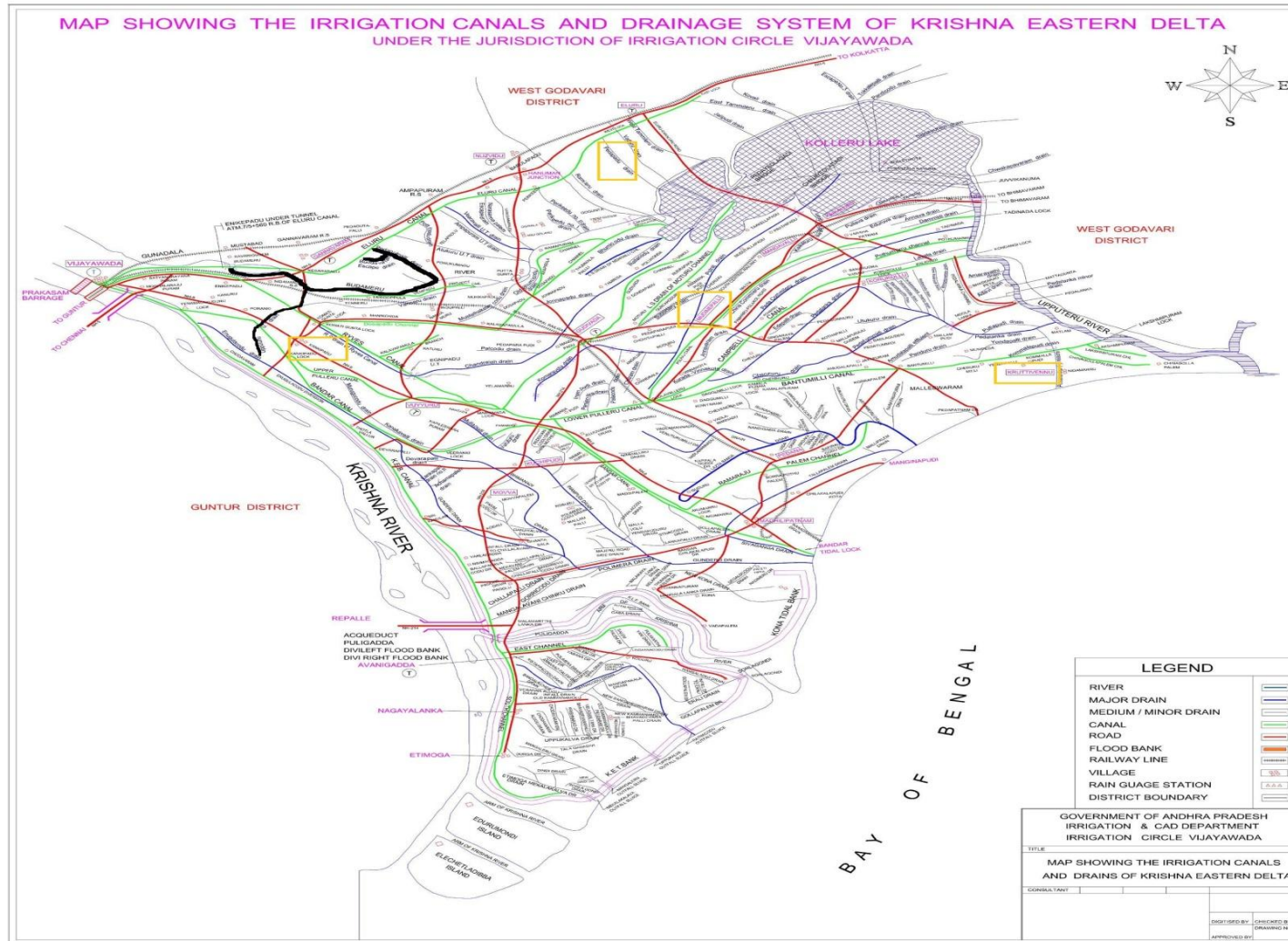
**Fig. 3.2. Map of Krishna Delta System.**



**Fig. 3.3. Map of canal network and flow monitoring of Krishna Delta System.**

### 3.2.3 Selection of Project Committee (PC)

There are two project committees in the Krishna delta region each located in Krishna Eastern and Western Delta respectively. Each project committee is headed by a Project Chairman. The project committee for Krishna Eastern Delta is located in Vijayawada of Krishna district and for existing Krishna Western Delta the project committee is situated in Tenali of Guntur district. These two project committees were selected for the study. The map showing Krishna eastern delta and Krishna western delta were presented in fig. 3.4 and 3.5 respectively.



**Fig. 3.4. Map of Krishna Eastern Delta.**

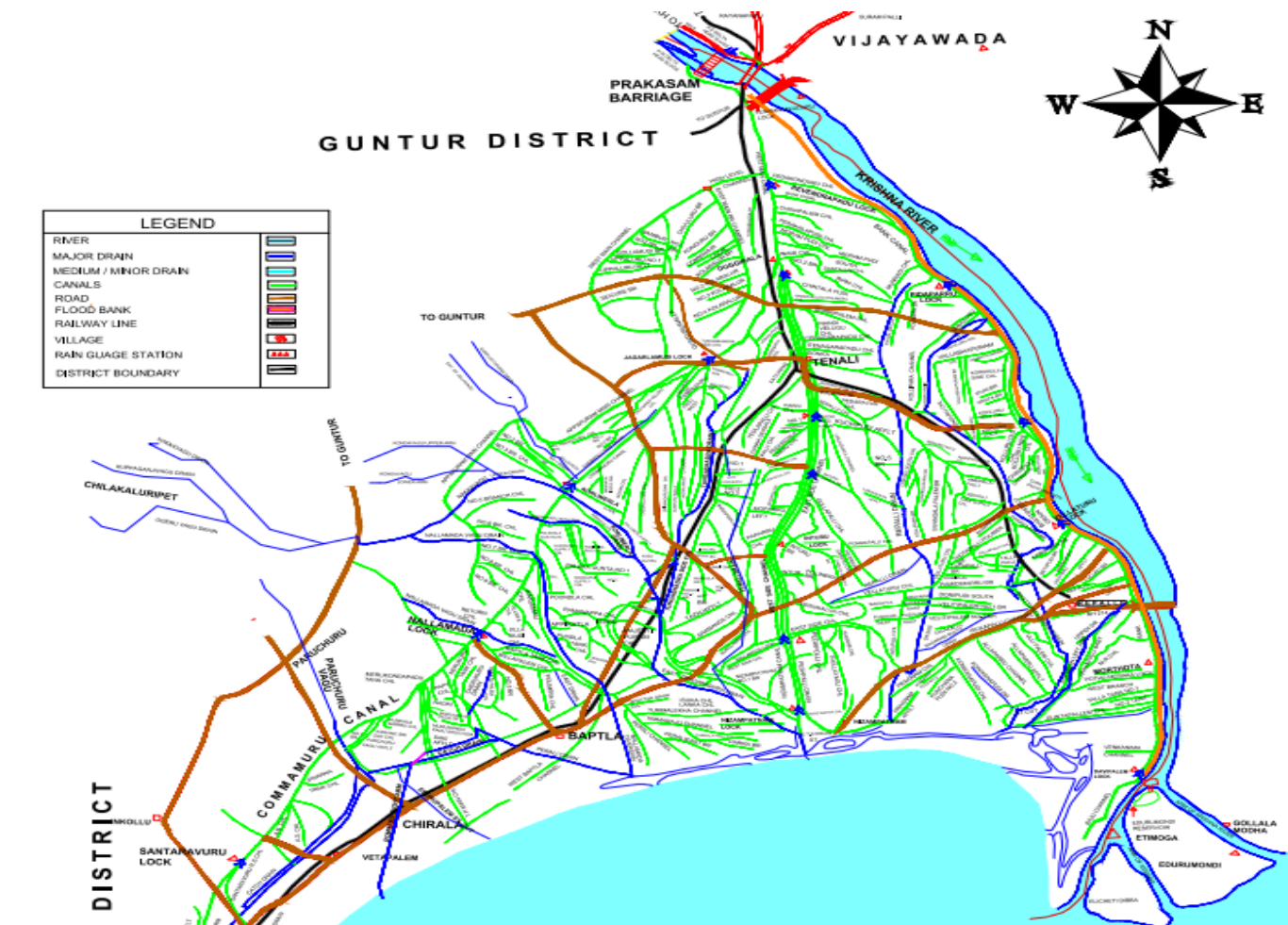


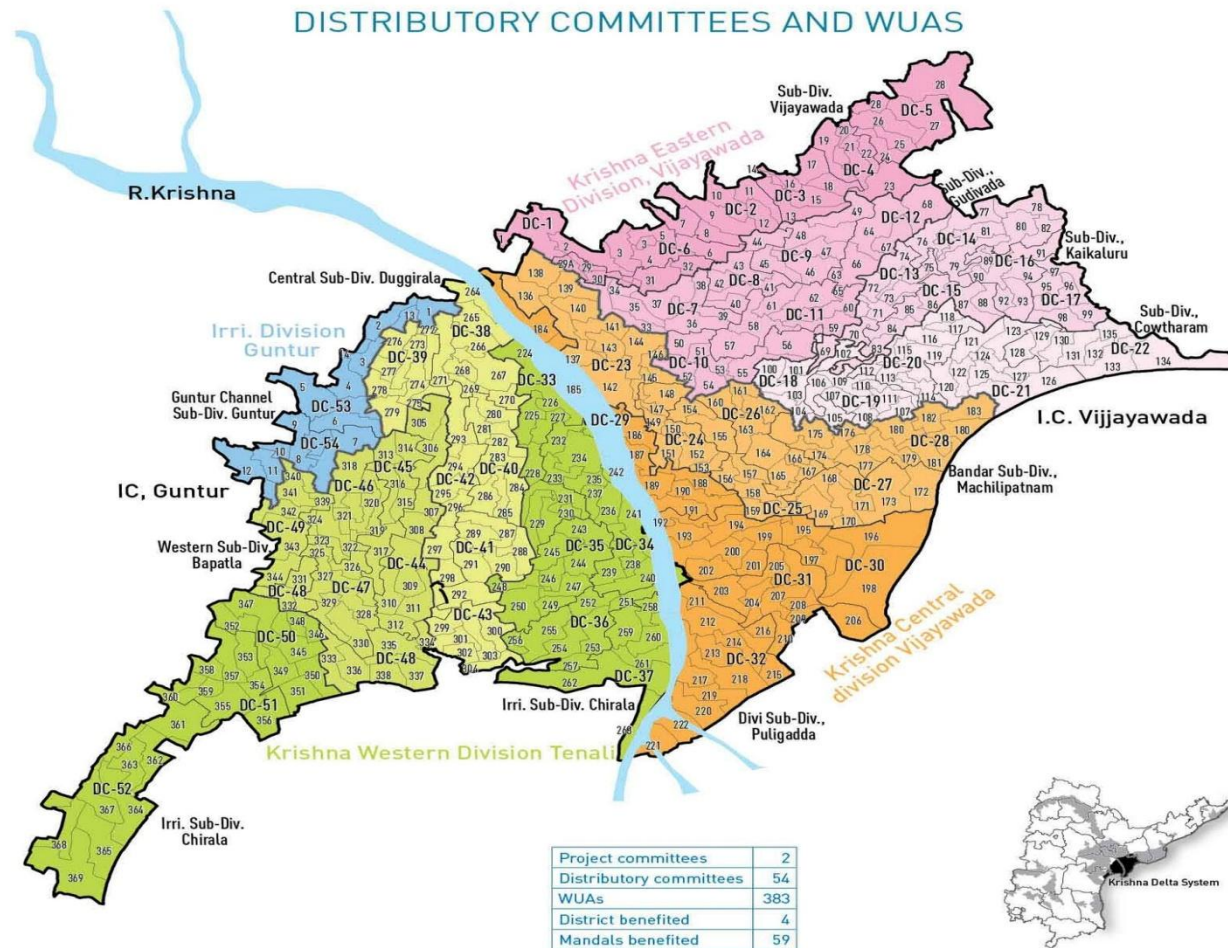
Fig. 3.5 Map of Krishna Western Delta.

### **3.2.4 Selection of Distributory Committee (DC)**

A total of 54 distributory committees are there in Krishna delta region in which 32 distributory committees are in Krishna Eastern Delta and 22 are in Krishna Western Delta. Out of which four distributory committees from Krishna Eastern and three distributory committees from Krishna Western Delta were selected on proportionate random basis.

### **3.2.5 Selection of Water Users Associations (WUA)**

Both Krishna eastern and western delta consist of 382 water users associations in which 222 are from Eastern delta and 160 are from Western delta. A total of 41 water users associations were selected through proportionate random sampling method for the present study. In that 23 water users associations were from Krishna eastern delta (20 in Krishna and 3 in West Godavari district respectively) and 18 water users associations from Krishna western delta (15 in Guntur and 3 in Prakasam district respectively). The map showing DC and WUAs of Krishna delta were presented in fig. 3.6.



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**Fig. 3.6. Map showing Distributory Committees and Water Users Associations.**

### 3.2.6 Selection of respondents

A total of 240 functionaries of Water Users Associations were selected through proportionate random sampling method from both Krishna Eastern Delta and Krishna Western Delta. Each Water Users Association is formed by six members *i.e.*, a president, vice-president and four members. So that 138 respondents were from Eastern Delta and the remaining 102 respondents were from Western Delta. Along with the functionaries of Water Users Associations, 40 officials from Irrigation Department were also selected proportionately from Krishna delta region.

**Table 3.1. Particulars of the sampling procedure**

Delta system	Krishna delta		Total	Selected sample size
	Eastern delta	Western delta		
Project Committee	1	1	2	2
Distributory Committee	32	22	54	7
Water Users Associations	222	160	382	41
Respondents selcted	138	102	240	

**Table 3.2. Particulars of the delta, Project Committee (PC), Distributory Committee (DC) and Water Users Associations (WUA) selected**

Delta System	Project Committee	Distributory Committee	Water Users Associations	No of respondents selected	
Krishna Delta System	Krishna Eastern Delta	Vijayawada	Denduluru	Chataparru	5
				Dunduluru	6
				Palagudem	6
			Kankipadu	Edupugallu	6
				Godavarru	6
				Gurazada	6
				Kolavennu	5
				Kunderu	6
				Pedaogirala	6
				Poranki	6
		Vanukuru		6	
		Vuyyuru		6	
		Mudinepalli		Dakaram	6
			Gannavaram	4	
			Guraja	6	
			Konkollu	6	
			Lingala	6	
			Vinnakota	5	
		Kruthivennu	Garisipudi	6	
			Kommalapudi	6	
	Lakshmipuram		6		
	Munipeda		6		
	Pendurru		6		
	Krishna Western Delta	Tenali	Duggirala	Chivuluru	6
				Duggirala	6
				Emani	5
				Kolakaluru	6
				Namburu	6
				Pedavadlapudi	6
				Perikalapudi	6
				Tenali	6
				Thummapudi	6
				Uppalapadu	6
		Kuchipudi	Khajipalem	6	
			Nijampatnam 1	6	
			Nijampatnam 2	6	
			Rambotlavaripalem	6	
			Siripudi	6	
			Chirala	Pedaganjam 1	6
		Santharavuru		6	
		Timmasamudram		6	
		<b>2</b>	<b>7</b>	<b>41</b>	<b>240</b>

The schematic representation of sampling procedure was presented in fig. 3.7

### 3.3 VARIABLES AND THEIR MEASUREMENTS

The variables were selected based on the review of literature, in consultation with the experts and from the previous studies in the related subjects. The variables found relevant to the present investigation were included in the present study. The instruments that were used to measure variables were presented with their detailed procedure. The list of variables and their variables were given in the following table 3.3.

**Table 3.3. Variables and their empirical measurement of the study**

S. No.	Variables	Instruments used for the study
<b>Dependent variables</b>		
1	Opinion towards water users associations	Scale developed for the study
2	Direct and indirect changes	Schedule developed for the study
<b>Independent variables</b>		
1	Age	Chronological age of the respondents in completed years
2	Education	Scale developed by Venkataramaiah (1983) revised in 2002
3	Land holding	A.P. Land Reforms Act (1973)
4	Extension contact	Scale developed by Seshachar (1980) with suitable modification
5	Social participation	Scale developed by Trivedi (1963) with suitable modification
6	Source of information	Scale developed by Patil (1994) with slight modification
7	Training received	Schedule developed for the study
8	Perceived work load	Schedule developed for the study
9	Information and communication behaviour	Schedule developed for the study
10	Cropping pattern	Schedule developed for the study
11	Decision making	Schedule developed for the study
12	Innovativeness	Scale developed by Natikar (2001) with slight modification
13	Risk orientation	Scale developed by Supe (1969) with suitable modification
14	Achievement motivation	Scale developed by Hardikar (1998) with slight modification
15	Economic orientation	Schedule developed for the study
16	Management orientation	Scale developed by Samantha, (1977) with suitable modification

### **3.3.1 Measurement of dependent variables**

#### **3.3.1.1 Opinion towards water users associations**

For the purpose of the study opinion was operationalized as the feelings of the respondents towards the functioning, operation and maintenance works, water availability to their crops, implementation of warabandhi schedule and management of water system in water users associations.

The opinion of the respondents towards functioning of the water users associations was measured by the Likerts scale especially constructed to meet the objectives of the study. Likerts summated rating scale was used to construct the opinion scale because this technique has high reliability co-efficient and it gets a 4 or 5 point judgment on each item rather than mere acceptance or rejection.

#### **Methodology**

The steps in the construction of opinion scale using Likerts scale (1932) were as follows:

##### **(i) Collection and editing of items**

A total of 133 statements representing the opinion of the respondents towards the functioning of the water users associations were gathered from various sources *viz.*, literature and interaction with the experts. These statements were then edited based on the criteria suggested by Edward, L.A. (1957).

The statements representing the opinion of the respondents towards the functioning of the water users associations were administered to 30 judges. The judges were asked to indicate their relevancy for each statement on five point continuums ranging from “most relevant” to “least relevant”. The scoring pattern adopted was 5 weightage for most relevant response, 4 to relevant, 3 to undecided, 2 to less relevant and 1 to least relevant response given by the

judges. The responses were then summated and mean value is calculated for all the statements. After finding the grand mean to the total statements, then 68 statements having mean value that was more than the grand mean value were selected for further scrutiny.

Then these statements were administered to 100 respondents in the non-sample area and were asked to indicate their degree of agreement or disagreement on five point continuum. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response for favourable opinion statements. In case of unfavourable statements the scoring pattern was reverse viz., 5 weightage to strongly disagree response , 4 to disagree, 3 to undecided 2 to agree and 1 to strongly agree response and the responses were summated for all the statements. For each individual the maximum possible score on 68 statements is 340 and the minimum score is 68. The scores of the respondents were arranged in descending order and twenty five per cent of the highest and twenty five per cent of the lowest scores were taken for the item analysis. The responses were subjected to item analysis to constitute the final opinion scale.

The critical ratio i.e., t-value which is a measure of the extent to which a given statements differentiates between the high and low groups of respondents for each statement was calculated by using the formula suggested by Edwards (1957).

$$t = \frac{(\bar{X}_H - \bar{X}_L)}{\sqrt{\frac{\sum(X_H - \bar{X}_H)^2 + (X_L - \bar{X}_L)^2}{n(n-1)}}$$

$$\sum(X_H - \bar{X}_H)^2 = \left(\sum X_H^2\right) - \frac{(\sum X_H)^2}{n}$$

$$\sum(X_L - \bar{X}_L)^2 = \left(\sum X_L^2\right) - \frac{(\sum X_L)^2}{n}$$

Where

$\bar{X}_H$  = The mean score on a given statement for the high group

$\bar{X}_L$  = The mean score on a given statement for the low group

$\Sigma X_H^2$  = Sum of squares of the individual score on a given statement for high group

$\Sigma X_L^2$  = Sum of squares of the individual score on a given statement for low group

$\Sigma X_H$  = Summation of scores on a given statement for high group

$\Sigma X_L$  = Summation of scores on a given statement for low group

$n$  = Number of judges for in each group

$\Sigma$  = Summation

## **(ii) Selection statements for final scale**

After computing the t-values finally 22 statements were selected from opinion scale comprising of 19 positive and 3 negative statements. The statements with t value equal or greater than 1.75 were selected and included in the scale developed to measure the opinion of the respondents towards functioning of water users associations (**Appendix D**).

## **(iii) Reliability of the opinion scale**

According to Kerlinger (1983) “Reliability is the accuracy or precision of measuring instrument”. To know the reliability, test-retest method was followed.

## **Test and retest method**

The set of 22 statements with five point continuum which represents the opinion of the respondents towards the functioning of the water users associations was administered to fresh group of 50 respondents in the non-sample area. After a period of 15 days, the scale was again administered to the same respondents and the two sets of scores were obtained. The correlation

coefficient of the two sets worked out was 0.87 indicating that the scale was highly suitable for administration to the respondents as the scale was stable and dependable in measurement.

#### **(iv) Validity of opinion scale**

##### **Content validity**

It referred to that representativeness or sampling adequacy of the content of a measuring instrument (Kerlinger, 2008). The validity of the test depends upon fidelity with which it measures what it is expected to measure. This method was used in the present scale to determine the content validity of the scale. As the value differences for almost all statements included had a very high discrimination value, it seemed reasonable to accept the scale as a valid measure of the opinion.

#### **(v) Administration of the scale**

As the scale thus met the reliability and validity test satisfactorily indicated its ability to measure the opinion of the respondents towards the functioning of the water users associations.

The scale was administered to the respondents with five point continuum. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response for favourable opinion statements and reverse in case of unfavourable statements. The score obtained for each statement was summated to arrive the opinion score of the respondent. The score ranged from 110 (maximum) to 22 (minimum). The obtained minimum and maximum scores were 49 and 95 respectively. The respondents were grouped into less favourable, moderately favourable and highly favourable based on inclusive class interval method.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Less favourable opinion	49-64
2.	Moderately favourable opinion	65-80
3.	Highly favourable opinion	81-95

### 3.3.1.2 Direct changes

Direct changes are the results or effects of some activity that were experienced or faced by the people. A series of statements were prepared to know the impact of functioning of Water Users Associations in terms of direct changes and scores were given accordingly in the following table.

S. No.	Statement	Score
<b>1</b>	<b>Availability of sufficient irrigation water throughout the crop growth period</b>	
	All the six months	4
	3-4 months	3
	1-2 months	2
	<1 month	1
<b>2</b>	<b>Availability of sufficient quantity of water</b>	
	Full capacity	4
	50-75 %	3
	25-50 %	2
	<25 %	1
<b>3</b>	<b>Utilization of available water</b>	
	Grown two crops	3
	Grown one crop	2
	Used for aquaculture	1
<b>4</b>	<b>Employment generation during</b>	
	Cleaning of drains	4
	Repairs and rehabilitation	3
	Warabandhi schedule	2
	No employment	1
<b>5</b>	<b>Implementation of Warabandhi schedule</b>	
	Excellent	4
	Good	3
	Average	2
	Poor	1
<b>6</b>	<b>Rehabilitation of water courses/canals</b>	
	Excellent	4
	Good	3
	Average	2
	Poor	1

<b>S. No.</b>	<b>Statement</b>	<b>Score</b>
<b>7</b>	<b>Availability of irrigation water for the farmers of tail end areas</b> Full capacity 50-75 % 25-50 % <25 %	4 3 2 1
<b>8</b>	<b>Resolving water disputes</b> No disputes, everyone use water only when his turn comes During conflicts arrange meeting and settle Leave people to fight and settle on their own	3 2 1
<b>9</b>	<b>Benefit due to WUA</b> WUA jurisdiction Village level In House/Family Individual	4 3 2 1
<b>10</b>	<b>Participation of WUAs in water management</b> Excellent Good Average Poor	4 3 2 1
<b>11</b>	<b>Delegation of powers to WUAs in water management</b> Sufficient Undecided Insufficient	3 2 1
<b>12</b>	<b>Enhancement of coordination among WUAs, Irrigation and Revenue departments</b> Excellent Good Average Poor	4 3 2 1
<b>13</b>	<b>Avenue plantation along the bunds of the canal</b> Excellent Good Average Poor	4 3 2 1

Along with these statements the some other items were included in the direct changes to know the major changes that were being occurred due to the functioning of water users associations. This includes the direct changes that have been taken place before and after the functioning of WUAs and scoring pattern was given accordingly in the following table.

<b>S. No.</b>	<b>Statement</b>	<b>Before establishment of WUA (1)</b>	<b>After establishment of WUA (2)</b>
<b>1.</b>	Increased irrigated area (ac)		
<b>2.</b>	Change in cropping intensity		
<b>3.</b>	Change in cropping pattern		
	a) Paddy		
	b) Paddy + Pulses		
	c) Paddy + Maize		
	d) Sugarcane		
	e) Chillies		
<b>4.</b>	Increase in yield (in bags)		
	a) Paddy		
	b) Pulses i. Blackgram ii. Greengram		
	c) Maize		
	d) Sugarcane		
	e) Chillies		
	f) Cotton		
<b>5.</b>	Increased income (Rs.)		
<b>6.</b>	Employment generation (man days/year)		
<b>7.</b>	Increased livestock		
	a) Buffalo		
	b) Cow		
	c) Sheep		
	d) Goat		
	e) Poultry		

<b>S. No.</b>	<b>Statement</b>	<b>Before establishment of WUA (1)</b>	<b>After establishment of WUA (2)</b>
<b>8.</b>	Increased fodder availability		
	a) Area under grass		
	b) Paddy straw		
<b>9.</b>	Enhancement of area under less water used rice production technologies		
	a) System of Rice Intensification (SRI)		
	b) Mechanized System of Rice Intensification (MSRI)		
	c) Direct Sown Rice (DSR)		
	d) Drum Seeding		
	e) Conventional method		

The possible score ranged from 54 (maximum) to 27 (minimum). The obtained minimum and maximum scores were 27 and 53 respectively. The respondents were grouped into low, medium and high direct changes based on inclusive class interval method.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low direct changes	27-35
2.	Medium direct changes	36-44
3.	High direct changes	45-53

### **3.3.1.3 Indirect changes**

The indirect changes usually occur as a result of direct changes. A series of items were prepared to know the impact of functioning of WUAs in terms of indirect changes. The items include increased credit needs, enhancement of land values and availability of water, increased wage rates, reduction in cost of cultivation, change in economic status and social life, decrease in migration of farmers, increased education standards of children and assets, improved communication behaviour, development of self respect, autonomy in decision making, less water theft, increased personal empowerment, knowledge on water

use efficiency, improved mechanization and land use pattern, conjunctive use of canal water, ground water and drain water, change in knowledge, attitude and skill, decline in water quality, increased migration of birds, rise in ground water levels and increased fish/aquaculture. The scoring pattern adopted was 3 for agree, 2 for undecided and 1 for disagree.

<b>S. No.</b>	<b>Category</b>	<b>Score Range</b>
1.	Low indirect changes	44-52
2.	Medium indirect changes	53-61
3.	High indirect changes	62-70

The score ranged from 78 (maximum) to 26 (minimum). The obtained minimum and maximum scores were 44 and 70 respectively. The respondents were grouped into low medium and high indirect changes based on inclusive class interval method.

### **3.3.2 Measurement of independent variables**

#### **3.3.2.1 Age**

Age was operationalised as the number of completed years of the respondents at the time of enquiry and the chronological age was taken as measure. The age has been categorized into three groups namely young, middle and old as adopted by Government of Andhra Pradesh (2014). The actual age was taken as individual score. The number of respondents falling under each category worked out through frequency and Percentage.

<b>S. No.</b>	<b>Category</b>	<b>Age</b>	<b>Score</b>
1.	Young age	Up to 35 years	1
2.	Middle age	36-58years	2
3.	Old age	More than 58 years	3

### 3.3.2.2. Education

Education was operationalised as the level of literacy possessed by the respondent. The scores were assigned to calculate education level of respondent by adopting scale developed by Venkataramaiah (1983) revised in 2002.

The sub items were no schooling (illiterate), primary school referred to formal schooling up to fifth standard, middle school referred to sixth to seventh standard, high school meant the education from eighth to tenth standard, intermediate referred to plus two standard, graduation meant to degree and post graduation referred to above under graduation.

S. No.	Education	Score
1.	No schooling (illiterate)	1
2.	Primary school (1-5)	2
3.	Middle school (6-7)	3
4.	High school (8-10)	4
5.	Intermediate	5
6.	Graduation	6
7.	Post graduation	7

The maximum and minimum score of each respondent was 7 and 1, respectively. The number of respondents falling under each category worked out through frequency and Percentage.

### 3.3.2.3 Landholding

The land holding has been operationalised as the number of standard hectares of land possessed by the respondent at the time of enquiry. The respondents were grouped into different categories based A.P. Land reforms Act (1973).

The minimum and maximum score was 1 and 5, respectively. To calculate the individual respondents land holding, the scoring pattern adopted was as given below. The number of respondents falling under each category worked out through frequency and Percentage.

<b>S. No.</b>	<b>Category</b>	<b>Score</b>
1.	Marginal (below 1.0 ha)	1
2.	Small (1.1 to 2.0 ha)	2
3.	Semi medium (2.1 to 4.0 ha)	3
4.	Medium (4.1 to 10.0 ha)	4
5.	Large (above 10.0 ha)	5

#### **3.3.2.4 Extension contact**

Extension contact was operationalised as the degree to which an individual contact the extension persons or agencies for getting information on various aspects of irrigation and agriculture.

Scale developed by Seshachar (1980) was used with suitable modifications. The modified scale in appendix-A includes 14 sub items to study the frequency of extension contact. This variable was measured in terms of frequency of contacts the individual maintained with the change agent and these were measured on three point continuum i.e., 3 for frequently, 2 for occasionally and 1 for rarely as in the following table.

The maximum and minimum scores of each respondent were 42 and 14, respectively. The minimum and maximum scores obtained were 16 and 41 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

S. No.	Source	Frequency of contact		
		Frequently (3)	Occasionally (2)	Rarely (1)
1.	WUA Member			
2.	WUA Vice-President			
3.	WUA President			
4.	Distributor Committee Chairman			
5.	Project Committee Chairman			
6.	Lasker			
7.	Assistant Engineer (AE)			
8.	Assistant Executive Engineer (AEE)			
9.	Deputy Executive Engineer (DEE)			
10.	Executive Engineer (EE)			
11.	Superintendent Engineer (SE)			
12.	MPEO/AEO/MAO/ADA			
13.	Scientists of ANGRAU			
14.	Political leaders (MLA)			

S. No.	Category	Class interval
1.	Low extension contact	16-23
2.	Medium extension contact	24-32
3.	High extension contact	33-41

### 3.3.2.5 Social participation

Social participation was operationally defined as the degree of involvement of the respondents in formal organizations like government, private, NGOs or any other organizations as a member or office bearer in one or more organizations.

Scale developed by Trivedi (1963) with suitable modifications was used to study the social participation of the respondents. The social participation was studied in two ways *viz.*, membership and extent of participation. Membership

was measured in terms of member and non-member with scores 2 and 1 respectively in appendix-A. Extent of participation was studied in terms of regular, occasional and never with scores 3, 2 and 1 respectively.

The maximum and minimum scores of each respondent for social participation were 5 and 2 respectively. The minimum and maximum scores obtained were 3 and 5 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low social participation	3.0-3.9
2.	Medium social participation	4.0-4.9
3.	High social participation	5.0-5.9

### **3.3.2.6 Source of information**

The Source of information refers to the source through which the respondents obtain up to date information regarding water source and availability. The extent of use of information sources was measured by taking into three different accounts of sources *viz.*, personal localite, personal cosmopolite and impersonal cosmopolite in appendix-A. These three sources were further categorized into sub items. The respondents were asked as how often they got needed information from each source.

The scale developed by Patil (1994) with slight modifications was used to analyze the frequency of getting information by the respondents. The scoring procedure used was most often-4, often-3, sometimes-2 and never-1.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low source of information	12-16
2.	Medium source of information	17-21
3.	High source of information	22-26

The maximum and minimum score an individual could obtain was 40 and 10 respectively. The minimum and maximum scores obtained were 12 and 26 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

### **3.3.2.7 Training received**

Training received was operationalized as the nature and number of training programmes or meetings related to water users associations was received or attended by the respondents.

<b>S. No.</b>	<b>Training</b>	<b>Score</b>
1	No training	0
2	1 training	1
3	2 trainings	2
4	3 trainings	3
5	4 trainings	4
6	5 trainings	5

The training programmes or meetings were conducted by the irrigation department or the meetings were held among the members of water users associations. The schedule was developed for the study and the list of items included was as follows.

The scoring pattern followed was 0 for no training received, 1, 2, 3, 4 and 5 to the number of training programmes or meetings attended by the respondents accordingly. The maximum and minimum score an individual could obtain was 5 and 0 respectively. The number of respondents falling under each category worked out through frequency and Percentage.

### **3.3.2.8 Perceived work load**

It was operationilised as the degree to which respondents have comprehend the nature and quantum of work and its relation to the quality of their performance. The schedule was developed with six statements under this variable with three positive and three negative statements with five point continuum in appendix-A.

The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low perceived workload	8-14
2.	Medium perceived workload	15-21
3.	High perceived workload	22-28

The maximum and minimum score could be 30 and 6 respectively. The minimum and maximum scores obtained were 8 and 28 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

### **3.3.2.9 Information and communication behaviour**

For the purpose of operationalization, the concept of information and communication behaviour was segregated into three main components namely information input behaviour, information processing behaviour and information output/disseminating behaviour. Each component was further categorized into sub components. Information input behaviour was categorized into Personal localite sources, Personal cosmopolite sources and Impersonal cosmopolite sources. Under each sub component different items related to information input behaviour were included. The scoring pattern followed was frequently-3, sometimes-2 and never-1 in appendix-A. Information processing behaviour was again divided into sub components which include Information Evaluation Behaviour, Information Storage Behaviour which followed the scoring pattern followed as Yes-2, No-1. The other sub components were Information Utilization Behaviour and Information Transformation Behaviour. Each sub component included different items related to information processing behaviour. The scoring procedure followed was regularly-3, occasionally-2 and never-1. Similarly information output/disseminating behaviour also further included different items which represent the method of disseminating information to the respondents. The scoring procedure followed was regularly-3, occasionally-2 and never-1.

<b>.S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low information and communication behaviour	97-124
2.	Medium information and communication behaviour	125-151
3.	High information and communication behaviour	152-180

The maximum and minimum possible scores an individual could obtain were 229 and 84 respectively. The minimum and maximum scores obtained were 97 and 180 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

### **3.3.2.10 Cropping pattern**

The cropping pattern refers to the proportion of area under different crops at a particular period of time. The schedule was developed for the cropping pattern according to the crops grown and source of irrigation practiced by the respondents. The scoring procedure was followed accordingly to the number of crops grown by the respondent or for the aquaculture practiced as canal-2 and canal + pumpset-1.

<b>S. No.</b>	<b>Season</b>	<b>Crop/ Aquaculture</b>	<b>Area cultivated (ha)</b>	<b>Method of irrigation practiced</b>	
				<b>Canal (2)</b>	<b>Canal + Pumpset (1)</b>
1.	Kharif				
2.	Rabi				
3.	Summer				

The maximum and minimum score obtained could be 2 and 1 for each crop grown or aquaculture in appendix-A. The number of respondents falling under each category worked out through frequency and Percentage.

### **3.3.2.11 Decision making**

It is operationally defined as the ability of respondent to select a course of action among the several alternative scenarios. The schedule was developed with six statements under this variable with three positive and three negative

statements with five point continuum. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements in appendix-A.

The maximum and minimum score could be 30 and 6 respectively. The minimum and maximum scores obtained were 14 and 28 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low decision making	14-18
2.	Medium decision making	19-23
3.	High decision making	24-28

### **3.3.2.12 Innovativeness**

Innovativeness was operationalized as the degree to which an individual adopted new ideas relatively earlier than other members of the social system. Innovativeness was studied to know the extent the extent to which an individual has acquired awareness of the need to be innovative. The scale developed by Natikar (2001) with slight modification was used to collect data. The scale consists of eight statements with three negative statements with five point continuum in appendix-A. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low innovativeness (18-24)	18-24
2.	Medium innovativeness (25-31)	25-31
3.	High innovativeness (32-38)	32-38

The maximum and minimum score could be 40 and 8 respectively. The minimum and maximum scores obtained were 18 and 38 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

### **3.3.2.13 Risk orientation**

Risk orientation was operationalised as the degree to which the respondents were oriented towards risk and uncertainty to face the problems regarding water issues in water users association jurisdiction. It was measured with the help of scale developed by Supe (1969) with slight modifications. The scale consists of six statements with three positive and three negative statements with five point continuum in appendix-A. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements.

The maximum and minimum score could be 30 and 6 respectively. The minimum and maximum scores obtained were 12 and 29 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low risk orientation	12-17
2.	Medium risk orientation	18-23
3.	High risk orientation	24-29

### **3.3.2.14 Achievement motivation**

Achievement motivation can be defined as the desire to excel in one's endeavour regardless of social rewards. The scale developed by Hardikar (1998) was used in this study to measure this variable. The scale consists of seven statements with three positive and four negative statements with five point continuum in appendix-A. The scoring pattern adopted was 5 weightage to

strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements.

The maximum and minimum score could be 35 and 7 respectively. The minimum and maximum scores obtained were 13 and 33 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low achievement motivation	13-19
2.	Medium achievement motivation	20-26
3.	High achievement motivation	27-33

### **3.3.2.15 Economic orientation**

This variable was operationalised as the degree to which a respondent was oriented towards profit maximization in farming and the relative value placed by a water users association member on economic ends. . The schedule was developed with five statements under this variable with four positive and one negative statement with five point continuum in appendix-A. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low economic orientation	10-14
2.	Medium economic orientation	15-19
3.	High economic orientation	20-24

The maximum and minimum score could be 25 and 5 respectively. The minimum and maximum scores obtained were 10 and 24 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

### **3.3.2.16 Management orientation**

It was operationalized as the degree to which the respondent was oriented towards planning of irrigation schedule, water management, trainings or meetings record maintenance etc. The scale developed by Samantha (1977) was used with suitable modifications. The scale consists of five statements under this variable with three positive and two negative statements with five point continuum in appendix-A. The scoring pattern adopted was 5 weightage to strongly agree response, 4 to agree, 3 to undecided 2 to disagree and 1 to strongly disagree response and the scoring was reversed in case of negative statements.

<b>S. No.</b>	<b>Category</b>	<b>Class interval</b>
1.	Low management orientation	11-15
2.	Medium management orientation	16-20
3.	High management orientation	21-25

The maximum and minimum score could be 25 and 5 respectively. The minimum and maximum scores obtained were 11 and 25 respectively and respondents were grouped into low, medium and high categories based on inclusive class interval method.

### **3.4 FUNCTIONS OF PROJECT COMMITTEE, DISTRIBUTORY COMMITTEE AND WATER USERS ASSOCIATIONS**

The functions of water users associations were listed and the respondents were asked to rank the functions based on the performance of WUAs to carry out those functions. The schedule was developed for the study and the list of items included was as follows.

### 3.4.1 Functions of Project Committee

S. No.	Functions of Project Committee	Fully performed		Partially performed		Non-performed	
		F	%	F	%	F	%
1	Approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the Competent Authority						
2	Approve a plan for the maintenance of irrigation system including the major drains within its area of operation						
3	Maintain a list of the Distributory Committees and Water Users Associations in its area of operation						
4	Maintain an inventory of the Distributory and Drainage Systems in its area of operation						
5	Maintenance works with the funds of the committee from time to time and regular water budgeting						
6	Resolve disputes if any, between the Distributory Committees						
7	Promote economy in the use of water						
8	Maintain accounts, cause annual audit of its accounts, social audits and other records as may be prescribed						
9	Conduct General Body Meetings as may be prescribed						
10	Encourage avenue plantations and modernization of agriculture in its area of operation						

### 3.4.2 Functions of Distributory Committee

S. No.	Functions of Distributory Committee	Fully performed		Partially performed		Non-performed	
		F	%	F	%	F	%
1	Preparation of operational plan based on its entitlement, area, soil, cropping pattern						
2	Maintenance of both distributaries and medium drains within its area of operation						
3	Regulate the use of water among the various Water Users Associations under its area of operation and monitor the flow of water for irrigation						
4	Resolve disputes, if any, between the Water Users Associations in its area of operation						
5	Maintain a register of Water Users Associations and an inventory of the irrigation system in the area of its operation, including drains						
6	Maintenance works with the funds of the committee from time to time						
7	Promote economy in the use of water allocated						
8	Maintain accounts, cause annual audit, social audits and other records as may be prescribed						
9	Conduct General Body Meetings and abide by the decisions of the Project Committee						
10	Assist in the conduct of elections to the Managing Committee						
11	Encourage avenue plantations and modernization of agriculture in its area of operation						

### 3.4.3 Functions of water users associations

S. No.	Functions of water users associations	Fully performed (3)	Partially performed (2)	Non-performed (1)
1	Prepare and implement warabandhi schedule and regulation of water schedule			
2	Prepare a plan for maintenance of irrigation system			
3	Resolve disputes			
4	Monitor flow of water for irrigation			
5	Maintain an inventory of irrigation system, registers of landholders and co-opted members			
6	Maintain accounts, records and social audits			
7	Raise resources and promote economy in the use of water allocated			
8	Assistance in conduct of elections and managing committee			
9	Assistance to revenue department in collection of water rates			
10	Conduct general body meetings, water budgeting as prescribed			
11	Abide decisions of distributory committee and project committee			
12	Encourage avenue plantation			
13	Maintain feeder channels of minor irrigation tanks			

The scoring pattern adopted was fully performed-3, partially performed-2 and non-performed-1. The maximum and minimum score of each respondent was 39 and 13, respectively. The number of respondents falling under each category worked out through frequency and Percentage.

### **3.5 SWOC ANALYSIS OF WATER USERS ASSOCIATIONS**

SWOC analysis refers to Strengths, Weakness, Opportunities and Challenges of water users associations.

For the purpose of the study strengths can be operationalized as the internal capacity of the water users associations to withstand great force in their functioning.

Weakness can be operationalized as lack of power or the state of being weak to perform the demanding tasks by the water users associations which are an internal factor.

Opportunities can be operationalized as the external factors which make the water users associations to perform better in their functions.

Challenges can be operationalized as the external factors that are something new and difficult which requires great effort and determination by the water users associations to take up tasks in their functioning.

The respondents were asked to rank the strengths, weakness, opportunities and challenges according to their preference. For this Garrett ranking method was used to know the respondents preferences.

### **3.6 COLLECTION OF DATA**

#### **3.6.1 Method of data collection**

Keeping in view the objectives of the study a well structured interview schedule was developed for data collection. The data collection was done with the use of pre-tested interview schedule (APPENDIX-A). The schedule consists of three parts. The first part dealt with the profile characteristics of the respondents. The second part consists of opinion of respondents towards water users associations and direct and indirect changes occurred because of water users associations. The third part includes strengths, weakness, opportunities and challenges of water users associations.

### **3.6.2 Pre-testing of interview schedule**

Before going to final data collection and finalizing the interview schedule, the schedule developed was pre-tested with 12.5 per cent of the respondents from non-sampling area. Based on the experiences gained in the pre-testing, the interview schedule was modified with necessary wordings and statements. The final format of the interview schedule was enclosed in the appendices.

### **3.6.3 Data collection**

After pre-testing the interview schedule was translated to Telugu language to communicate easily with the respondents. The data were collected during the month of November, December (2018) and January (2019) by personally interviewing the respondents.

### **3.6.4 Preparation of report**

The data collected was coded, classified and tabulated in order to make the findings meaningful through the use of different statistical tools. The findings were suitably interpreted and necessary conclusions and inferences were drawn.

## **3.7 STATISTICAL TOOLS USED FOR DATA INTERPRETATION**

The statistical tools employed for the analysis and the interpretation of the data were as follows.

3.7.1 Frequency and Percentage analysis

3.7.2 Arithmetic mean and Standard Deviation

3.7.3 Class Interval Method

3.7.4 Chi-square test

3.7.5 Garrett's Ranking Method

### 3.7.1 Frequency and Percentage Analysis

In the present study the data were subjected to frequencies and used to know the distribution of the respondents according to selected variable.

Frequency refers to the number of items repeated in a variable. Percentage is used for the analysis of independent and dependent variables. For calculating Percentage the frequency of the particular cell was divided by total number of respondents of that particular cell and multiplied by 100. It is also used for making simple comparisons. Percentage was corrected to two decimal places.

### 3.7.2 Arithmetic Mean and Standard Deviation

#### 3.7.2.1 Arithmetic Mean ( $\bar{X}$ )

Arithmetic mean as defined as the sum of all the observations in the series is divided by the total number of observations (Rao, 1983). It is calculated by using the following formula:

$$\text{Arithmetic mean } (\bar{X}) = \frac{\sum xi}{n} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

Where

$\bar{X}$  = Arithmetic mean

$X_i$  = Values of  $i^{\text{th}}$  item of  $\bar{X}$

$\sum x$  = Sum of each individual item

$i$  = 1, 2, 3, ..... $n$

$n$  = Total number of beneficiaries

### 3.7.2.2 Standard Deviation (S.D)

It is positive square root of the mean of the squared observation taken from arithmetic mean as defined by Rao, (1983). It was used to find out the variation in the score in the variables. It is represented by symbol ( $\sigma$ ).

$$SD (\sigma) = \sqrt{\frac{1}{n} \left[ \sum x^2 - \frac{(\sum x)^2}{n} \right]}$$

Where

$\sigma$  = Standard Deviation

$\sum x^2$  = Sum of squares of observations

$[\sum x]^2$  = Square of sum of 'x' values

$n$  = Number of observations

### 3.7.3 Class Interval

The inclusive method of class interval was used to categorize certain variables. Class interval is difference between the upper and lower limit of a class and is calculated using the following formula.

$$C.I. = \frac{\text{Maximum score} - \text{Minimum score}}{\text{No. of classes}}$$

### 3.7.4 Chi-square test

The Chi Square statistic is commonly used for testing relationships between categorical variables. It is a non-parametric test. It measures how expectations compare to actual observed data. For analysis of the data chi-square test was carried out to know the relationship between dependent and independent variables using the Statistical Package for the Social Sciences (SPSS) software.

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where

$\Sigma$	=	Summation
$O_i$	=	Observed value
$E_i$	=	Expected value

### 3.7.5 Garrett Ranking Technique

It was used to analyze the factors that influence the strengths, weakness, opportunities and challenges of water users associations. In this technique the Percentage position is calculated by using the following formula:

$$\text{Percentage Position} = 100(R_{ij} - 0.5)/N_j$$

Where

$R_{ij}$	=	Rank given for $i^{\text{th}}$ factor by $j^{\text{th}}$ respondent
$N_j$	=	Total number of factors ranked

The Percentage positions were calculated and their corresponding Garrett values were taken for each of the rank from Garrett's ranking table. The total score and mean score for each factor has been calculated based on frequency of rank given to each factor and total number of respondents. Total score was calculated by multiplying the number of each respondent ranking each factor by their respective table values. Mean score was calculated by dividing the total score by the number of respondents. Finally the ranks were given based on highest mean score to each factor.

### 3.8 HYPOTHESIS

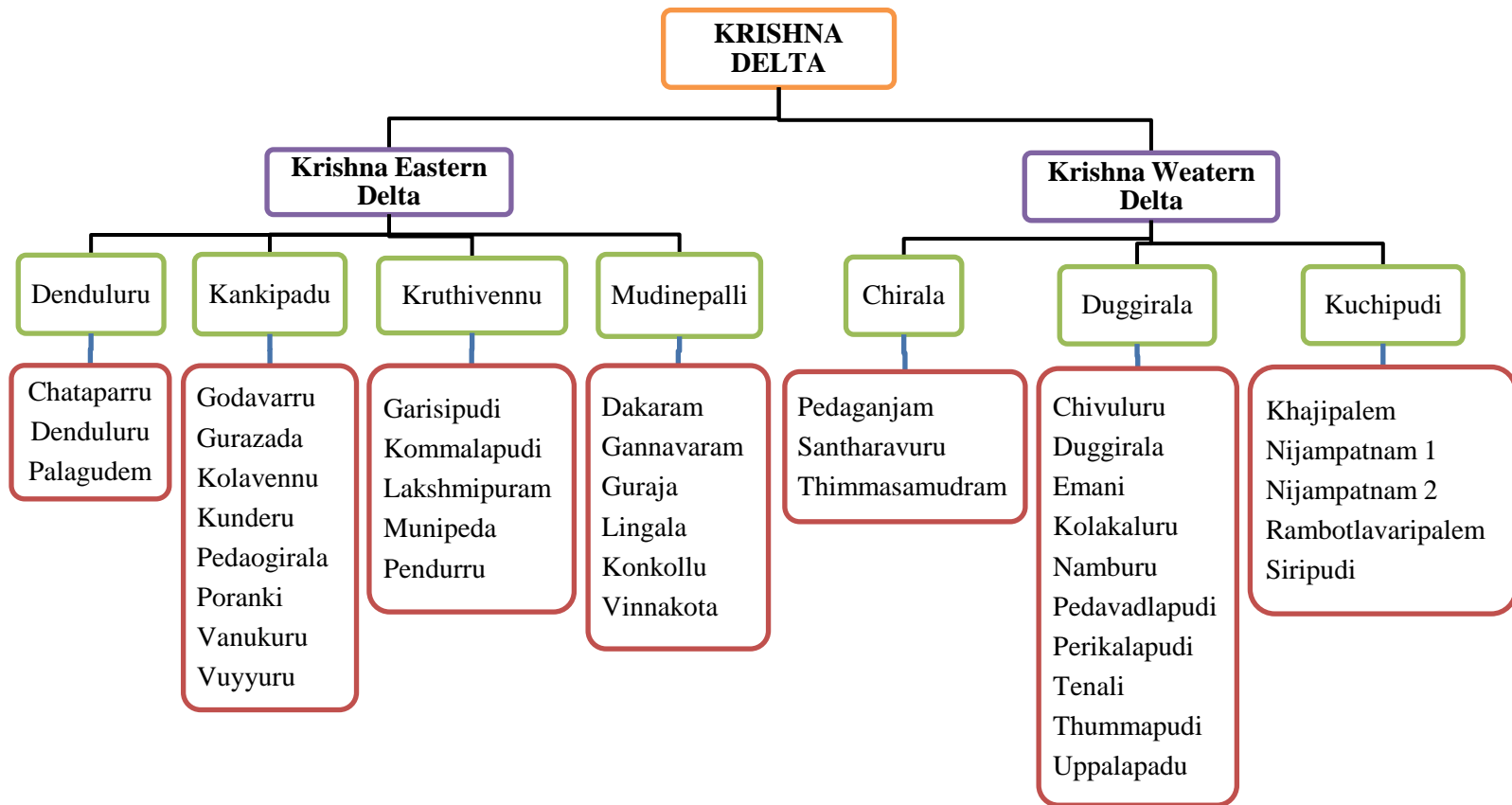
A hypothesis is a tentative statement about the relationship between two or more variables. It is a specific, testable prediction about what you expect to happen in a study. Hypothesis guides the researcher to go through the facts, select and synthesize only those that are relevant to the problem.

### **3.8.1 Null Hypothesis (H<sub>0</sub>)**

There is no relationship between profile characteristics namely age, education, land holding, extension contact, social participation, source of information, training received, perceived work load, information and communication behaviour, cropping pattern, decision making, innovativeness, risk orientation, achievement motivation, economic orientation and management orientation with opinion and direct and indirect changes occurred due to water users associations.

### **3.8.2 Empirical Hypothesis (H<sub>1</sub>)**

There is a relationship between profile characteristics namely age, education, land holding, extension contact, social participation, source of information, training received, perceived work load, information and communication behaviour, cropping pattern, decision making, innovativeness, risk orientation, achievement motivation, economic orientation and management orientation with opinion, direct and indirect changes occurred due to water users associations.



**Fig. 3.7. Schematic Representation of Sampling Procedure.**

## Chapter – IV

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### *Results and Discussion*

## CHAPTER - IV

# RESULTS AND DISCUSSION

This chapter highlights the results of an investigation. The factual data denoting empirical evidences were analyzed by using relevant statistical and mathematical tests. The findings were presented under the following sections.

- 4.1 Personal, Socio- economic and Psychological characteristics of the functionaries.
- 4.2 Functioning of the project committees, distributory committees and Water Users Associations.
- 4.3 Opinion of the functionaries towards Water Users Associations. Impact of Water Users Associations in Krishna delta in terms of direct and indirect changes.
- 4.4 Relationship between Personal, Socio- economic and Psychological characteristics of the functionaries with their opinion and direct and indirect changes.
- 4.5 Strengths, weakness, opportunities and challenges of Water Users Associations as perceived by the functionaries of Water User Association and Irrigation Department.
- 4.6 Strategies for sustainability of Water Users Associations in Krishna delta of Andhra Pradesh.
- 4.7 Empirical model of the study.

### **4.1 PERSONAL, SOCIO- ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE FUNCTIONARIES**

The functionaries of water users associations were the respondents of the study distributed into different categories as based on their selected personal, socio-economic and psychological characteristics has been presented in the following tables and interpreted through frequencies and Percentages.

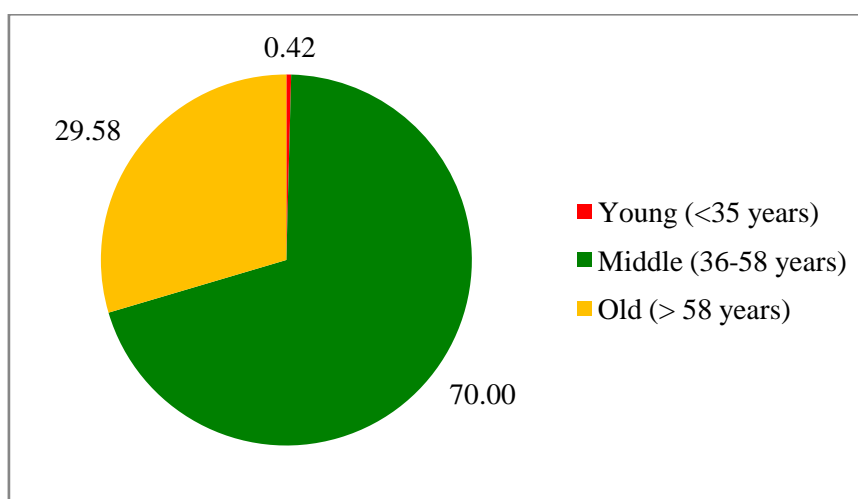
### 4.1.1 Age

Table 4.1. and fig. 4.1 indicated that 70 per cent of the respondents were found to be middle aged followed by old aged (29.58 %) and only 0.42 per cent of the respondents were under young aged category in Krishna delta area

**Table 4.1. Distribution of respondents according to their age** (n=240)

S. No.	Category	Frequency	Percentage
1.	Young age (<35 years)	1	0.42
2.	Middle age (36-58years)	168	70.00
3.	Old age (>58 years)	71	29.58
TOTAL		240	100

From the above results it could be concluded that middle aged respondents were more than old and young aged respondents. The younger generation because of their education, is getting attracted to employment opportunities. The middle aged respondents have shown more interest and enthusiasm in participating water management works of water users associations.



**Figure 4.1 Distribution of respondents according to age**

The probable reason might be that they also possess more physical vigour, more working efficiency and responsibility than old and young aged respondents. The findings were in accordance with the findings of Mini (2006), Rathode and Mandve (2012) and Reddy *et al.* (2014).

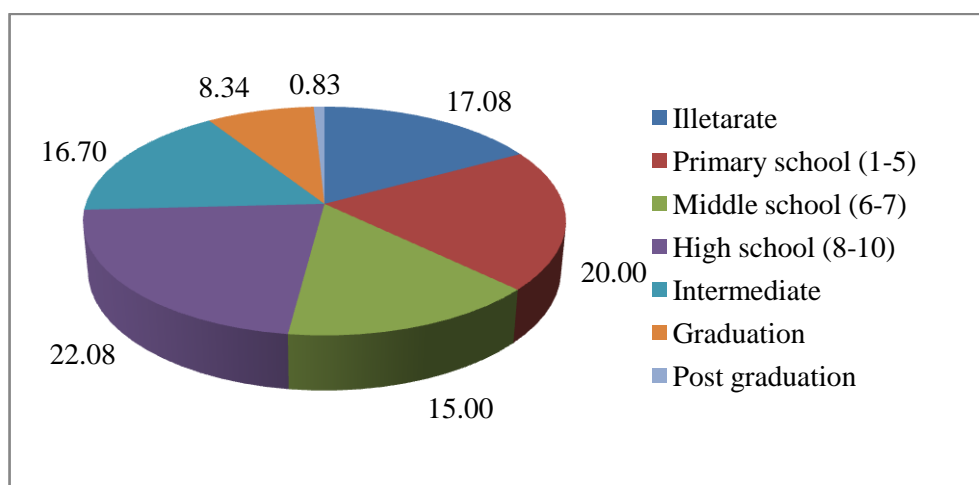
#### 4.1.2 Education

The table 4.2. indicated the education qualifications of water users associations members in Krishna delta area. Majority of the respondents possessed high school education (22.08 %) followed by those with primary school (20.00 %), illiterate (17.08 %), intermediate (16.67 %), middle school education (15.00 %), graduation (8.34 %) and post graduation education (0.83 %) in the study area.

**Table 4.2. Distribution of respondents according to their education (n=240)**

S. No.	Category	Frequency	Percentage
1	Illiterate	41	17.08
2	Primary school (1-5)	48	20.00
3	Middle school (6-7)	36	15.00
4	High school (8-10)	53	22.08
5	Intermediate	40	16.67
6	Graduation	20	8.34
7	Post graduation	2	0.83
Total		240	100

The table 4.2. and fig. 4.2 stated that, majority (22.08 %) of the respondents possessed high school education followed by those with primary school (20.00 %). This might be due to awareness among the respondents on importance of education and availability of the higher secondary schools in the study area. The illiterates were up to 17.08 per cent this might be because of lack of awareness among elders in the village about education, poor educational facilities during their childhood days. The middle school education was up to 15 per cent and the reason to discontinue their education was lack of encouragement or support from their family members. Graduation and post graduation Percentage was comparatively low and this might be due to poor economic status or the other reason might be they were engaged to look after their farming. The findings were in line with Kutty (2002), Badatya and Mohapatra (2010).



**Figure 4.2. Distribution of respondents according to education**

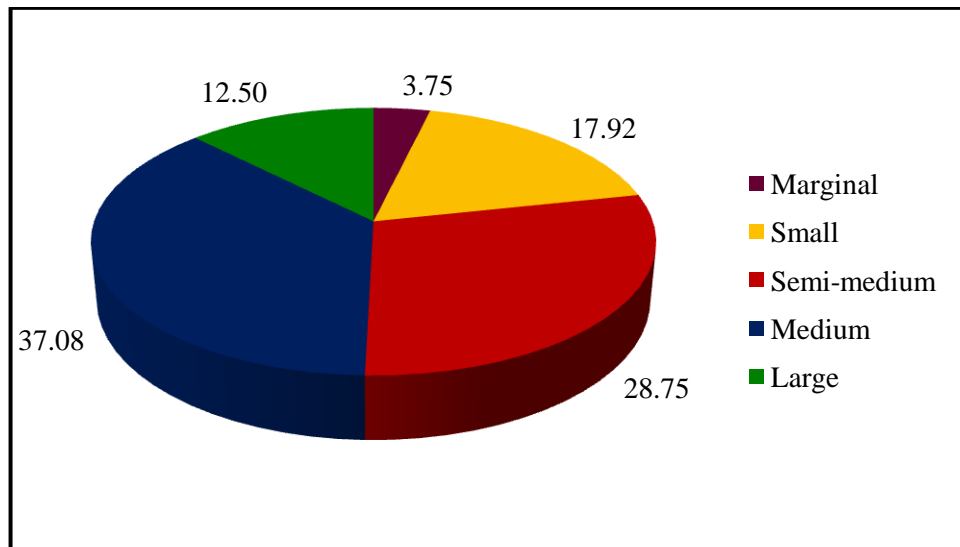
### 4.1.3 Landholding

Table 4.3 indicated the landholdings of the respondents of water users associations in Krishna delta area. Majority of the respondents had medium (37.08%) landholdings, followed by semi-medium (28.75 %), small (17.92 %) large (12.50 %) and a meagre portion of the respondents were under marginal (3.75 %) category.

**Table 4.3. Distribution of respondents according to their landholding (n=240)**

S. No.	Category	Frequency	Percentage
1	Marginal (< 1 ha)	9	03.75
2	Small (1.01-2.0 ha)	43	17.92
3	Semi-medium (2.01-4.0 ha)	69	28.75
4	Medium (4.01-10.0 ha)	89	37.08
5	Large (>10 ha)	30	12.50
TOTAL		240	100

The above table 4.3. and fig. 4.3 indicated that majority of the respondents had medium landholdings. The possible reason might be the respondents those who had agriculture as their main occupation of the family had depended on their land for their livelihood, followed by respondents with semi-medium, small landholdings.



**Figure 4.3. Distribution of respondents according to landholding**

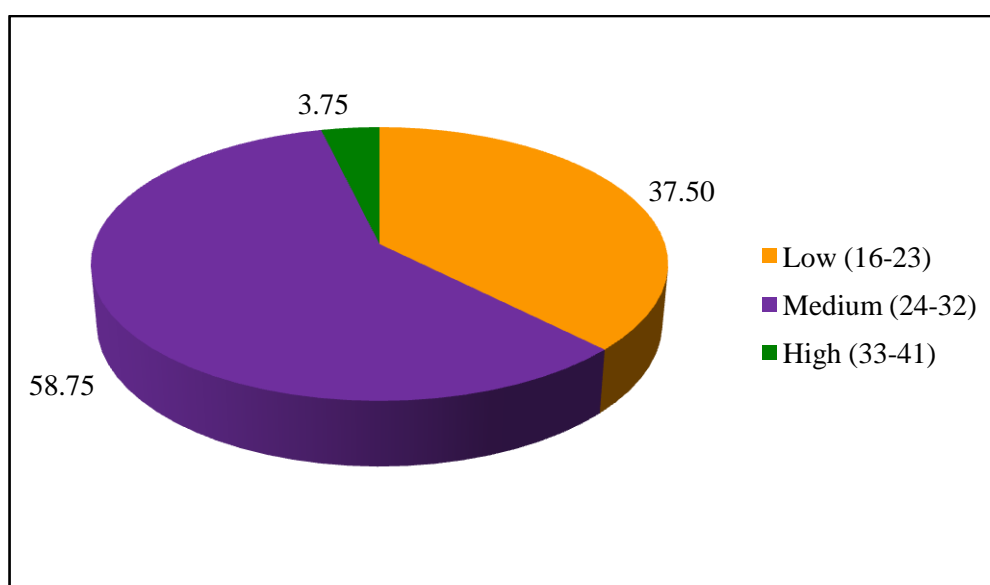
The reason could be the fragmentation of landholdings because of separation of the families. This reason also withstands for the respondents with meagre portion of marginal landholdings. About 12.50 per cent of the respondents fall under large landholdings the reason could be since they belonged to higher social status in the society and acquired the large landholdings from their ancestors. The results were in accordance with Kumar (2009).

#### **4.1.4 Extension contact**

Table 4.4. and fig. 4.4 indicated the extension contact of the respondents of water users associations in Krishna delta area. About 58.75 per cent of the respondents had medium level of extension contact, followed by low (37.50 %) and high (3.75 %) level of extension contact. The table indicated that more than half of the respondents had medium extension contact due to regular contacts maintained with the president and vice president of that particular water users association. The detailed information about extension contact of the respondents was depicted in Table 4.5

**Table 4.4. Distribution of respondents according to their extension contact (n=240)**

S. No.	Category	Frequency	Percentage
1	Low extension contact (16-23)	90	37.50
2	Medium extension contact (24-32)	141	58.75
3	High extension contact (33-41)	9	3.75
TOTAL		240	100



**Figure 4.4. Distribution of respondents according to extension contact**

From table 4.5. it could be seen that majority (74.16 %) of the beneficiaries had frequent extension contact with water users association President, followed by Vice-President (62.09 %), WUA members (62.05 %), Assistant Engineer (42.09 %), Lasker (36.66 %), Scientists of ANGRAU (17.5 %), MPEO/AEO/MAO/ADA (11.67 %), Distributory committee chairman (10.42 %), People representatives (09.53 %), Assistant Executive Engineer (08.75 %), Project committee chairman (05.83 %), Deputy Executive Engineer and Superintendent Engineer (04.17 %) and Executive Engineer (03.75 %).

**Table 4.5. Content analysis of respondents according to their extension contact (n=240)**

S. No.	Source	Frequency of contact					
		Frequently		Occasionally		Rarely	
		F	%	F	%	F	%
1.	WUA Member	150	62.5	80	33.33	10	4.17
2.	WUA Vice-President	151	62.9	81	33.75	8	3.33
3.	WUA President	178	74.16	53	33.75	9	3.33
4.	Distributory Committee Chairman	25	10.42	62	25.83	153	63.75
5.	Project Committee Chairman	14	5.83	28	11.67	198	82.5
6.	Lasker	88	36.66	101	42.09	51	21.25
7.	Assistant Engineer (AE)	101	42.09	95	39.58	44	18.33
8.	Assistant Executive Engineer (AEE)	21	8.75	36	15	183	76.25
9.	Deputy Executive Engineer (DEE)	10	4.17	9	3.75	221	92.08
10.	Executive Engineer (EE)	9	3.75	8	3.33	223	92.92
11.	Superintendent Engineer (SE)	10	4.17	31	12.91	199	82.92
12.	MPEO/AEO/ MAO/ADA	28	11.67	143	59.58	69	28.75
13.	Scientists of ANGRAU	42	17.5	98	40.83	100	41.67
14.	People representatives	23	9.53	71	29.58	146	60.84

The respondents around 59.58 per cent had occasional extension contact with MPEO/AEO/MAO/ADA, followed by Lasker (42.09 %), Scientists of ANGRAU (40.83 %), Assistant Engineer (39.58 %), WUA President and Vice-President (33.75 %), WUA members (33.33 %), People representatives (29.58 %), Distributory committee chairman (25.83 %), Assistant Executive Engineer (15.00 %), Superintendent Engineer (12.91 %), Project committee chairman (11.67 %), Deputy Executive Engineer (3.75 %) and Executive Engineer (3.33 %).

Around 92.92 per cent of the respondents were in rare contact with Executive Engineer followed by Deputy Executive Engineer (92.08 %), Superintendent Engineer (82.92 %), Project committee chairman (82.50 %), Assistant Executive Engineer (76.25 %), Distributory committee chairman (63.75 %), People representatives (60.84 %), Scientists of ANGRAU (41.67 %), MPEO/AEO/ MAO/ADA (28.75), Lasker (21.25 %), Assistant Engineer (18.33 %), WUA members (04.17 %), WUA president and Vice-President (3.33 %).

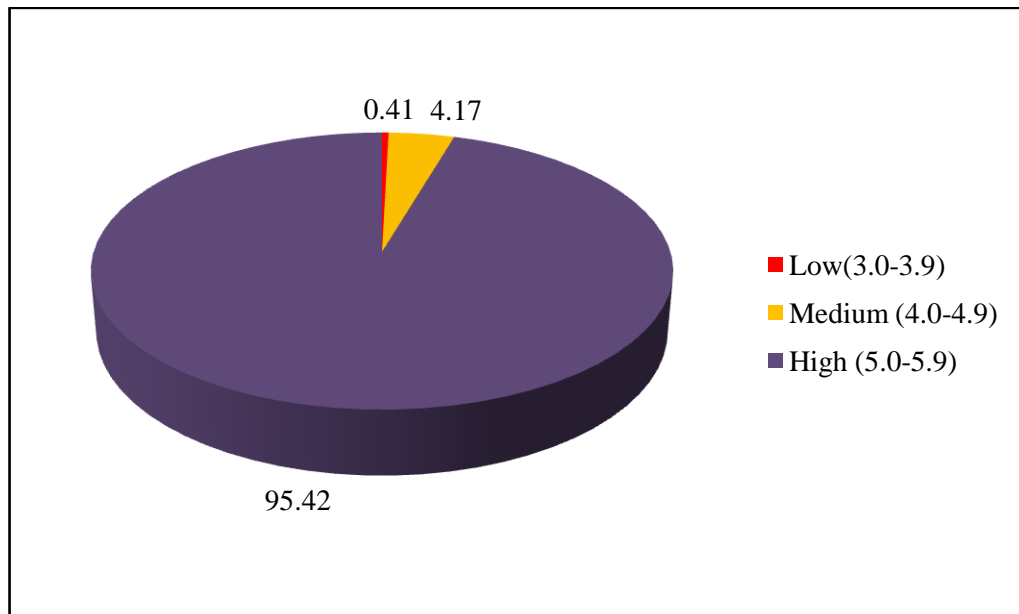
From table 4.5. we could observe that the respondents were mostly in contact with the WUA president, vice-president and members. This might be because of they were the persons who were readily available in their local area to provide the information they required. Apart from them the officials of irrigation department like Assistant Engineer and lasker were also available at the field level to provide the information they need on water availability and management. The other officials of irrigation department were rarely in contact with them since they were busy in their administration works and unavailable at the ground level to provide the required information. The results were in support of Badatya and Mohapatra (2010).

#### **4.1.5 Social participation**

Table 4.6. and fig. 4.5 stated that 95.42 per cent of the respondents had high level of social participation followed by medium (04.17 %) and low (0.41 %) level of social participation of the respondents of water users associations in Krishna delta area, this was because of the person who were the member of water users association should not have any membership in other social organization. This leads an opportunity for the members to participate in the meetings and discussions of water users associations.

**Table 4.6. Distribution of respondents according to their social participation (n=240)**

<b>S. No.</b>	<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
1	Low social participation (3.0-3.9)	1	00.41
2	Medium social participation (4.0-4.9)	10	04.17
3	High social participation (5.0-5.9)	229	95.42
<b>TOTAL</b>		<b>240</b>	<b>100</b>



**Figure 4.5. Distribution of respondents according to social participation**

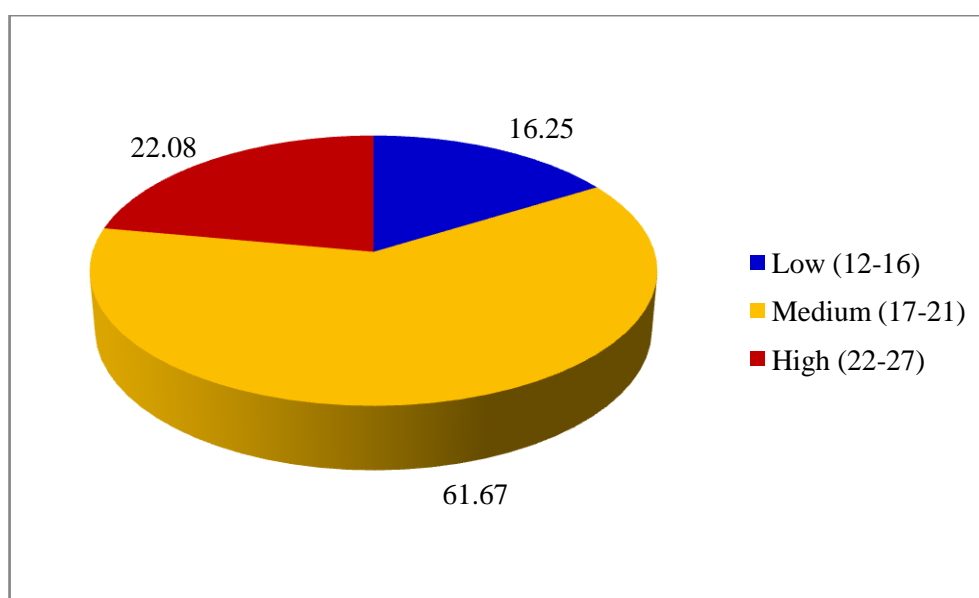
The members would participate in meetings held within the water user associations, with distributory committee chairman, project committee chairman and also with the irrigation department depending on their designation and discusses the pros and cons on water availability, planning and implementation of warabandhi schedule, equal distribution of water to head reach, middle and tail end areas, etc. The results were not in support of previous findings.

#### **4.1.6 Source of information**

The table 4.7. and fig. 4.6 resulted that about 61.67 per cent of the respondents had medium level of source of information followed by high (22.08 %) and low (16.25 %) source of information for the respondents of water users associations in Krishna delta area, this was because of the respondents mostly obtain information from local representatives of water users associations (President, Vice-President and Members) and officials of irrigation department who were available at the field level. They provide information on water releasing and closing dates to their field, funds allotment procedure for WUAs to take up the repairs and rehabilitation works of canals if any and other operation and maintenance works. The scientists of ANGRAU and department of agriculture provide information on management of available water.

**Table 4.7. Distribution of respondents according to their source of information (n=240)**

S. No.	Category	Frequency	Percentage
1	Low source of information (12-16)	39	16.25
2	Medium source of information (17-21)	148	61.67
3	High source of information (22-26)	53	22.08
TOTAL		240	100



**Figure 4.6. Distribution of respondents according to source of information**

Information was provided on efficient utilization of water, cultivation of less water used crops so as to improve agricultural productivity. Along with them trainings were organized by the officials of Andhra Pradesh Water Sector Improvement Project (APWSIP) through Farmer Training Centre on improving irrigation service delivery on sustainable basis, capacity building of water users associations, rehabilitation of irrigation infrastructure for improving irrigation efficiency, planning, development and management of water resources. The results were in accordance with Roy *et al.* (2013)

#### 4.1.7 Training received

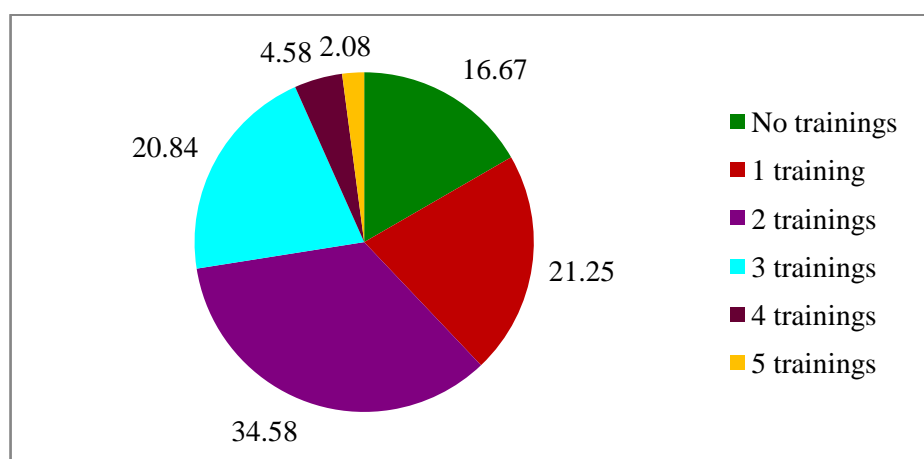
Table 4.8. revealed the trainings attended by the respondents of water users associations in Krishna delta area. Majority (34.58 %) of the respondents had attended two trainings followed by only one training (21.25 %), three (20.84 %). About 16.67 per cent of respondents had not attended any trainings, only 4.58 per cent attended four trainings and nearly 2.08 per cent of the respondents had attended five trainings.

Table 4.8. and fig. 4.7 indicated that majority of the respondents attended two trainings. This might be due to less involvement of water users associations members in the regular trainings. These meetings or trainings were held within the water users associations or with the Irrigation Department officials. Mostly the Presidents and Vice-President would attend the trainings to discuss the issues on water management.

**Table 4.8. Distribution of respondents according to their training received (n=240)**

S. No.	training	Frequency	Percentage
1	No training	40	16.67
2	1 training	51	21.25
3	2 trainings	83	34.58
4	3 trainings	50	20.84
5	4 trainings	11	4.58
6	5 trainings	5	2.08
TOTAL		240	100

Some of the respondents had not attended any training and the reason would be the trainings were not conducted during their convenient time. Only few people had attended up to 4-5 trainings. The reason could be the presidents of WUAs, chairman of DCs and PCs would attend the trainings whenever held with their higher officials. The findings were in line with the findings of Krishna (2001) and Badatya and Mohapatra (2010).



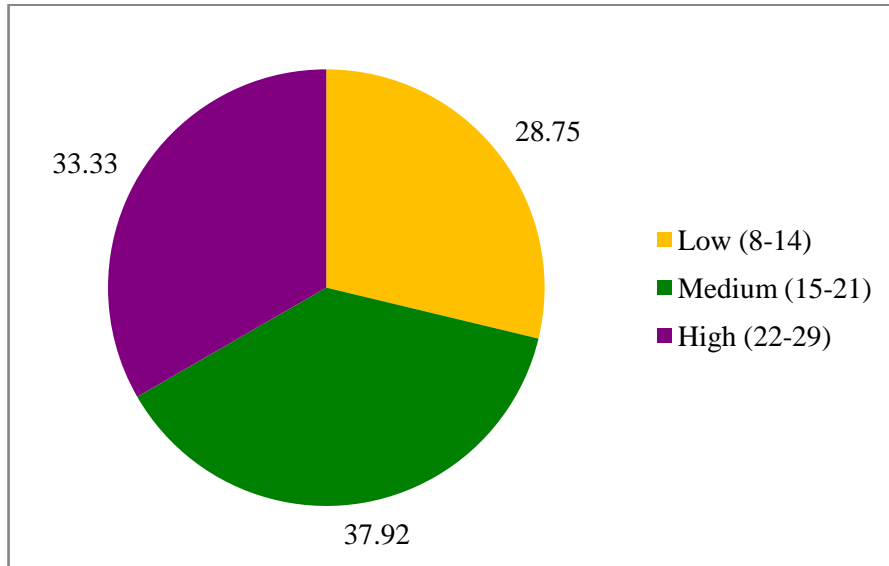
**Figure 4.7. Distribution of respondents according to training received**

#### 4.1.8 Perceived workload

Table 4.9. and fig. 4.8 indicated that, 37.92 per cent of the respondents had medium level of perceived workload, followed by high (33.33 %) and low (28.75 %) level of perceived workload of the respondents of water users associations in Krishna delta area. From table 4.9 it was indicated that majority of the respondents had medium perceived workload. The possible reason could be the workload would be mainly in the summer season and before the arrival of water into canals and channels. The Presidents or Vice-Presidents would involve in maintenance of canal works like removal of aquatic weeds by spraying herbicides, removal of wastage from canals and channels, repairs and rehabilitation works of canals if any, desilting of canals etc.

**Table 4.9. Distribution of respondents according to their perceived workload (n=240)**

S. No.	Category	Frequency	Percentage
1	Low perceived workload (8-14)	69	28.75
2	Medium perceived workload (15-21)	91	37.92
3	High perceived workload (22-28)	80	33.33
TOTAL		240	100



**Figure 4.8. Distribution of respondents according to perceived workload**

These works were done through labours and contractors. Since the work is for only 2-3 months the workload was not much heavy for the water users associations. The results were not in support of previous findings.

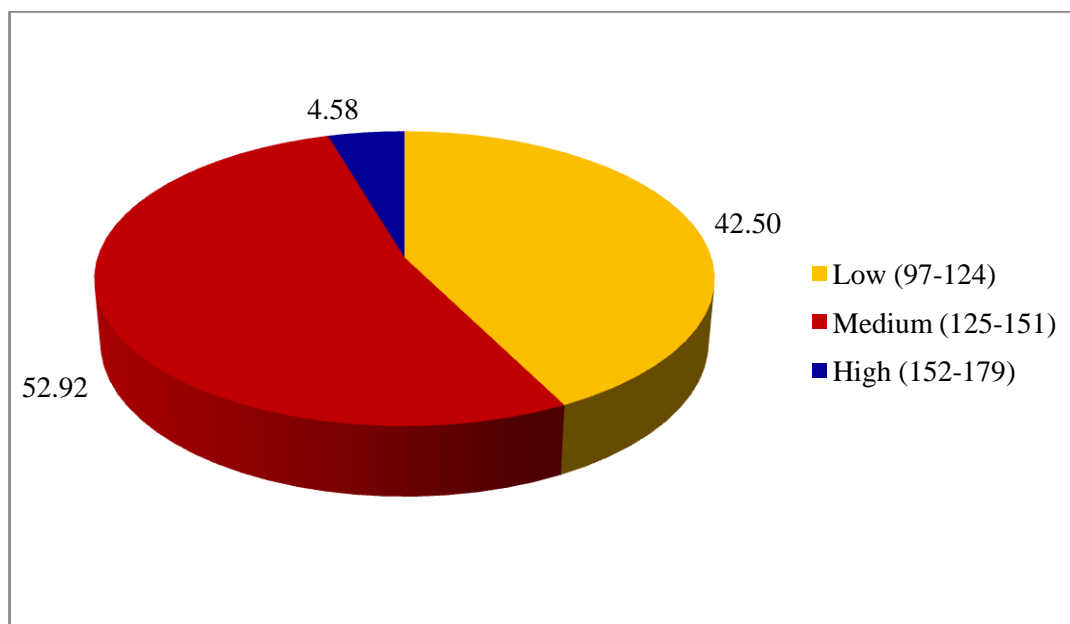
#### **4.1.9 Information and communication behaviour**

Table 4.10. and fig. 4.9 resulted that, 52.92 per cent of the respondents had medium level of information and communication behaviour, followed by low (42.50 %) and high (4.58 %) level of information and communication behaviour of the respondents of water users associations in Krishna delta area.

The table 4.10 resulted that majority of the respondents had medium information and communication behaviour. The reason could be maintenance of good contact with other WUAs, Irrigation Department officials and other informal communications to obtain information.

**Table 4.10. Distribution of respondents according to their information and communication behaviour (n=240)**

S. No.	Category	Frequency	Percentage
1	Low information and communication behaviour(97-124)	102	42.50
2	Medium information and communication behaviour (125-152)	127	52.92
3	High information and communication behaviour (152-180)	11	4.58
TOTAL		240	100



**Figure 4.9. Distribution of respondents according to information and communication behavior**

**Table 4.11. Content analysis of respondents according to their information and communication behaviour (n=240)**

**Table 4.11.1. Information Input Behaviour**

S. No.	Category	Frequently		Sometimes		Never	
		F	%	F	%	F	%
<b>a) Personal localite sources</b>							
1.	Friends	148	61.67	79	32.91	13	05.42
2.	Neighbours	56	23.33	124	51.67	60	25.00
3.	WUA members	165	68.75	57	23.75	18	7.50
4.	Local leader	36	15	83	34.58	121	50.42
5.	SHG members	8	03.33	14	05.83	218	90.84
6.	Panchayaths	7	02.92	35	14.98	198	82.50
7.	Cooperatives	7	02.92	49	20.42	184	76.66
8.	Farm organizations	5	02.08	31	12.92	204	85.00
<b>b) Personal cosmopolite sources</b>							
1.	WUA President	163	67.92	74	30.83	03	01.25
2.	WUA Vice-President	163	67.92	72	30.00	05	02.08
3.	Distrybutory Committee Chairman	30	12.5	60	25.00	150	62.50
4.	Project Committee Chairman	17	7.08	23	9.58	200	83.34
5.	Irrigation officials	63	26.25	124	51.67	53	22.08
6.	Agricultural officials	45	18.75	100	41.67	95	39.58
7.	Scientists of ANGRAU/ KVK/RARS	3	1.25	38	15.83	199	82.92
8.	NGO's	5	2.08	18	7.50	217	90.42
9.	Bank personnels	5	2.08	42	17.50	193	80.42
10.	Demonstrations	5	2.08	28	11.67	207	86.25
11.	Field day/field trips	3	1.25	30	12.5	207	86.25
12.	Trainings	9	3.75	179	74.58	52	21.67
13.	Study tours	3	1.25	117	48.75	120	50.00
<b>c) Impersonal cosmopolite sources</b>							
1.	Radio	3	01.25	6	2.50	231	96.25
2.	Television	45	18.75	184	76.67	11	4.58
3.	Newspapers	52	21.67	50	20.83	138	57.50
4.	Mobile phones	142	59.17	66	27.50	32	13.33
5.	Internet	5	2.08	20	8.33	215	89.59
6.	Agribusiness centres	2	0.83	16	6.67	222	92.50
7.	Agricultural magazines	3	1.25	13	5.42	224	93.33
8.	Krishimela/ exhibitions	1	0.42	14	5.83	225	93.75
9.	Agri portals	0	0.00	3	1.25	237	98.75

Table 4.11. indicated the information input behaviour of the respondents. Through personal localite the respondents obtain information frequently from WUA members (68.75 %), Friends (61.67 %), Neighbours (23.33 %), Local leaders (15.00 %), SGH members (3.33 %), Panchayaths and Cooperatives (02.92 %) and Farm organizations (2.08 %). The respondents obtain information from Neighbours (51.67 %), Local leaders (34.58 %), Friends (32.91 %), WUA members (23.75 %), Cooperatives (20.42 %), Panchayaths (14.98 %), Farm organizations (12.98 %) and SGH members (5.83 %) only for sometimes. The respondents obtain information never from SGH members (90.84 %), Farm organizations (85.00 %), Panchayaths (82.50 %), Cooperatives (76.66 %), Local leaders (50.42 %), Neighbours (25.00 %), WUA members (07.50 %) and Friends (05.42 %).

Table 4.11. also indicated the information input behaviour through personal cosmopolite sources. The respondents get information input frequently from WUA President and Vice-president (67.92 %), Irrigation officials (26.25 %), Agriculture officials (18.75 %), Distributotry committee chairman (12.50 %), Project committee chairman (7.08 %), Trainings (3.75 %), NGO's, Bank personnel's and Demonstrations (2.08 %), Scientists of ANGRAU, Field day/field trips and Study tours (1.25 %). The respondents get information input sometimes from Trainings (74.58 %), Irrigation officials (51.67 %), Study tours (48.75 %), Agriculture officials (41.67 %), WUA President (30.83 %), Vice-president (30.00 %), Distributotry committee chairman (25.00 %), Bank personnel's (17.50 %), Scientists of ANGRAU (15.83 %), Field day/field trips (12.50 %), Demonstrations (11.67 %), Project committee chairman (09.58 %) and NGO's (07.50 %). The respondents get information input rarely from NGO's (90.42 %), Demonstrations and Field day/field trips (86.25 %), Project committee chairman (83.34 %), Scientists of ANGRAU (82.92 %), Bank personnel's (80.42 %), Distributotry committee chairman (62.50 %), Trainings (74.58 %), Study tours (50.00 %), Agriculture officials (39.58 %), Irrigation officials (22.08 %), WUA Vice-president (02.08 %) and WUA President (01.25 %).

From table 4.11. it could be indicated that the input behaviour through impersonal cosmopolite sources. The respondents frequently get information through Mobile phones (59.17 %), Newspapers (21.67 %), Television (18.75 %), Internet (02.08 %), Radio and Agriculture magazines (1.25 %), Agribusiness centres (0.83 %) and Krishimela/exhibitions (0.42 %) and nothing from Agri portals. The respondents sometimes get information through Television (76.67 %), Mobile phones (27.50 %), Newspapers (20.83 %), Internet (08.83 %), Agribusiness centres (06.67 %), Krishimela/exhibitions (05.83 %), Agriculture magazines (05.83 %), Radio (02.50 %) and Agri portals (01.25 %).

The respondents rarely get information through Agri portals (98.75 %), Radio (96.25 %), Krishimela/exhibitions (93.75 %), Agriculture magazines (93.33 %), Agribusiness centres (92.50 %), Internet (89.59 %), Newspapers (57.50 %), Mobile phones (13.33 %) and Television (04.58 %).

From the above table 4.11. it could be concluded that the respondents obtain information mainly through WUA representatives, irrigation officials and through mobile phones and agriculture officials. The possible reason might be they were the persons readily available to give any kind of information on issues regarding water to their fields. They were the major source of providing information either directly or through mobile phones required by the respondents.

**Table 4.11.2. Information Processing Behaviour**

<b>a) Information Evaluation Behaviour</b>					
<b>S. No.</b>	<b>Statements</b>	<b>Yes</b>		<b>No</b>	
		<b>F</b>	<b>%</b>	<b>F</b>	<b>%</b>
1.	Discussing with family members	96	40.00	144	60.00
2.	Discussing with neighbours	130	54.67	110	45.83
3.	Discussing with local leaders	158	65.83	82	34.67
4.	Discussing with fellow farmers	159	66.25	81	33.75
5.	Discussing with WUA members	172	71.67	68	28.33
6.	Discussing with WUA President/Vice-President	211	87.92	29	12.08
7.	Discussing with Distributory/ Project Committee Chairman	87	36.25	153	63.75
8.	Discussing with extension personnel	153	63.75	87	36.25
9.	Judging in the light of past experience	182	75.83	58	24.17
10.	Judging by considering the degree of complexity	200	83.33	40	24.67
11.	Considering its economic feasibility.	203	84.58	37	15.42
12.	Accepted as such	64	26.67	176	73.33
<b>b) Information Storage Behaviour</b>					
1.	Memorizing	236	98.33	04	1.67
2.	Taking down in a notebook or diary	29	12.08	211	87.92
3.	Preserve the printed literatures like leaflets, bulletins, booklets etc	45	18.75	195	81.25
4.	Saving in tablet and mobile phone	24	10.00	216	90.00
5.	Recording the information in voice recorders	8	3.33	232	96.67
6.	By maintaining information received as it is in files	6	2.5	234	97.50
7.	Saving in computer	7	2.92	233	97.08
8.	Storing in external hard disk /pen drive	5	2.08	235	97.92
9.	Recording the information in CDs and DVDs	2	0.83	238	99.67
10.	Preserve newspaper cuttings	11	04.58	229	95.42
11.	Storing files in Google drive/email for easy online access	3	1.25	237	98.75

c) Information Utilization Behaviour							
S. No.	Statements	Regularly		Occasionally		Never	
		F	%	F	%	F	%
1.	Selection of seeds for planting on canal bunds	69	28.75	118	49.17	53	22.08
2.	Application of herbicides for management of aquatic weeds	98	40.83	121	50.42	21	8.75
3.	Planning the date of release of irrigation water	135	56.25	86	35.83	19	7.92
4.	Scheduling irrigation	122	50.83	93	38.75	25	10.42
5.	Canal rehabilitation works like desilting etc.	120	50.00	110	41.67	20	8.33
d) Information Transformation Behaviour							
1.	Preparing success stories	6	2.5	14	5.83	220	91.67
2.	CD-ROM	3	1.25	11	4.58	226	94.17
3.	Developing songs music, drama	5	2.08	19	7.92	216	90.00
4.	Adding personal experience to the information	100	41.67	125	52.08	15	6.25
5.	Preparing written materials or handouts	5	2.08	7	2.92	228	95.00
6.	Developing PowerPoint presentations	4	1.67	5	2.08	231	96.25
7.	Preparing lectures in local language	5	2.08	4	1.67	231	96.25
8.	Developing information boards	0	0.00	3	1.25	237	98.75
9.	Preparing charts ,graphs, posters etc	0	0.00	2	0.83	238	99.17

Table 4.11.2 stated the information processing behaviour of the respondents. It was categorised into four parts.

**Table 4.11.2.a) Information evaluation behaviour:** To evaluate the gained information the respondents discusses with the WUA President, Vice-president (87.92 %), Considers the economic feasibility (84.58 %), Judges by considering the degree of complexity (83.33 %), judging with the past experience (75.83 %), WUA members (71.67 %), Discussing with fellow farmers (66.25 %), Local leaders (65.83 %), Extension personnel (63.75 %), Neighbours (54.67 %), Family members (40.00 %), DC/PC chairman (36.25 %) and Accepting as such (26.67 %).

**Table 4.11.2.b) Information storage behaviour:** The respondents store the information mainly through Memorizing (98.33 %) it for further utilization, Preserving the printed literatures (18.75), Noting down in a book or diary (12.08), Saving in a tablet or mobile phone (10.00 %), Preserving newspaper cuttings (4.58 %), Voice recorders (3.33 %), Saving in computer (2.92 %), Storing in external devices (2.08 %), Storing in Google drive/email (1.25 %), Recording information in CDs and DVDs (0.83 %).

**Table 4.11.2.c) Information utilization behaviour:** The information stored was utilized regularly for Planning dates for realising of irrigation water (56.25 %), Scheduling of irrigation (50.83 %), Canal rehabilitation works (50.00 %), Applying herbicides for managing aquatic weeds (40.83 %) and Selection of seed for planting on canal bunds (28.74 %).

**Table 4.11.2.d) Information transformation behaviour:** The information that was used could be transformed to other members by Adding personal experience to the information (52.08 %), Preparing success stories (2.50 %), Developing songs music, drama, written materials or handouts and lectures in local language (2.08 %), Power point presentations (1.67 %) and CD-ROM (1.25 %).

The above table 4.11.2. information processing behaviour of respondents resulted that the respondents had evaluated the information acquired by them with the available WUA representatives in terms of degree of complexity and economic feasibility. The reason might be if the respondents were interested to utilize the information gained by them, so as to check its suitability to their economical conditions and complexity through WUA representatives and also by adding past experience to the information obtained. Most of the respondents had stored the information only by memorizing it, preserving printed materials and by noting down in the dairy. The reason might be many of them were middle aged and old aged persons and their educational qualifications were not even up to high school education. So the respondents those who were able to write have noted the information in dairy and preserved the printed materials for future use hence they were unable to use the electronic materials for storing information.

The information gained from different sources, stored in different ways was used to plan the water releasing dates and scheduling of irrigation, canal rehabilitation and removal of aquatic weeds. The possible reason might be to allow free flow of water in the canals and channels by removing weeds and wastage, scheduling of irrigation was to inform all the farmers to be prepared and make use of water available in time and to control the disputes among the farmers for water. The information acquired, evaluated and stored was also transformed to other farmers if necessary by adding personal experience to the information. This could be in case of informing water arriving time to other farmers or rehabilitation works, allotment of funds etc., in case of WUA members.

**Table 4.11.3. Information Output/Dissemination Behaviour**

S. No.	Method of disseminating information	Regularly		Occasionally		Never	
		F	%	F	%	F	%
1.	Group Discussion with WUA members	133	55.42	96	40.00	11	4.58
2.	Conducting field days	96	40.00	78	32.50	66	27.50
3.	Group discussion with fellow farmers	81	33.75	85	35.42	74	30.83
4.	Group Discussion with extension workers	67	27.92	73	30.42	100	41.66
5.	Demonstrations	41	17.08	55	22.92	144	60.00
6.	Farmers training programmes	82	34.16	85	35.42	73	30.42
7.	Phone calls	157	65.42	45	18.75	38	15.83
8.	e learning modules	13	5.42	19	7.92	208	86.66
9.	Film shows	0	0.00	13	5.42	227	94.58
10.	Conducting workshops	2	0.83	11	4.58	227	94.59
11.	Participating farm broadcasts	3	1.25	23	9.58	214	89.17
12.	Farm and Home visits	7	2.92	43	17.92	190	79.16
13.	Campaigns	2	0.83	21	8.75	217	90.42
14.	Writing in newspapers	1	0.42	18	7.50	221	92.08
15.	Sending SMS/voice mails	1	0.42	9	3.75	230	95.83
16.	Agricultural exhibitions	0	0.00	12	5.00	228	95.00
17.	Posters, leaflets, bulletins	0	0.00	4	1.67	236	98.33

Table 4.11.3. highlighted the information output behaviour of the respondents. The information retained with the respondents would be disseminated regularly in many ways through Phone calls (65.42 %), Group discussion with WUA members (55.42 %), Field days (40.00 %), Farmer training programmes (34.16 %), Group discussion with fellow farmers

(33.75 %), Extension workers (27.92 %), Demonstrations (17.08 %), e-learning modules (5.42 %), Farm and home visits (2.92 %), Participating in farm broadcasts (1.25 %), Campaigns and workshops (0.83 %), Writing in newspapers and Sending SMS/voice mails (0.42 %) and nothing through film shows, Agricultural exhibitions, Posters, Leaflets and Bulletins. The information was disseminated occasionally through Group discussion with WUA members (40.00 %), Farmer training programmes and Group discussion with fellow farmers (35.50 %), Field days (32.50 %), Group discussion with extension workers (30.42 %), Demonstrations (22.92 %), Phone calls (18.75 %), Farm and home visits (17.92 %), Participating in farm broadcasts (09.58 %), Campaigns (08.75 %), e-learning modules (07.92 %), Writing in newspapers (07.50 %), film shows (05.42 %), Agricultural exhibitions (05.00 %), Workshops (04.58 %), and Sending SMS/voice mails (03.75 %) and Posters, Leaflets and Bulletins (01.67 %). The information that was never disseminated through Posters, Leaflets and Bulletins (98.33 %), Sending SMS/voice mails (95.83 %), Agricultural exhibitions (95.00 %), Workshops (94.59 %), Film shows (94.58 %), Writing in newspapers (92.08 %), Campaigns (90.42 %), Participating in farm broadcasts (89.17 %), e-learning modules (86.66 %), Farm and home visits (79.16 %), Demonstrations (60.00 %), Group discussion with Extension workers (41.66 %), Group discussion with fellow farmers (30.83 %), Farmer training programmes (30.42 %), Field days (27.50 %), Phone calls (15.83 %) and Group discussion with WUA members (04.58 %).

From table 4.11.3. resulted that the respondents would disseminate the information among themselves mainly through phone calls, group discussions with WUA representatives and training programmes. The possible reason might be, phone call was the quickest and easiest way for them to contact at any time in any place to disseminate the information to other WUA representatives or to other farmers. In group discussions and training programmes held within the WUAs or with the irrigation department officials the WUA representatives would attend and discuss about warabandhi schedule, solving disputes or to clear any other operation and maintenance works within the jurisdiction of that particular water users association. The findings were in line with the findings of Patel (2015).

#### 4.1.10 Cropping pattern

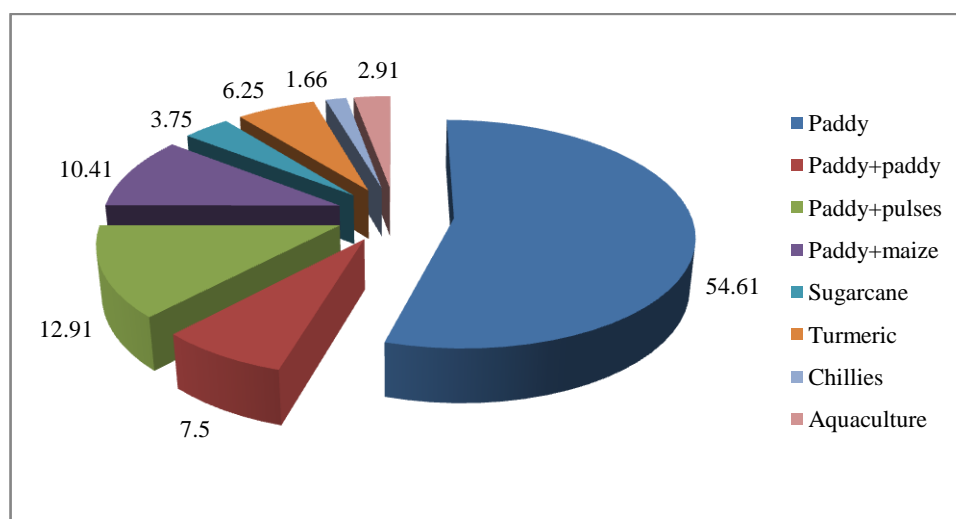
The table 4.12. highlighted the cropping pattern followed by the respondents of water users associations in Krishna delta area. About 54.61 per cent of the respondents cultivate only paddy crop in karif season. Rest of them followed the cropping pattern of paddy +pulses (12.91 %), paddy + maize (10.41 %), paddy + paddy (7.50 %) turmeric (6.25 %), sugarcane (3.75 %), aquaculture (2.91 %) and chillies (1.67 %).

From table 4.12. and fig. 4.10 it could be concluded that as it is the delta area, sufficient water was available to cultivate the paddy crop. In Krishna eastern delta, at some head reach places of canals some of the respondents would cultivate sugarcane or paddy (Kankipadu), similarly turmeric crop was cultivated at the head reach areas of both Krishna eastern (Kankipadu) and western (Duggirala) delta where the water availability was sufficient. The findings were in line with the findings of Raju *et al.* (2006).

**Table 4.12. Distribution of respondents according to their cropping pattern (n=240)**

S. No.	Cropping pattern	Frequency	Percentage
1	Paddy	131	54.61
2	Paddy+paddy	18	7.50
3	Paddy+pulses	31	12.91
4	Paddy+maize	25	10.41
5	Sugarcane	9	3.75
6	Turmeric	15	6.25
7	Chillies	4	1.66
8	Aquaculture	7	2.91
TOTAL		240	100

In tail end areas of Krishna eastern delta (Krithivenu) aquaculture was practiced as an alternative to paddy crop. The respondents opined that the agriculture was not profitable for them because of non remunerative minimum support price. Hence they have shifted from agriculture to aquaculture.



**Figure 4.10. Distribution of respondents according to cropping pattern**

In Krishna western delta at some head reach areas the cropping sequence paddy followed by maize crop cultivation was increasing gradually replacing paddy followed by pulses due to severe attack of yellow vein mosaic virus in pulses. Chilli crop was grown in some places of tail end areas (Chirala) in Krishna western delta as the water availability to that area was less and also crop suited for that soil was grown. Information regarding water source have been presented in the table 4.13.

**Table 4.13. Water source for the crops cultivated in Krishna delta area (n=240)**

S. No.	Crop	Water source				Total
		Canal		Canal+ pump set		
		Frequency	Percentage	Frequency	Percentage	
1	Paddy	217	97.75	5	2.25	100
2	Sugarcane	10	66.67	5	33.33	100
3	Turmeric	24	92.30	2	7.70	100
4	Maize	37	95.00	2	5.00	100
5	Chillies	9	100	-	-	100

From the table 4.13. it could be concluded that the water source for 97.75 per cent of the paddy crop in Krishna delta area was from canal and only 2.25 per cent of the crop get water source from both canal water and pump set. The water source for 66.67 per cent of the sugarcane crop was from canal and 33.33 per cent from both canal water and pump set. For turmeric crop the major (92.30 %) water source was canal water and both canal and pump set was for up

to 7.70 per cent. About 95.00 per cent of the crop gets water source from canal and only 5.00 per cent from both canal water and pump set. The major (100.00 %) water source for chilli crop was completely from the canal water.

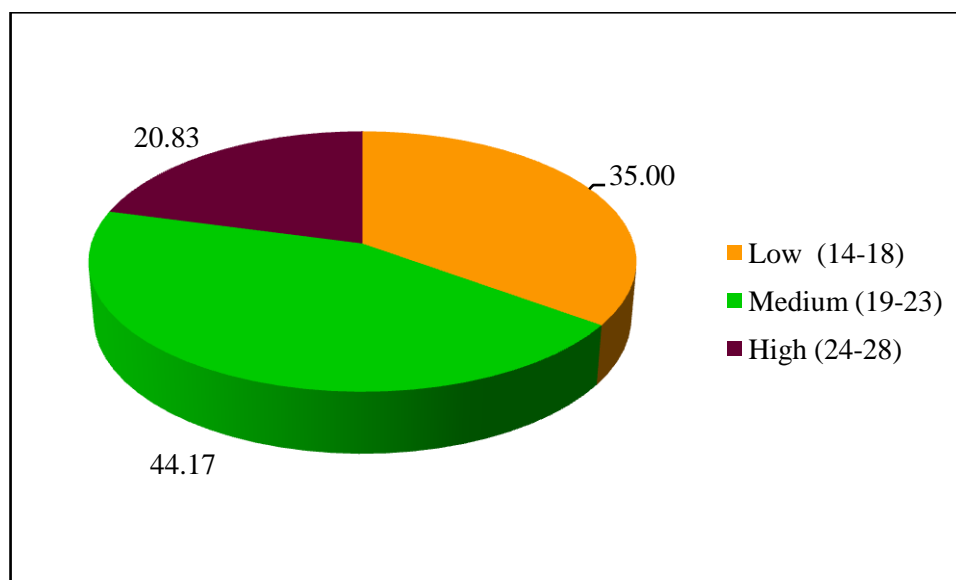
The possible reason might be in Krishna delta area sufficient water was supplied through canals and channels during the crop season through warabandhi schedule, hence suitable crops were grown and cropping sequence was followed according to the water availability. Along with the available canal water, the pump sets were also present in some head reach areas of Krishna delta area.

#### 4.1.11 Decision making

**Table 4.14. Distribution of respondents according to their decision making (n=240)**

S. No.	Category	Frequency	Percentage
1	Low decision making (14-18)	84	35.00
2	Medium decision making (19-23)	106	44.17
3	High decision making (24-28)	50	20.83
TOTAL		240	100

Table 4.14. and fig. 4.11 resulted that 44.17 per cent of the respondents had medium level of decision making, followed by low (35.00 %) and high (20.83 %) level of decision making of the respondents of water users associations in Krishna delta area.



**Figure 4.11. Distribution of respondents according to decision making**

It can be concluded from the above table 4.14 that majority of them possess medium level of decision making ability. This could be due to in maximum extent of area in Krishna delta area only the presidents and vice-presidents of water users associations were involved in the decision making activity, because many of them were not attending all the meetings or trainings and involve in discussions to take decisions. The other reason might be although most of the respondents would attend the meetings or trainings, persons who were in active participation would only involve decision making. Another reason would be the respondents from lower class of the society who are the members of water users association were not interested to show their active participation or involvement in decision making activities of water users associations. The findings were in line with the findings of Badatya and Mohapatra (2010).

#### **4.1.12 Innovativeness**

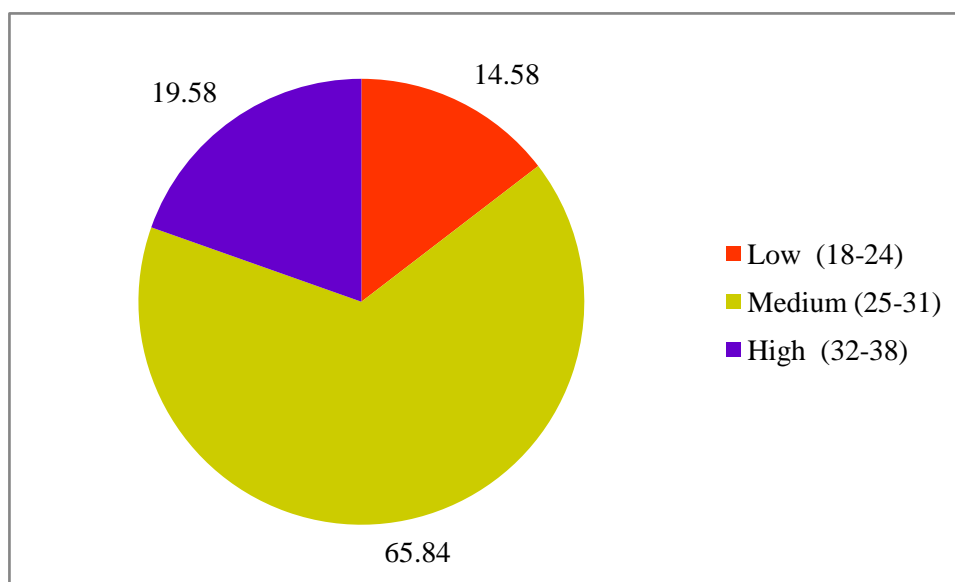
Table 4.15. and fig. 4.12 indicated the innovativeness of respondents of water users associations in Krishna delta area. Majority (65.84 %) of the respondents had medium level of innovativeness, followed by high (19.58 %) and low (14.58 %) level of innovativeness.

**Table 4.15. Distribution of respondents according to their innovativeness (n=240)**

<b>S. No.</b>	<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
1	Low innovativeness (18-24)	35	14.58
2	Medium innovativeness (25-31)	158	65.84
3	High innovativeness (32-38)	47	19.58
<b>TOTAL</b>		<b>240</b>	<b>100</b>

The table 4.15. resulted that majority of the respondents had medium innovativeness. This could be due to water availability for the crops in delta area was sufficient which resulted in increase in production and productivity of crops and this might have motivated the farmers to learn and adopt innovative methods in increasing the productivity of their crops. The other reasons might be the

respondents were updating themselves with the information on water conservation practices like digging farm ponds in their fields, attending trainings organized by irrigation department officials and implementation of warabandhi schedule for better utility of water. The findings were in line with the findings of Babu and Venkataramaiah (2004).



**Figure 4.12. Distribution of respondents according to innovativeness**

#### 4.1.13 Risk orientation

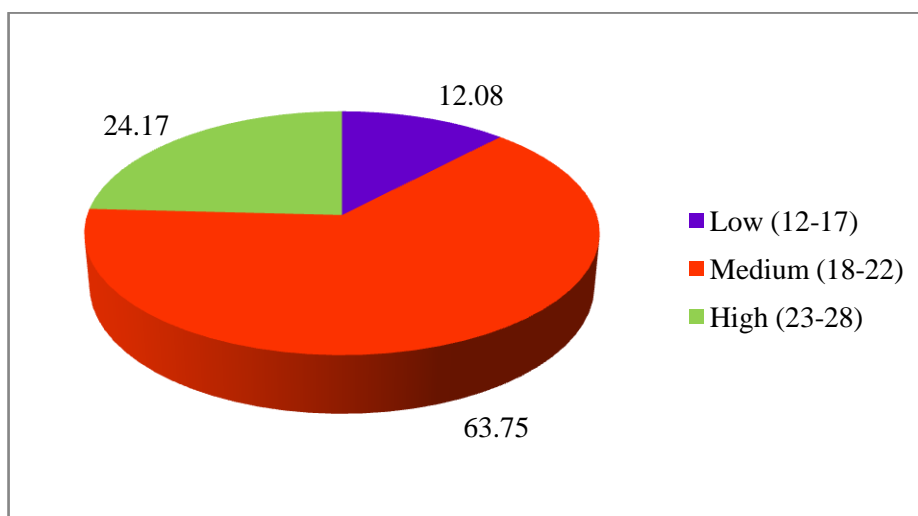
Table 4.16. and fig. 4.13 indicated the risk orientation of respondents of water users associations in Krishna delta area. Majority (63.75 %) of the respondents had medium level of risk orientation, followed by high (24.17 %) and low (12.08 %) level risk orientation.

**Table 4.16. Distribution of respondents according to their risk orientation (n=240)**

S. No.	Category	Frequency	Percentage
1	Low risk orientation (12-17)	29	12.08
2	Medium risk orientation (18-23)	153	63.75
3	High risk orientation (24-29)	58	24.17
TOTAL		240	100

The reason could be the respondents at middle and tail end areas would completely depend on canal water besides rainfall for growing crops. This might be due to non-availability of other water source for irrigating their crops. In

some areas the respondents have changed cropping pattern from paddy + pulses to paddy + maize, agriculture to aquaculture based on water availability which may include certain risk. The presidents and vice-presidents were the persons who would take more risk compared to the members.



**Figure 4.13. Distribution of respondents according to risk orientation**

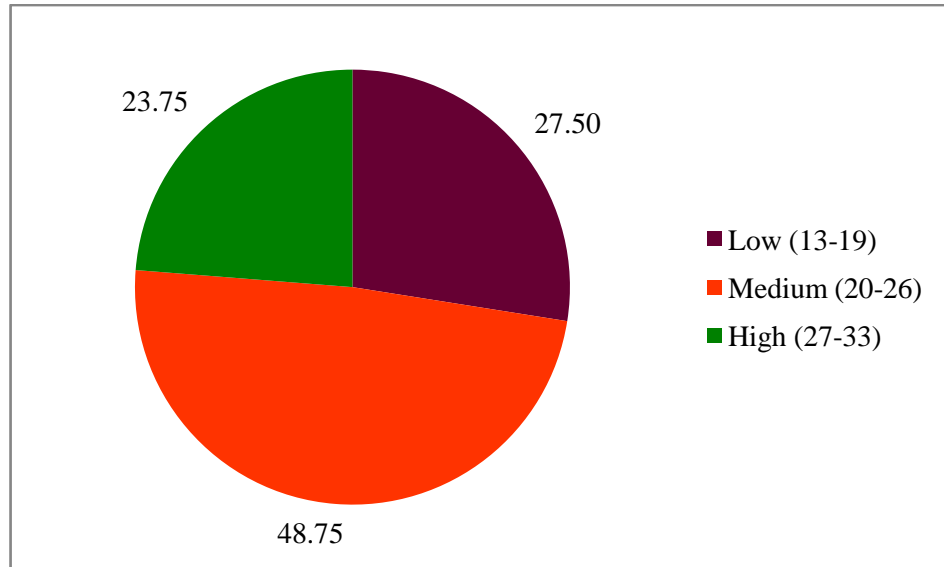
The reason could be they have come forward and took the responsibility to resolve the disputes among the farmers regarding water, cleaning of drains, repairs and rehabilitation works and sometimes bare the amount needed for maintenance works till the government release funds. The findings were in line with the findings of Babu and Venkataramaiah (2004) and Abirami (2012).

#### 4.1.14 Achievement motivation

Table 4.17. and fig. 4.14 indicated that majority (48.75 %) of the respondents had medium level of achievement motivation, followed by low (27.50 %) and high (23.75 %) level of achievement motivation of respondents of water users associations in Krishna delta area.

**Table 4.17. Distribution of respondents according to their Achievement motivation (n=240)**

S. No.	Category	Frequency	Percentage
1	Low achievement motivation (13-19)	66	27.50
2	Medium achievement motivation (20-26)	117	48.75
3	High achievement motivation (27-33)	57	23.75
TOTAL		240	100



**Figure 4.14. Distribution of respondents according to achievement motivation**

The above table 4.17. highlighted the achievement motivation of the respondents was at medium level. This was done due to the respondents came to know the need of learning new skills for better management of water through meetings and trainings organized by irrigation and agriculture departments. The priority was given for proper implementation of warabandhi schedule so that water will be distributed to whole WUA jurisdiction. Finally the yield of every crop had been increased due to sufficient irrigation to their crops. Disputes regarding water among the farmers have been reduced as water was supplied through warabandhi schedule of irrigation. High social participation was also a reason for the medium achievement motivation of the respondents. The findings were in line with the findings of Roy *et al.* (2013).

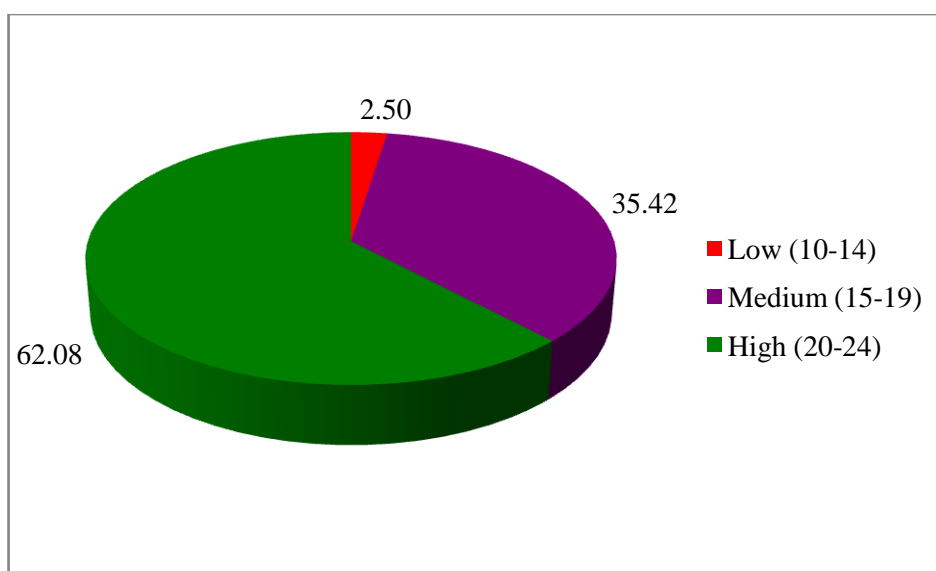
#### **4.1.15 Economic orientation**

Table 4.18. and fig. 4.15 indicated that majority (62.08 %) of the respondents had high level of economic orientation, followed by medium (35.42 %) and low (2.50 %) level of economic orientation of respondents of water users associations in Krishna delta area.

**Table 4.18. Distribution of respondents according to their economic orientation (n=240)**

S. No.	Category	Frequency	Percentage
1	Low economic orientation (10-14)	6	2.50
2	Medium economic orientation (15-19)	85	35.42
3	High economic orientation (20-24)	149	62.08
TOTAL		240	100

From the table 4.18. it can be concluded that high economic orientation have been seen from the respondents. The reason might be water was made available to everyone by that they obtained better yields. Water was efficiently utilized by them. Because in Krishna western delta mainly in Duggirala region direct sown rice method was followed. In Krishna eastern delta side in Kruthivenu region due to loss in agriculture the respondents have shifted to aquaculture and gained profits from it.



**Figure 4.15. Distribution of respondents according to economic orientation**

This resulted in high economic orientation. Along with the above reasons medium innovativeness and achievement motivation were also possible reasons for the high economic orientation of the respondents. The findings were in line with the findings of Manjunath (2002).

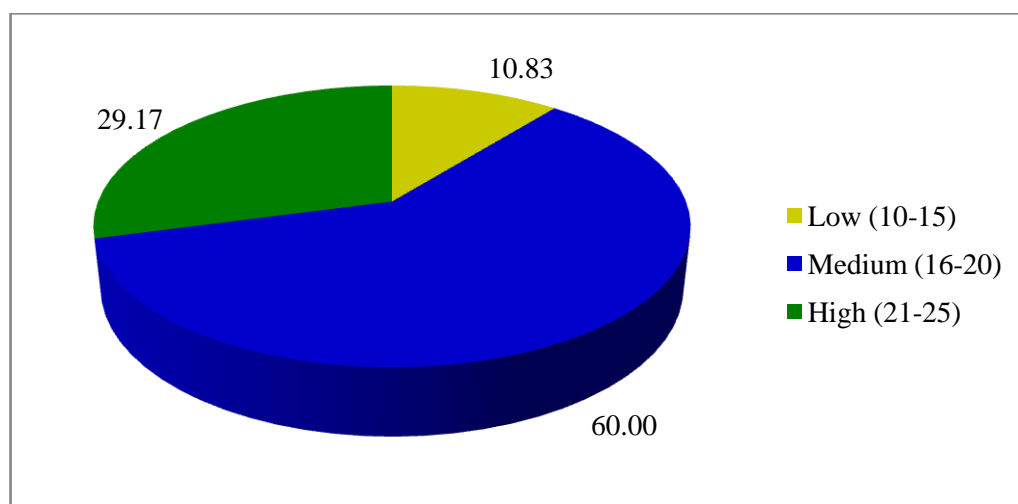
#### 4.1.16 Management orientation

Table 4.19. and fig. 4.16 indicated the management orientation of respondents of water users associations in Krishna delta area. Majority (60.00 %) of the respondents had medium level of management orientation followed by high (29.17 %) and low (10.83 %) level of management orientation.

The reason might be equal allocation of water or optimization of irrigation scheduling to everyone, reducing the overflow of water at head reach areas, proper management of cleaning of drains, repairs and rehabilitation works, proper maintenance of records and registers of water users associations, solving the disputes and other issues if any at the field level and efficient management of other operation and maintenance works.

**Table 4.19. Distribution of respondents according to their management orientation (n=240)**

S. No.	Category	Frequency	Percentage
1	Low management orientation (11-15)	26	10.83
2	Medium management orientation (16-20)	144	60.00
3	High management orientation (21-25)	70	29.17
TOTAL		240	100



**Figure 4.16. Distribution of respondents according to management orientation**

Apart from these, medium extension contact, information and communication behaviour and the trainings undergone helped them for proper water management. The findings were in line with the findings of Reddy (2005).

## **4.2 FUNCTIONING OF THE PROJECT COMMITTEES, DISTRIBUTORY COMMITTEES AND WATER USERS ASSOCIATIONS**

Participatory approach is crucial for management of irrigation projects for conserving and optimal utilization of resources. Participatory Irrigation Management (PIM) refers to involvement of irrigation users in all aspects of irrigation management and at all levels. Recognising the need to provide legal backup to PIM in the country, Ministry of Water Resources commissioned an NGO, “Society for Peoples’ Participation in Ecosystem Management” (SOPPECOM), Pune to suggest suitable amendments in the existing irrigation acts which could be recommended to States for incorporation in their State Irrigation Acts. In such circumstances Andhra Pradesh, enacted the “**Andhra Pradesh Farmers’ Management of Irrigation Systems (APFMIS) Act, March, 1997**”. The legal framework provided for creation of farmers organisations at different levels of irrigation system as under:

**a. Water Users’ Association (WUA):** will have a delineated command area on a hydraulic basis, which shall be administratively viable. Generally a WUA would cover a group of farmers (water users).

**b. Distributory Committee:** will comprise of 5 or more WUAs. All the presidents of WUAs will comprise general body of the distributory committee.

**c. Project Committee:** will be an apex committee of an irrigation system and presidents of the Distributory committees in the project area shall constitute general body of this committee.

A group of WUAs forms the distributory committee. All the WUA Presidents are members of the DC they elect the president of the DC. All the DC Presidents are the members of the project committees and they elect chairman of the project committee. Above all, an apex committee headed by the minister for major and medium projects shall be constituted to formulate broad policy guidelines and to resolve the disputes.

**Table 4.20.a. Distribution of respondents according to functions performed by Project Committee (n=240)**

S. No.	Functions of Project Committee	Fully performed		Partially performed		Non-performed	
		F	%	F	%	F	%
1	Approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the Competent Authority	228	95.00	12	5.00	0	0.00
2	Approve a plan for the maintenance of irrigation system including the major drains within its area of operation	217	90.42	23	9.58	0	0.00
3	Maintain a list of the Distributory Committees and Water Users Associations in its area of operation	240	100	0	0.00	0	0.00
4	Maintain an inventory of the Distributory and Drainage Systems in its area of operation	197	82.08	39	16.25	4	1.67
5	Maintenance works with the funds of the committee from time to time and regular water budgeting	182	75.83	46	19.17	12	5.00
6	Resolve disputes if any, between the Distributory Committees	97	40.42	68	28.33	75	31.25
7	Promote economy in the use of water	145	60.42	54	22.50	41	17.08
8	Maintain accounts, cause annual audit of its accounts, social audits and other records as may be prescribed	109	45.42	86	35.83	45	18.75
9	Conduct General Body Meetings as may be prescribed	53	22.08	87	36.25	100	42.00
10	Encourage avenue plantations and modernization of agriculture in its area of operation	26	10.83	56	23.33	158	65.84

Table 4.20.a. indicated the functions performed by the project committee. The functions fully performed were maintain a list of the distributory committees and water users associations in its area of operation (100.00 %), approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the competent authority (95.00 %), approve a plan for the maintenance of irrigation system including the major drains within its area of operation (90.42 %), maintain an inventory of the distributory and drainage systems in its area of operation (82.08 %), maintenance works with the funds of the committee from time to time and regular water budgeting (75.83 %), promote economy in the use of water (60.42 %), maintain accounts, cause

annual audit of its accounts, social audits and other records as may be prescribed (45.42 % ), conduct general body meetings as may be prescribed (22.08 % ) and encourage avenue plantations and modernization of agriculture in its area of operation (10.83 %).

The functions that were performed partially were conduct general body meetings as may be prescribed (36.25 %), maintain accounts, cause annual audit of its accounts, social audits and other records as may be prescribed (35.83 %), resolve disputes if any, between the distributory committees (28.33 %), encourage avenue plantations and modernization of agriculture in its area of operation (23.33 %), maintenance works with the funds of the committee from time to time and regular water budgeting (19.17 %), maintain an inventory of the distributory and drainage systems in its area of operation (16.25 %), approve a plan for the maintenance of irrigation system including the major drains within its area of operation (9.58 %) and approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the competent authority (5.00 %).

The functions that were non-performed were encourage avenue plantations and modernization of agriculture in its area of operation (65.84 %), conduct general body meetings as may be prescribed (42.00 %), resolve disputes if any, between the distributory committees (31.25 %), maintain accounts, cause annual audit of its accounts, social audits and other records as may be prescribed (18.75 %), promote economy in the use of water (17.08 %), maintain an inventory of the distributory and drainage systems in its area of operation (5.00 %) and maintenance works with the funds of the committee from time to time and regular water budgeting (1.67 %).

The possible reasons could be the project committee was perfectly maintainin the list of the distributory committees and water users associations, approving the operational plan based on their resource availability and approving maintenance of irrigation system under DC, partially they conduct the general body meetings, social audits etc. But the PC has failed to motivate the Dcs and

WUAs to encourage avenue plantation. The water disputes were also solved to the maximum extent at the DC and WUAs levels. The findings were in line with the findings of Raju *et al.* (2006), International Water Management Institute (2011), Shaoshu and Yuan (2013) and Shivaji Sangle (2016).

**Table 4.20.b. Distribution of respondents according to functions performed by Distributory Committee (n=240)**

S. No.	Functions of Distributory Committee	Fully performed		Partially performed		Non-performed	
		F	%	F	%	F	%
1	Preparation of operational plan based on its entitlement, area, soil, cropping pattern	183	76.25	34	14.17	23	9.58
2	Maintenance of both distributaries and medium drains within its area of operation	157	65.42	62	25.83	21	8.75
3	Regulate the use of water among the various Water Users Associations under its area of operation and monitor the flow of water for irrigation	201	83.75	26	10.83	13	5.42
4	Resolve disputes, if any, between the Water Users Associations in its area of operation	226	94.17	11	4.58	3	1.25
5	Maintain a register of Water Users Associations and an inventory of the irrigation system in the area of its operation, including drains	230	95.83	10	4.17	0	0.00
6	Maintenance works with the funds of the committee from time to time	160	66.67	64	26.66	16	6.67
7	Promote economy in the use of water allocated	195	81.25	33	13.75	12	5.00
8	Maintain accounts, cause annual audit, social audits and other records as may be prescribed	216	90.00	24	10.00	0	0.00
9	Conduct General Body Meetings and abide by the decisions of the Project Committee	186	77.50	32	13.33	22	9.17
10	Assist in the conduct of elections to the Managing Committee	177	73.75	46	19.17	17	7.08
11	Encourage avenue plantations and modernization of agriculture in its area of operation	38	15.83	23	9.58	179	74.59

Table 4.20.b. indicated the functions performed by the distributory committee. The functions fully performed were maintain a register of water users associations and an inventory of the irrigation system in the area of its operation, including drains (95.83 %), resolve disputes, if any, between the water users associations in its area of operation (94.17 %), maintain accounts, cause annual audit, social audits and other records as may be prescribed (90.00 %), regulate the use of water among the various water users associations under its

area of operation and monitor the flow of water for irrigation (83.75 %), promote economy in the use of water allocated (81.25 %), conduct general body meetings and abide by the decisions of the project committee (77.50 %), preparation of operational plan based on its entitlement, area, soil, cropping pattern (76.25 %), assist in the conduct of elections to the managing committee (73.75 %), maintenance works with the funds of the committee from time to time (66.67 %), maintenance of both distributaries and medium drains within its area of operation (65.42 %) and encourage avenue plantations and modernization of agriculture in its area of operation (15.83 %).

The functions performed partially were maintenance works with the funds of the committee from time to time (26.66 %), maintenance of both distributaries and medium drains within its area of operation (25.83 %), assist in the conduct of elections to the managing committee (19.17 %), preparation of operational plan based on its entitlement, area, soil, cropping pattern (14.17 %), promote economy in the use of water allocated (13.75 %), conduct general body meetings and abide by the decisions of the project committee (13.33 %), maintain accounts, cause annual audit, social audits and other records as may be prescribed (10.00 %), encourage avenue plantations and modernization of agriculture in its area of operation (9.58 %), resolve disputes, if any, between the water users associations in its area of operation (4.58 %) and maintain a register of water users associations and an inventory of the irrigation system in the area of its operation, including drains (4.17 %).

The functions that were non-performed were encourage avenue plantations and modernization of agriculture in its area of operation (74.59 %), preparation of operational plan based on its entitlement, area, soil, cropping pattern (9.58 %), conduct general body meetings and abide by the decisions of the project committee (9.17 %), maintenance of both distributaries and medium drains within its area of operation (8.75 %), assist in the conduct of elections to the managing committee (7.08 %), maintenance works with the funds of the committee from time to time (6.67 %), regulate the use of water among the various water users associations under its area of operation and monitor the flow

of water for irrigation (5.42 %), promote economy in the use of water allocated (5.00 %) and resolve disputes, if any, between the water users associations in its area of operation (1.25 %).

The distributory committee was maintaining the registers, accounts and social audits upto date. The disputes were resolved by water regulation to all the areas and by arranging meetings and discussions with the WUAs in their jurisdiction. The DC also failed to create awareness among WUAs in its area of operation on avenue plantation along the bunds of canals. The findings were in line with the findings of Raju *et al.* (2006), International Water Management Institute (2011), Shaoshu and Yuan (2013) and Shivaji Sangle (2016).

**Table 4.20.c. Distribution of respondents according to functions performed by Water Users Associations (n=240)**

S. No.	Functions of WUAs	Fully performed		Partially performed		Non-performed	
		F	%	F	%	F	%
1	Prepare and implement warabandhi schedule and regulation of water schedule	214	89.17	20	8.33	06	2.50
2	Prepare a plan for maintenance of irrigation system	198	82.50	29	12.00	13	5.50
3	Resolve disputes	230	95.50	7	2.90	3	1.20
4	Monitor flow of water for irrigation	178	74.17	50	20.83	12	5.00
5	Maintain an inventory of irrigation system, registers of landholders and co-opted members	231	96.25	9	20.83	0	0.00
6	Maintain accounts, records and social audits	216	90.00	24	10.00	0	0.00
7	Raise resources and promote economy in the use of water allocated	167	69.58	19	7.92	54	22.50
8	Assistance in conduct of elections and managing committee	182	75.83	49	20.42	9	3.75
9	Assistance to revenue department in collection of water rates	68	28.34	137	57.08	35	14.58
10	Conduct general body meetings, water budgeting as prescribed	218	90.83	22	9.17	0	0.00
11	Abide decisions of distributory committee and project committee	209	87.08	26	10.84	5	2.08
12	Encourage avenue plantation	48	20.00	26	10.83	166	69.17
13	Maintain feeder channels of minor irrigation tanks	160	66.67	58	24.16	22	9.17

Table 4.20.c. indicated the functions performed by the water users associations. The functions fully performed were maintain an inventory of irrigation system, registers of landholders and co-opted members (96.25 %), resolve disputes (95.50 %), conduct general body meetings, water budgeting as prescribed (90.83 %), maintain accounts, records and social audits (90.00 %), prepare and implement warabandhi schedule and regulation of water schedule (89.17 %), abide decisions of distributory committee and project committee (87.08 %), prepare a plan for maintenance of irrigation system (82.50 %), assistance in conduct of elections and managing committee (75.83 %), monitor flow of water for irrigation (74.17 %), raise resources and promote economy in the use of water allocated (69.58 %), maintain feeder channels of minor irrigation tanks (66.67 %), assistance to revenue department in collection of water rates (28.34 %) and encourage avenue plantation (20.00 %).

The functions that were performed partially were assistance to revenue department in collection of water rates (57.08 %), maintain feeder channels of minor irrigation tanks (24.16 %), monitor flow of water for irrigation and maintain an inventory of irrigation system, registers of landholders and co-opted members (20.83 %), assistance in conduct of elections and managing committee (20.42 %), prepare a plan for maintenance of irrigation system (12.00 %), abide decisions of distributory committee and project committee (10.84 %), encourage avenue plantation (10.84 %), conduct general body meetings, water budgeting as prescribed (9.17 %), prepare and implement warabandhi schedule and regulation of water schedule (8.33 %), raise resources and promote economy in the use of water allocated (7.92 %), resolve disputes (2.90 %).

The functions that were non-performed by the respondents were encourage avenue plantation (69.17 %), raise resources and promote economy in the use of water allocated (22.50 %), assistance to revenue department in collection of water rates (14.58 %), maintain feeder channels of minor irrigation tanks (9.17 %), prepare a plan for maintenance of irrigation system (5.50 %), monitor flow of water for irrigation (5.00 %), assistance in conduct of elections and managing committee (3.75 %), prepare and implement warabandhi schedule

and regulation of water schedule (2.50 %), abide decisions of distributory committee and project committee (2.08 %), resolve disputes (1.20 %), maintain an inventory of irrigation system, registers of landholders and co-opted members. The functions like maintain accounts, records and social audits and conduct general body meetings, water budgeting as prescribed was at zero per cent under non-performance.

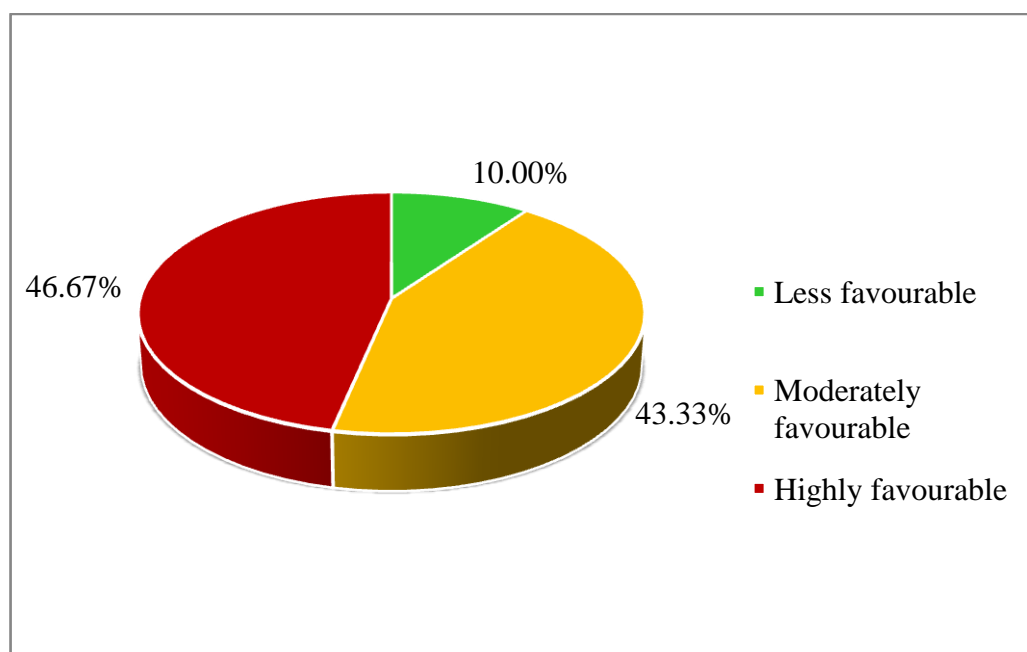
The possible reasons could be the WUA functionaries were in up to date in maintain the registers of land holders, co-opted members, inventory and accounts of irrigation system. They used to note down all the functions or programmes that were carried out in their registers. As the water availability to the crop was almost sufficient and on time due to implementation of warabandhi schedule the disputes were resolved among farmers. The WUA functionaries followed the decisions of their respective DC and PC in maintaining the irrigation system. Most of the respondents had non-performed the function of encouragement of avenue plantation due to less spacing of bunds of the fields, lack of knowledge and their uninterest to follow that function. The findings were in line with the findings of Raju *et al.* (2006), International Water Management Institute (2011), Shaoshu and Yuan (2013) and Shivaji Sangle (2016).

### **4.3 OPINION OF THE FUNCTIONARIES TOWARDS WATER USERS ASSOCIATIONS**

Table 4.21. and fig. 4.17 represented the opinion of the respondents towards water users associations in Krishna delta area. Majority of the respondents were highly favourable opinion (46.67 %) followed by favourable opinion (43.33 %) and less favourable opinion (10.00 %) towards water users associations

**Table 4.21. Distribution of respondents according to their opinion**  
(n=240)

S. No.	Category	Frequency	Percentage
1	Less favourable opinion (49-64)	24	10.00
2	Moderately favourable opinion (65-80)	104	43.33
3	Highly favourable opinion (81-95)	112	46.67
TOTAL		240	100



**Figure 4.17. Distribution of respondents according to opinion**

From the table 4.21. we can conclude that most of the respondents had highly favourable opinion towards water users associations. This would be because of the possible reasons except in few places of the tail end areas the rest of the areas were provided with sufficient irrigation water, the disputes were solved with proper implementation of warabandhi schedule, good support from the irrigation and agriculture departments for efficient managements of water through meetings/trainings. All these ultimately resulted in the increase of yields. The findings were in line with findings of and Badatya and Mohapatra (2010).

**Table 4.22 Content analysis of opinion of the respondents towards water users associations (n=240)**

S. No.	Statement	Response category									
		SA		A		UD		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
1	There is increase in crop yields due to economic use of irrigation	173	72.08	44	18.33	8	3.34	13	5.42	2	0.83
2	There is timely delivery of water in relation to crop requirements and farmers agricultural programmes	79	32.91	61	25.41	14	5.83	60	25.00	26	10.83
3	There is equity in delivery of water to upstream, midstream and tail-end sections of farmers	74	30.83	48	20.00	23	9.58	67	27.92	28	11.67
4	Participatory Irrigation Management provides opportunity for changing of cropping pattern Rice-pulses Rice-maize	66	27.50	42	17.50	19	7.92	93	38.75	20	8.33
5	Water Users Associations promote economy in the use of water allocated	115	47.92	78	32.50	27	11.25	18	0.50	2	0.83

S. No.	Statement	Response category									
		SA		A		UD		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
6	The Pattiseema Lift Irrigation scheme is largely beneficial to the farmers in the Krishna Delta area	142	59.17	52	21.67	21	8.75	19	7.91	6	2.50
7	Water Users Associations implement the warabandi schedule for each irrigation season	118	49.16	67	27.92	19	7.92	30	12.50	6	2.50
8	Water Users Associations helps in restoring the confidence of the farmers in the irrigation system	173	72.08	47	19.58	10	4.17	9	3.75	1	0.42
9	Cleaning of drains and its maintenance requires technical capabilities	125	52.08	52	21.67	14	5.83	39	16.25	10	4.17
10*	Participatory Irrigation Management contributed to increase disputes among stakeholders	59	24.58	18	7.50	33	13.75	103	42.92	27	11.25

S. No.	Statement	Response category									
		SA		A		UD		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
11	The water from Pattiseema project stabilizes 12 lakh acres besides meeting the second crop requirements of Krishna Delta area	106	44.17	48	12.92	31	20.00	50	20.83	5	2.08
12*	Proper communication skills are not required among the associations for its effective functioning	59	24.58	22	9.17	27	11.25	113	47.08	19	7.92
13	The Water Users Associations system gives freedom for the members to be effective and efficient	78	32.50	86	35.83	31	12.92	32	13.33	13	5.42
14	There is need of conducting technical training programmes particularly on efficient and effective water application practices and their impacts on environment	155	64.58	38	15.83	18	7.50	25	10.42	4	1.67

S. No.	Statement	Response category									
		SA		A		UD		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
15	Incentives should be given to less water used rice production technology users	148	61.67	49	20.42	15	6.25	23	9.58	5	2.08
16	All important decisions on water regulating and allocation are being discussed in the presence of all Water Users Associations members and I&CAD officials	121	50.42	61	25.42	26	10.83	27	11.25	5	2.08
17	Involvement of MGNREGS workers in canal rehabilitation	40	16.67	29	12.08	30	12.50	116	48.33	25	10.42
18*	Management Committee meetings are not conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management	57	23.75	20	08.34	23	09.58	111	46.25	29	12.08

S. No.	Statement	Response category									
		SA		A		UD		DA		SDA	
		F	%	F	%	F	%	F	%	F	%
19	Water Users Associations is one of the best associates for Participatory Irrigation Management	109	45.42	67	27.92	26	10.83	27	11.25	11	4.58
20	Though there is displacement of more people in the project area it is important to have Polavaram Project	127	52.92	60	25.00	27	11.25	23	9.58	3	1.25
21	Local political play a big role in the way of functioning of Water Users Associations	60	25.00	63	26.25	39	16.25	71	29.58	7	2.92
22	Avenue planting along the canals bringing about improvement in environment, etc.	61	25.41	35	14.58	25	10.42	100	41.67	19	7.92

To gain more weight on the opinion of the functionaries towards WUAs, content analysis was carried out and the results are furnished in the above table. The opinion scale comprised of 22 statements selected for the study.

The above table 4.22. stated the opinion of the functionaries towards WUAs in Percentage rank order of their decreasing importance are about 72.08 per cent of them were strongly agreed to that crop yields were increased due to economic use of irrigation and Water Users Associations helps in restoring the confidence of the farmers in the irrigation system (72.08 %), there was a need of

conducting technical training programmes particularly on efficient and effective water application practices and their impacts on environment (64.58 %), incentives should be given to less water used rice production technology users (61.67 %), the Pattiseema Lift Irrigation scheme was largely beneficial to the farmers in the Krishna Delta area (59.17 %), though there was displacement of more people in the project area it was important to have Polavaram Project (52.92 %), cleaning of drains and its maintenance requires technical capabilities (52.08 %), all important decisions on water regulating and allocation are being discussed in the presence of all Water Users Associations members and I&CAD officials (50.42 %), warabandi schedule was implemented for each irrigation season (49.16 %), Water Users Associations promote economy in the use of water allocated (47.92 %), Water Users Associations was one of the best associates for Participatory Irrigation Management (45.42 %), water from Pattiseema project stabilizes 12 lakh acres besides meeting the second crop requirements of Krishna Delta area (44.17 %), there was timely delivery of water in relation to crop requirements and farmers agricultural programmes (32.91 %), equity in delivery of water to upstream, midstream and tail-end sections of farmers (30.83 %).

The reasons for such favourable opinion might be due to the fact that the farmers might be impressed with the performance of WUAs in terms of equidistribution of irrigation water among head, middle and tail-end farmers. Also that due to sufficient availability of irrigation, good varieties of seeds and climatic conditions the yields of every crop has been increased. As warabandhi schedule has been implemented the water was supplied up to till tail end areas of the WUA jurisdiction. The timely release of water made the respondents to use the water economically. Technical capabilities were provided for cleaning and maintenance of canals, Water Users Association was one of the best associates for Participatory Irrigation Management because they were the ones that look after the needs of the farmers at village levels regarding irrigation water. Hence they played a best role in facilitating its services to the farmers, though there was displacement of more people in the Polavaram project area, many of them

opined that it benefited the people lot in many areas by providing water timely through Pattiseema lift irrigation scheme hence, it was important to have Polavaram Project. But there is an urgent need to organize effective training programmes and demonstrations at WUA level to create awareness regarding functioning of WUAs.

About 35.83 per cent of them were agreed that Water Users Associations system gives freedom for the members to be effective and efficient, Water Users Associations promote economy in the use of water allocated (32.50 %), Water Users Associations implement the warabandi schedule for each irrigation season and Water Users Associations is one of the best associates for Participatory Irrigation Management (27.92 %), local politics play a big role in the way of functioning of Water Users Associations (26.25 %), all important decisions on water regulating and allocation are being discussed in the presence of all Water Users Associations members and I&CAD officials (25.42 %), there is timely delivery of water in relation to crop requirements and farmers agricultural programmes (25.41 %), the Pattiseema Lift Irrigation scheme is largely beneficial to the farmers in the Krishna Delta area and Cleaning of drains and its maintenance requires technical capabilities (21.67 %), incentives should be given to less water used rice production technology users (20.42 %), there is equity in delivery of water to upstream, midstream and tail-end sections of farmers (20.00 %), Water Users Associations helps in restoring the confidence of the farmers in the irrigation system (19.58 %), there is increase in crop yields due to economic use of irrigation (18.33 %), Participatory Irrigation Management provides opportunity for changing of cropping pattern Rice-Pulses, Rice-Maize (17.50 %), there is need of conducting technical training programmes particularly on efficient and effective water application practices and their impacts on environment (15.83 %), avenue planting along the canals bringing about improvement in environment, etc. (14.58 %), the water from Pattiseema project stabilizes 12 lakh acres besides meeting the second crop requirements of Krishna Delta area (12.92 %), involvement of MGNREGS workers in canal rehabilitation (12.08 %), proper communication skills are not

required among the associations for its effective functioning (09.17 %), Management Committee meetings are not conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management (08.34 %) and Participatory Irrigation Management contributed to increase disputes among stakeholders (07.50 %).

Only less per cent of the respondents rejected the statement that WUAs promote economy in the use of water allocated. This could be due to farmers felt that the WUAs are necessary to improve the water use efficiency. The Water Users Associations were given rights to look after and satisfy the water requirements of farmers in their area. So, the WUA members were working effectively and efficiently and providing their services to fulfill the irrigation requirements of the farmers.

Majority (48.33 %) of the respondents disagreed for the statement involvement of MGNREGS workers in canal rehabilitation followed by Management Committee meetings were not conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management (46.25 %), Participatory Irrigation Management contributed to increase disputes among stakeholders (42.92 %), avenue planting along the canals bringing about improvement in environment, etc. (41.67 %), nearly 38.75 per cent of the respondents were disagreed that Participatory Irrigation Management provides opportunity for changing of cropping pattern Rice-Pulses, Rice-Maize, local politics play a big role in the way of functioning of Water Users Associations (29.58 %),

The respondents opined that with the introduction of WUAs they feel comfortable due to lack of disputes among farmers and irrigation officials. The Participatory Irrigation Management provides opportunity for changing of cropping pattern because many of them were not practicing rice-pulses due to the attack of Yellow vein Mosaic Virus (YMV) to the pulses they were rejecting to grow pulses, similarly rice-maize pattern increases the yield, it was used to followed only in few areas of Krishna delta area. The meetings were conducted by the Management Committee to monitor the operation and maintenance works of water users associations and also to discuss about the allocation of funds from the government for works in the WUA jurisdiction. The local political leaders involve in solving the issues regarding water in the villages. Many of the respondents opined that the not to involve the MGNREGS workers in canal rehabilitation works, because they felt the workers were not maintaining the quality of work done by them and also no proper time management for doing work.

#### **4.4 IMPACT OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA IN TERMS OF DIRECT AND INDIRECT CHANGES**

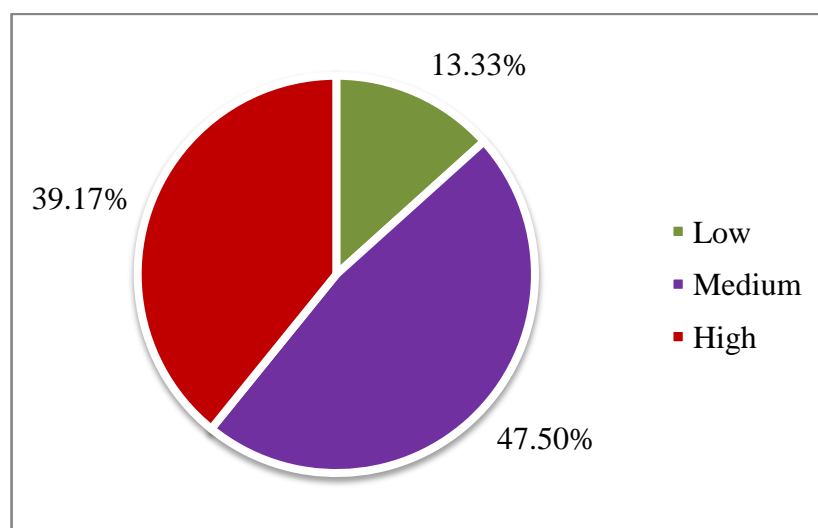
The changes that took place due to the functioning of water users associations have been presented in the following tables.

##### **A) DIRECT CHANGES**

**Table 4.23. Distribution of respondents according to direct changes**

**(n=240)**

<b>S. No.</b>	<b>Direct changes</b>	<b>Frequency</b>	<b>Percentage</b>
1	Low direct changes (27-35)	32	13.33
2	Medium direct changes (36-44)	114	47.50
3	High direct changes (45-53)	94	39.17
Total		240	100



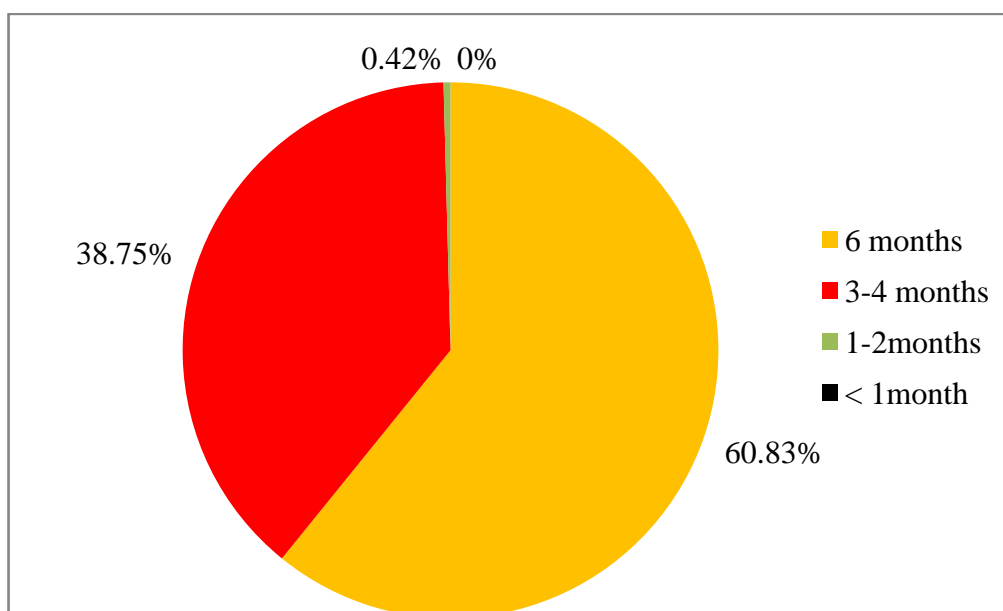
**Figure 4.18. Distribution of respondents according to direct changes**

Table 4.23. and fig. 4.18 reported that majority (47.50 %) of the respondents had medium level of direct changes, followed by high (39.17 %) and low (13.33 %) level of direct changes for the respondents of water users associations in Krishna delta area. The direct changes have been studied in terms of the following aspects:

**Table 4.24. Distribution of respondents according to availability of sufficient irrigation water (n=240)**

S. No.	Water Availability	Frequency	Percentage
1	6 months	146	60.83
2	3-4 months	93	38.75
3	1-2months	1	0.42
4	< 1month	0	0.00
TOTAL		240	100

Table 4.24. and fig. 4.19 stated that 60.83 per cent of the respondents said that they received water up to six months during the crop season, followed by 3-4 months (38.75 %), 1-2 months (0.42 %) and none of them said that water availability was for less than one month. The reason could be water was released as per warabandhi schedule which reduced the over exploitation of water at the head reach areas and made available to the crop throughout the crop growth period.

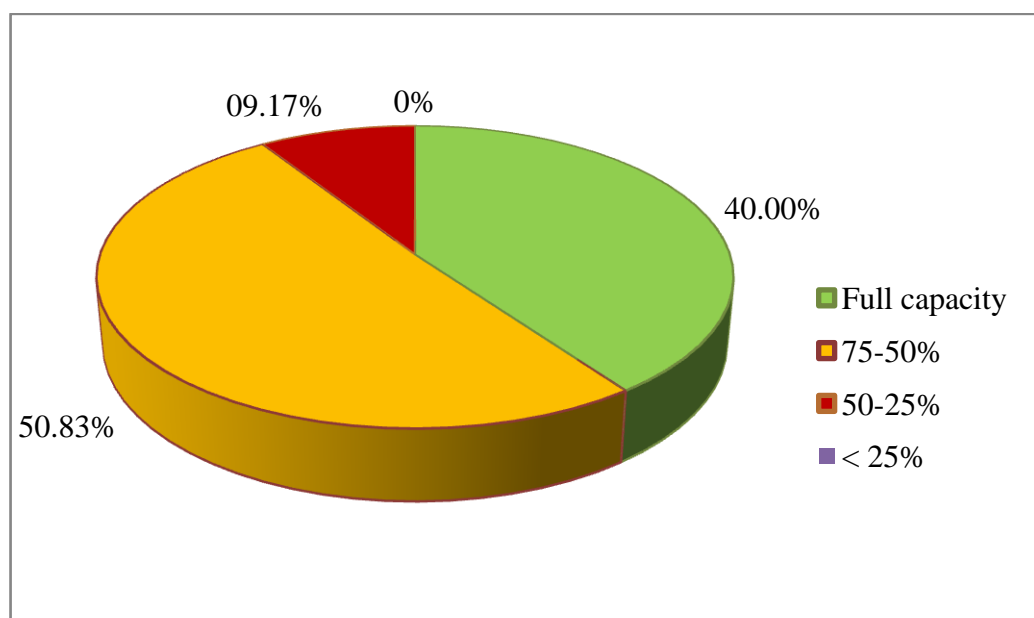


**Figure 4.19. Distribution of respondents according to availability of sufficient irrigation water**

**Table 4.25. Distribution of respondents according to availability of water quantity (n=240)**

S. No.	Water quantity	Frequency	Percentage
1	Full capacity	96	40.00
2	75-50 %	122	50.83
3	50-25 %	22	09.17
4	< 25 %	0	0.00
TOTAL		240	100

Table 4.25. and fig. 4.20 indicated the availability of sufficient water quantity to the crops for the respondents of WUAs in Krishna delta area. About 50.83 per cent of them said that they get water quantity at 75-50 per cent followed by full capacity (40.00 %), 50-25 per cent (9.17 %) and none of them were from less than 25 per cent. The reason might be since the water has to be supplied to all the areas viz., head reach, middle and tail end areas the water was released for a particular period of time depending on water availability in the Prakasam barrage.

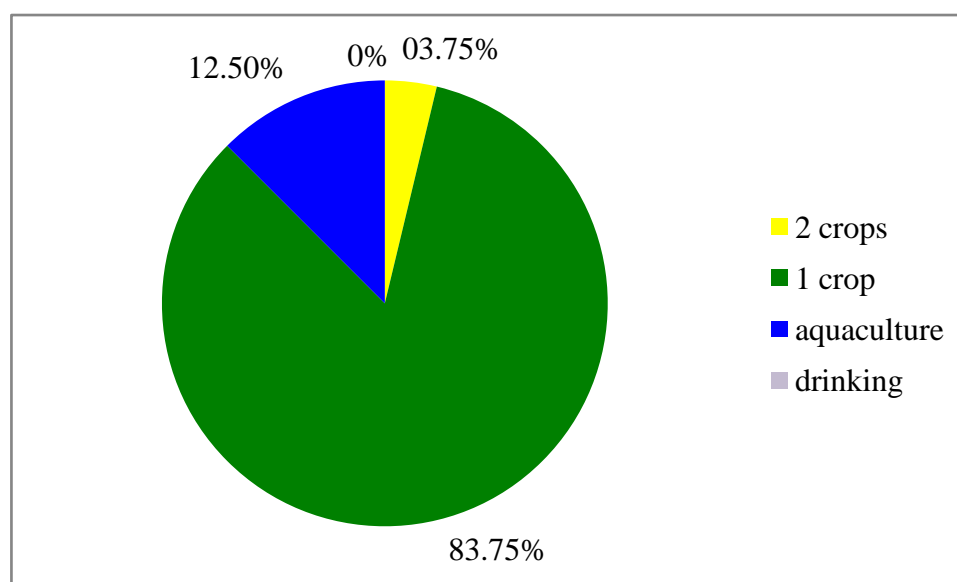


**Figure 4.20. Distribution of respondents according to availability of sufficient water quantity**

**Table 4.26. Distribution of respondents according to utilization of water (n=240)**

S. No.	Water Utilization	Frequency	Percentage
1	Two crops	9	3.75
2	One crop	201	83.75
3	Aquaculture+Agriculture (one crop)	30	12.50
TOTAL		240	100

Table 4.26. and fig. 4.21 stated the utilization of available water to the in Krishna delta area. About 83.75 per cent of them told that they utilize water only for one crop followed by aquaculture (12.50 %), two crops (3.75 %). The reason could be due to insufficient water availability, the water was released only during karif season and stops releasing of water before the harvesting of the crop. The respondents of tail-end area (Krithivenu) in Krishna eastern delta used water for aquaculture and only few respondents in head reach areas would also use water for the second crop.

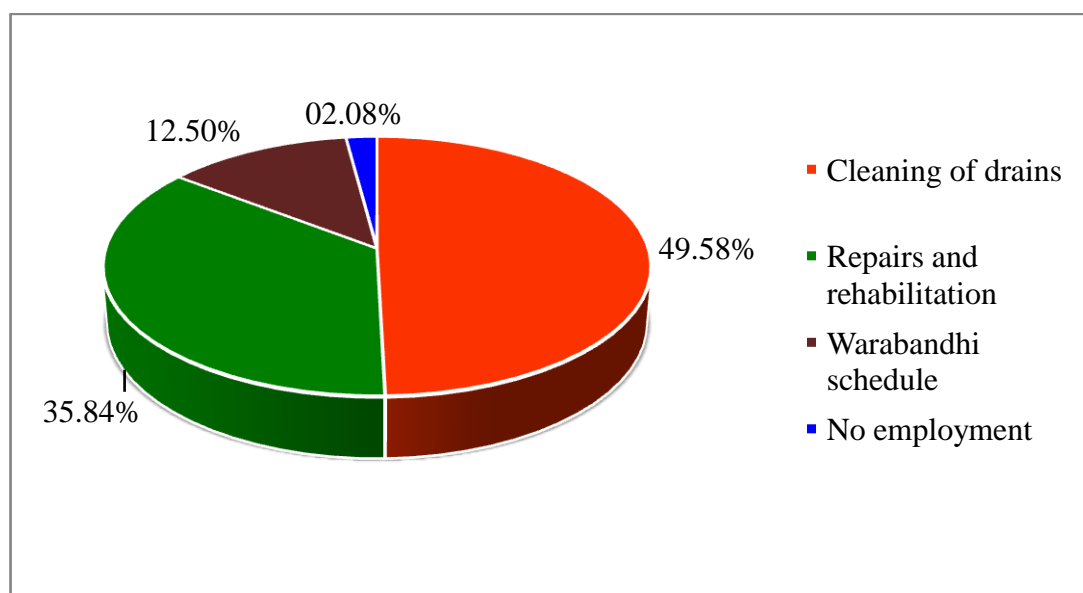


**Figure 4.21. Distribution of respondents according to water utilization**

**Table 4.27. Distribution of respondents according to employment generation (n=240)**

S. No.	Employment generation	Frequency	Percentage
1	Cleaning of drains	119	49.58
2	Repairs and rehabilitation	86	35.84
3	Warabandhi schedule	30	12.50
4	No employment	5	2.08
TOTAL		240	100

Table 4.27. and fig. 4.22 stated that majority (49.58 %) of the respondents had employment generation during cleaning of drains, followed by repairs and rehabilitation (35.8 %), warabandhi schedule (12.50 %) and no employment (2.08 %). The reason could be during summer season only any kind of works, constructions or repairs pertaining to canals should be done. So, employment was provided to people on cleaning of drains, repairs and rehabilitation works before the release of water into canals. Employment was also provided during the crop season viz., in warabandhi schedule if there was any requirement in canal works like earthen up, removal of weeds, etc.

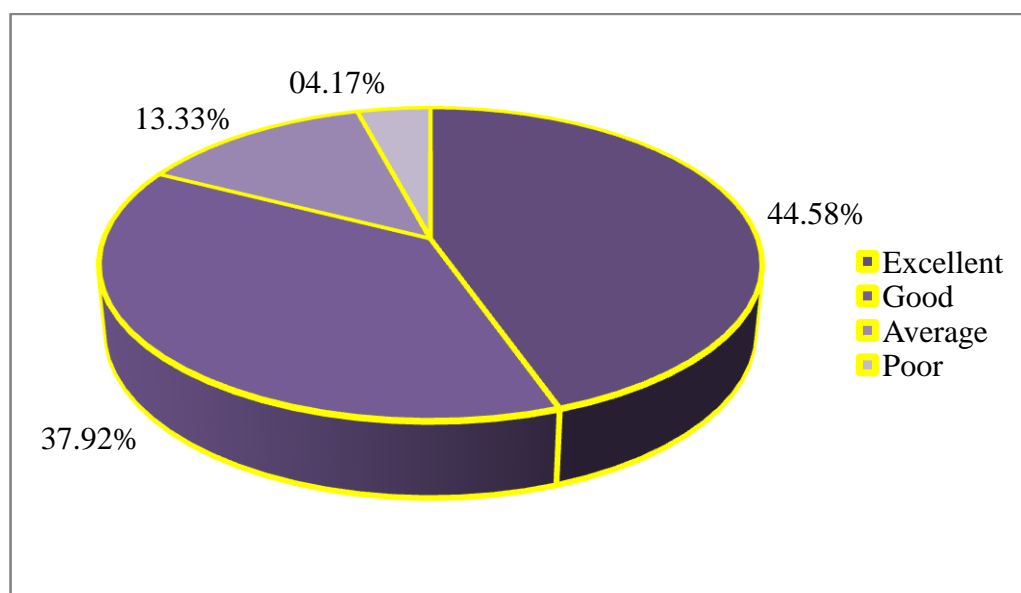


**Figure 4.22. Distribution of respondents according to employment generation**

**Table 4.28. Distribution of respondents according to implementation of warabandhi (n=240)**

S. No.	Implementation of warabandhi	Frequency	Percentage
1	Excellent	107	44.58
2	Good	91	37.92
3	Average	32	13.33
4	Poor	10	4.17
TOTAL		240	100

Table 4.28. and fig. 4.23 indicated the implementation of warabandhi schedule in the Krishna delta area. Nearly 44.58 per cent of them said that warabandhi was implemented excellently followed by good (37.92 %), average (13.33 %), and poor (04.17 %). Since the water should reach to the tail-end areas, the water users associations were taken care for the proper implementation of warabandhi schedule which otherwise might lead disputes among the farmers. The water users associations had planned for the irrigation schedule, providing required information regarding water release and closing dates to farmers and finally proper implementation of warabandhi schedule resulted in excellent performance of water users associations in implementing warabandhi schedule.

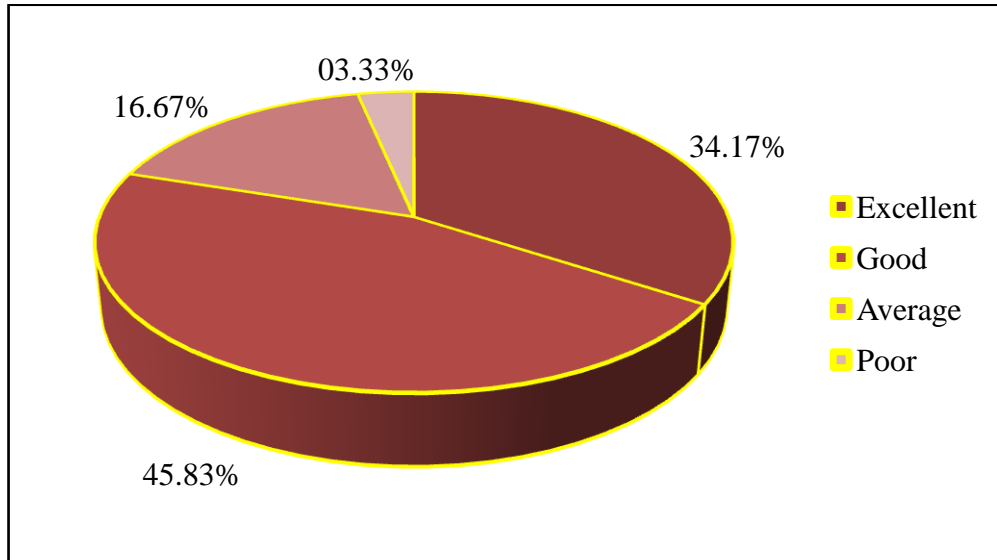


**Figure 4.23. Distribution of respondents according to implementation of warabandhi schedule**

**Table 4.29. Distribution of respondents according to rehabilitation of water courses (n=240)**

S. No.	Rehabilitation of water courses	Frequency	Percentage
1	Excellent	82	34.17
2	Good	110	45.83
3	Average	40	16.67
4	Poor	8	3.33
TOTAL		240	100

From the table 4.29. and fig. 4.24 it could be concluded that about 45.83 per cent of the respondents reported that rehabilitation of water courses were maintained at good level followed by excellent (34.17 %), average (16.67 %) and 3.33 per cent reported at poor level. The reason could be to maintain the water courses properly the funds allocated were not sufficient, though the aquatic weeds were cleaned frequently they used to appear again, canals/channels cleanliness were not maintained by the people especially in urban areas because they used to throw all the wastage like plastic, or other decomposable or non decomposable materials into water courses.

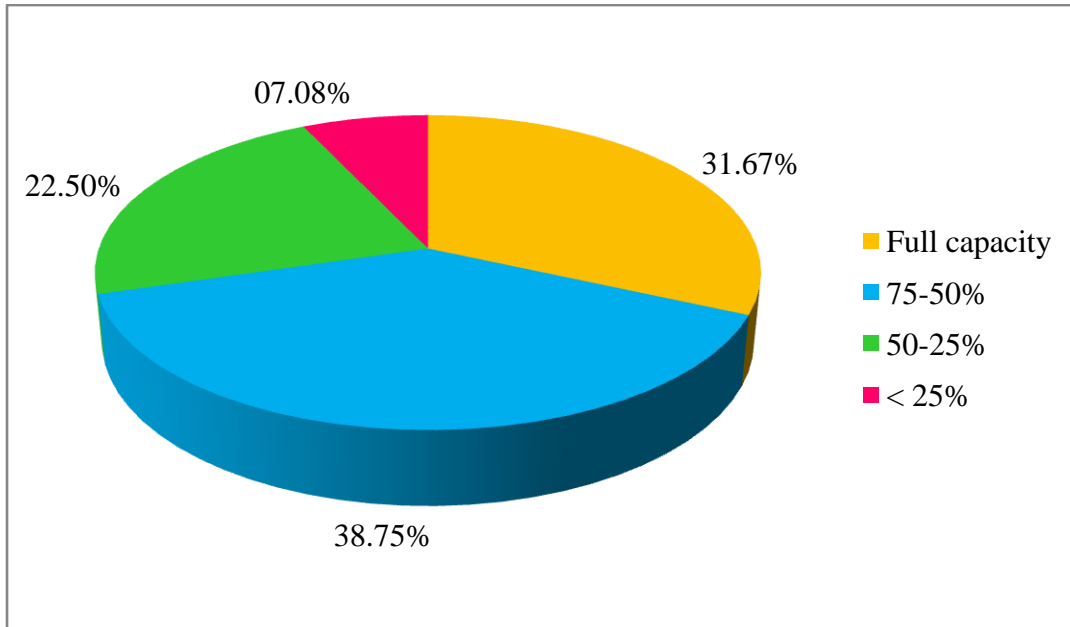


**Figure 4.24. Distribution of respondents according to rehabilitation of water courses**

**Table 4.30. Distribution of respondents according to water availability to tail-end areas (n=240)**

S. No.	Water availability to tail end areas	Frequency	Percentage
1	Full capacity	76	31.67
2	75-50 %	93	38.75
3	50-25 %	54	22.50
4	<25 %	17	7.08
TOTAL		240	100

Table 4.30. and fig. 4.25 stated the water availability to tail-end areas in Krishna delta area. About 38.75 per cent of them had reported that they received water up to 75-50 per cent followed by full capacity (31.67 %), 50-25 per cent (22.50 %) and less than 25 per cent (7.08 %). Nearly 75-50 per cent amount of water was supplied to tail-end areas, this was because of the water users association had worked a lot to implement the warabandhi schedule properly and also taken care to avoid the over exploitation of water at the head reach areas by that, water was supplied to tail-end areas to the maximum extent.

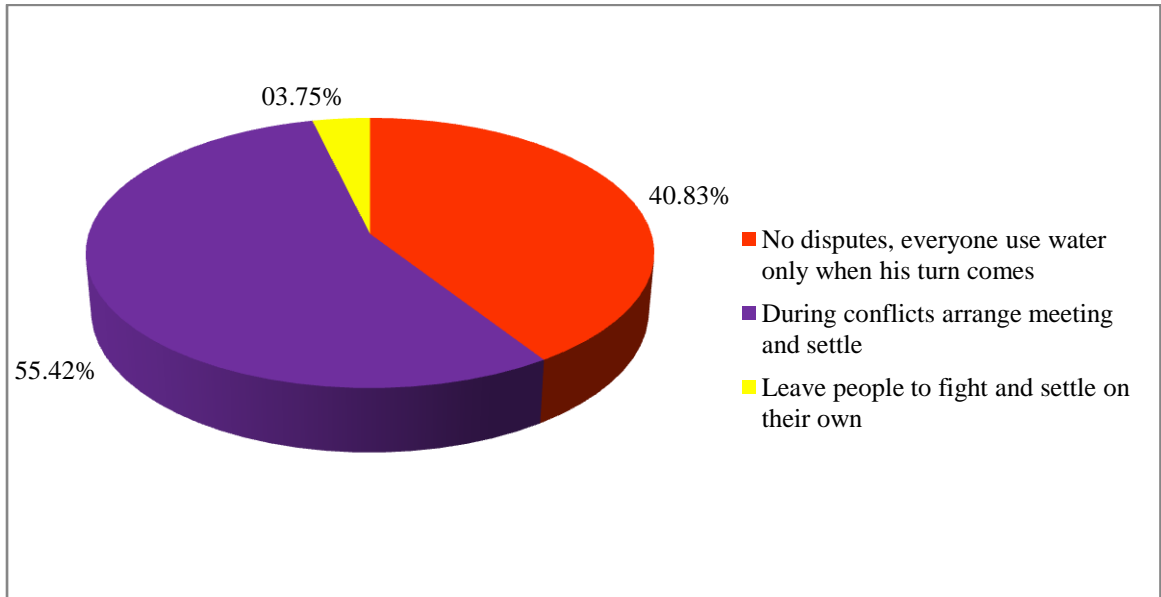


**Figure 4.25. Distribution of respondents according to availability of water to tail-end areas**

**Table 4.31. Distribution of respondents according to resolving water disputes (n=240)**

S. No.	Resolving water disputes	Frequency	Percentage
1	No disputes, everyone use water only when his turn comes	98	40.83
2	During conflicts arrange meeting and settle	133	55.42
3	Leave people to fight and settle on their own	9	3.75
TOTAL		240	100

Table 4.31. and fig. 4.26 stated that 55.42 per cent of the respondents reported that they arrange the meetings and settle the disputes during conflicts followed by no disputes, everyone use water only when his turn comes (40.83 %) and leave people to fight and settle on their own (03.75 %).



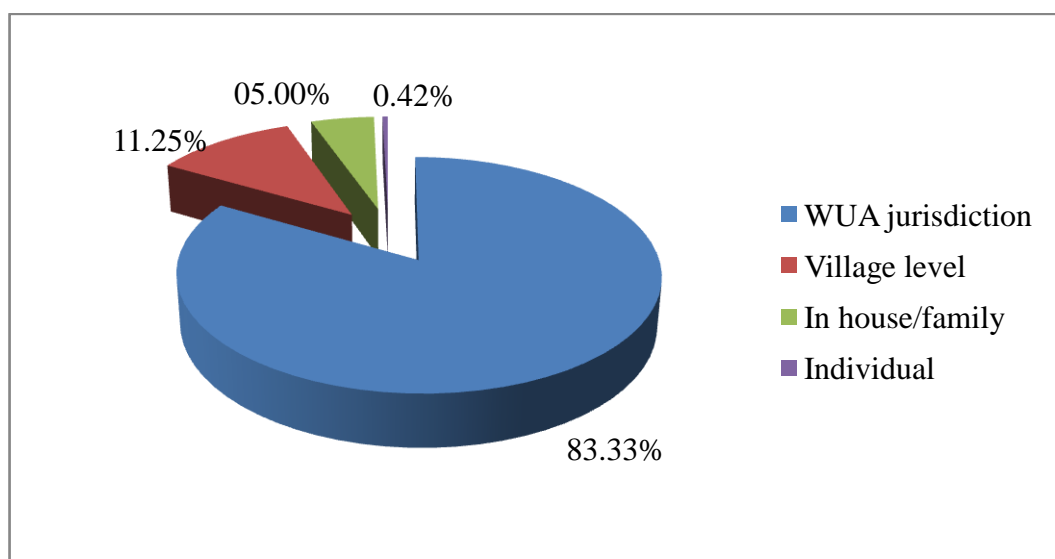
**Figure 4.26. Distribution of respondents according to resolving water disputes**

The reason might be water was supplied almost equally to all the areas to reduce the disputes. If any disputes arise regarding water the WUA members would try to settle the disputes by arranging meetings and convincing the farmers. In some areas due to sufficient availability of water there were no disputes among the farmers.

**Table 4.32. Distribution of respondents according to benefit due to WUA (n=240)**

S. No.	Benefit due to WUA	Frequency	Percentage
1	WUA jurisdiction	200	83.33
2	Village level	27	11.25
3	In House/Family	12	5.00
4	Individual	1	0.42
TOTAL		240	100

Table 4.32 and fig. 4.27 indicated the benefit due to WUA about 83.33 per cent of them said that the WUA jurisdiction was benefited followed by village level (11.25 %), house/family (5.00 %) and individual (0.42 %). The whole water users association jurisdiction was benefited with the functioning of water users association. As the water courses were not only restricted to only individual or family or village level the entire WUA jurisdiction was benefited.

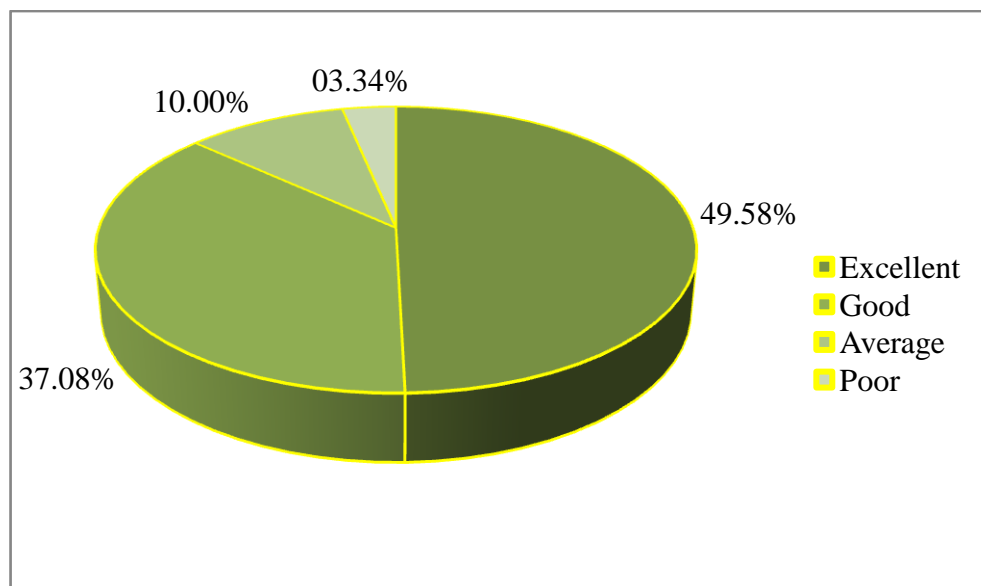


**Figure 4.27. Distribution of respondents according to benefit due to WUAs**

**Table 4.33. Distribution of respondents according to participation of WUAs in water management (n=240)**

S. No.	Participation of WUAs in water management	Frequency	Percentage
1	Excellent	119	49.58
2	Good	089	37.08
3	Average	24	10.00
4	Poor	8	3.34
TOTAL		240	100

Table 4.33. and fig. 4.28 stated the participation of WUAs in water management in Krishna delta area. Nearly 49.58 per cent of them reported that WUAs had participated excellently in water management followed by good (37.08 %), average (10.00 %) and poor (3.34 %). The reason might be the water users associations had strived a lot to supply water to all the areas in Krishna delta. The WUA members provide up to date information on water releasing and closing dates. Whenever the disputes arise, they tried to settle them. They had put their maximum efforts in organizing operation and maintenance works. Their efficient work output showed their participation in water management.



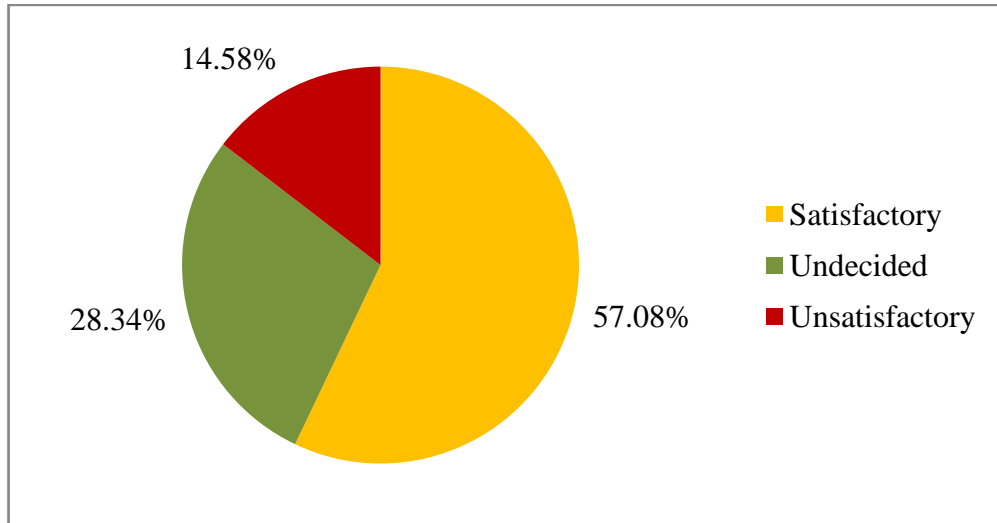
**Figure 4.28. Distribution of respondents according to participation of WUAs in water management**

Table 4.34. and fig. 4.29 denoted the delegation of powers to water users associations. Nearly 57.08 per cent of the respondents said that they had sufficient powers followed by undecided (28.34 %) and insufficient (14.58 %).

**Table 4.34. Distribution of respondents according to delegation of powers to WUAs (n=240)**

S. No.	Delegation of powers to WUAs	Frequency	Percentage
1	Sufficient	137	57.08
2	Undecided	68	28.34
3	Insufficient	35	14.58
TOTAL		240	100

Majority of the respondents replied that they had sufficient powers to carry out the functions under their jurisdiction. Making proposals regarding canal works to the government through irrigation department, collection and spending of allotted funds from the government for the proposals they made, operation and maintenance works in their jurisdiction, etc., were the powers delegated to them in water management. The president and vice-president were mainly involved and responsible for the works in water users associations.



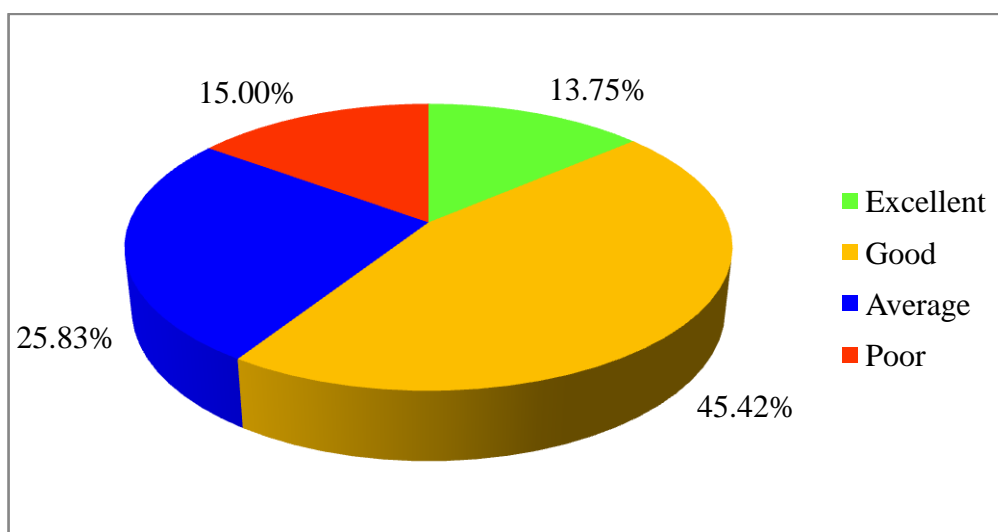
**Figure 4.29. Distribution of respondents according to delegation of powers to WUAs in water management**

Table 4.35. and fig. 4.30 stated that 45.92 per cent of them reported there were good relations among WUAs, Irrigation and Revenue departments followed by average (25.83 %), poor (15.00 %) and excellent (13.75 %).

**Table 4.35. Distribution of respondents according to coordination among WUAs, Irrigation and Revenue departments (n=240)**

S. No.	Coordination among WUAs, Irrigation and Revenue departments	Frequency	Percentage
1	Excellent	33	13.75
2	Good	109	45.42
3	Average	62	25.83
4	Poor	36	15.00
TOTAL		240	100

The reason could be in most of the places the WUAs, Irrigation and Revenue departments were maintain good relationships with mutual coordination among them. But in few places of tail-end areas there was no good cooperation and support from the irrigation department to WUAs. In some few places the respondents pointed that more powers were given to revenue department than the water users associations. The revenue department was collecting water cess from the farmers but, the WUAs were not getting its share from revenue department. So finally the coordination among WUAs, Irrigation and Revenue departments was maintaining at good levels with mutual cooperation.

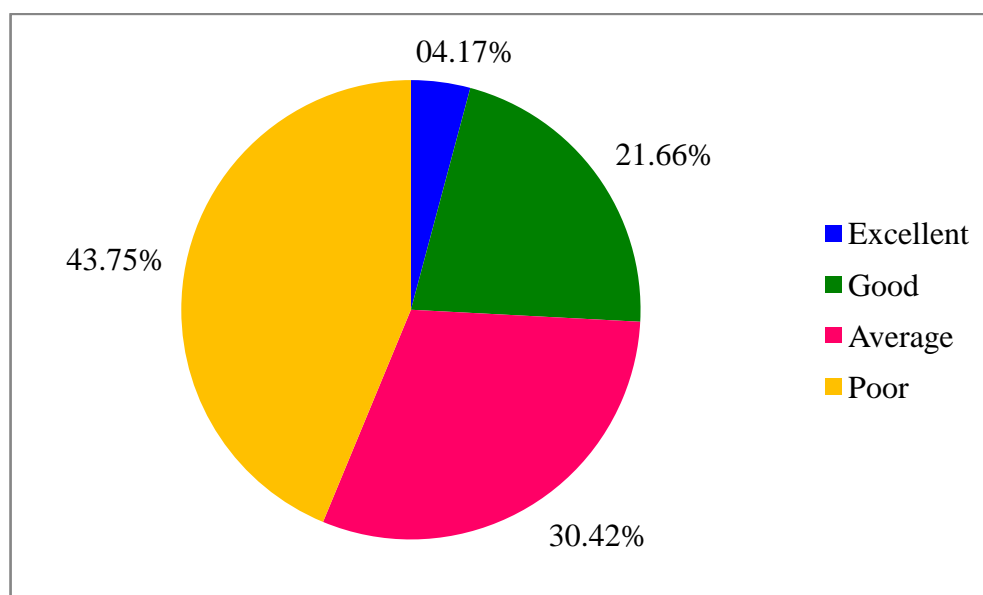


**Figure 4.30. Distribution of respondents according to coordination among WUAs, irrigation and revenue departments**

Table 4.36. and fig. 4.31 reported that the avenue plantation in Krishna delta area was poor (43.75 %) followed by average (30.42 %), good (21.66 %) and excellent (4.17 %). The reason for poor plantation was only in few places of delta area plantation was followed along the bunds of the canals. The produce of the plantation like coconut trees, vegetables, etc., was sold by conducting auction in that area and that money was used to works in that WUA jurisdiction. In some places due to the presence of green grass no particular plantation was practiced on canal bunds. Many of them were not interested to grow plantation as the canal bunds were not in required size.

**Table 4.36. Distribution of respondents according to avenue plantation along the bunds of the canal (n=240)**

S. No.	Avenue plantation along the bunds of the canal	Frequency	Percentage
1	Excellent	10	4.17
2	Good	52	21.66
3	Average	73	30.42
4	Poor	105	43.75
TOTAL		240	100



**Figure 4.31. Distribution of respondents according to avenue plantation along the bunds of the canal**

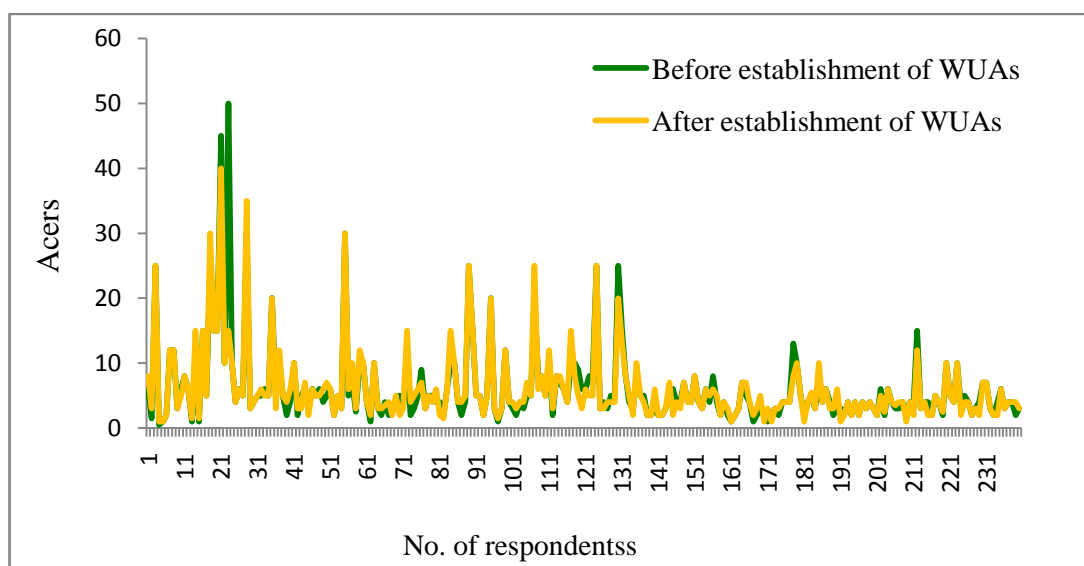
**Null hypothesis ( $H_0$ ) :** There is no difference in acreage before and after establishment of water users associations.

**Empirical hypothesis ( $H_1$ ) :** There is a difference in acreage before and after establishment of water users associations.

**Table 4.37. Distribution of respondents according to acres (n=240)**

Statistics	Before establishment of WUAs	After establishment of WUAs
Mean (ac)	6.07	6.05
Pearson Correlation	0.90	
Df	239	
t stat	0.08	
t critical two-tail	1.96	

Table 4.37. and fig. 4.32 showed the difference in acreage before and after establishment of water users associations in Krishna delta area. The average acreage before establishment of WUAs was 6.07 and after establishment of WUAs was 6.05. This might be due to majority of the respondents were medium landholders (4-10 ha). Since the t stat (0.08) value is less than t critical value the null hypothesis is accepted. Hence there is no difference in acreage.



**Figure 4.32. Distribution of respondents according to acres**

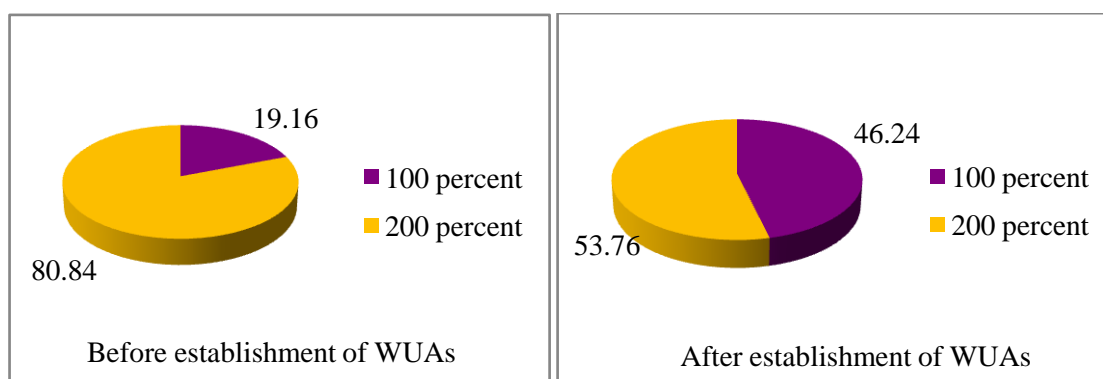
Table 4.38. and fig. 4.33 indicated the cropping intensity in Krishna delta region before and after the establishment of water users associations. The cropping intensity is referred to raising number of crops from the same field during one agricultural year. The overall cropping intensity before the establishment of water users associations was 180.41 per cent and after establishment of water users associations was 152.50 per cent.

From the table 4.38. it could be observed that there was increase in cropping intensity of 100 per cent has been increased after the establishment of WUAs (46.24 %) compared to before the establishment of WUAs (19.16 %). But the cropping intensity of 200 per cent has been decreased after the establishment of WUAs (53.76 %) compared to before the establishment of WUAs (80.84 %).

**Table 4.38. Distribution of respondents according to cropping intensity (n=240)**

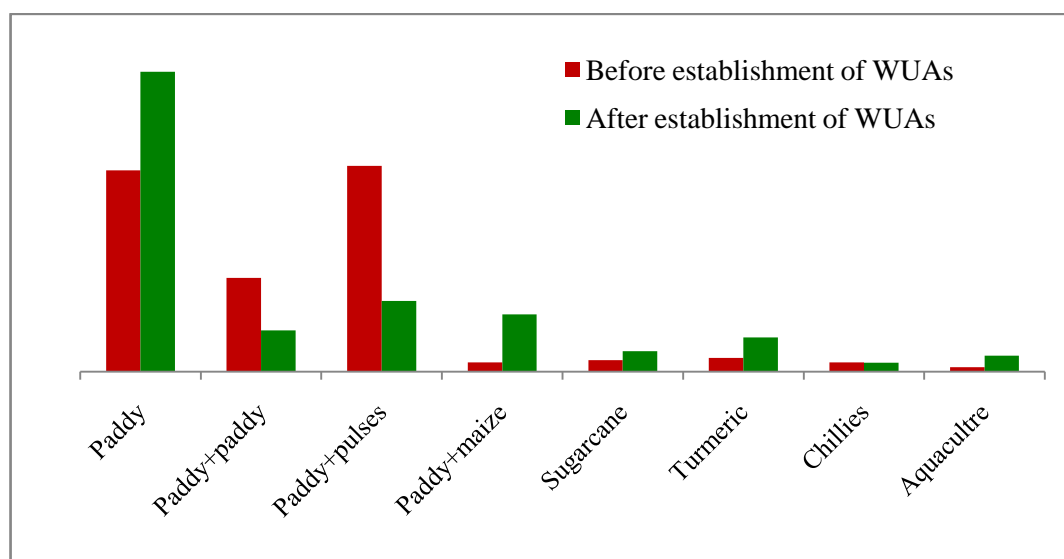
S. No.	Cropping intensity (in %)	Before establishment of WUAs		After establishment of WUAs	
		Frequency	Percentage	Frequency	Percentage
1	100 per cent	46	19.16	106	46.24
2	200 per cent	194	80.84	129	53.76
TOTAL		240	100	240	100

The probable reasons could be the change in climatic conditions and low rainfalls resulted in water scarcity to crops. However due to timely release of water and implementation of warabandhi schedule helped in supply of irrigation water to all the areas. In some tail-end areas because of these WUAs only it was made possible to cultivate at least one crop per year. Hence the cropping intensity of only one crop per year has been increased compared to two crops per year. The findings were not in line with other findings.



**Figure 4.33. Distribution of respondents according to cropping intensity**

Table 4.39. and fig. 4.34 indicated the cropping pattern in Krishna delta region before and after the establishment of water users associations. It showed that the cropping pattern was paddy + pulses at 37.50 per cent followed by paddy (36.67 %), paddy + paddy (17.08 %), turmeric (2.50 %), sugarcane (2.08 %), chillies, paddy + maize (1.67 %) and aquaculture (0.83 %) before the establishment of water users associations. Similarly it was also observed that the cropping pattern followed after the establishment of water users associations was paddy at 54.61 per cent followed by paddy + pulses (12.91 %), paddy + maize (10.41 %), paddy + paddy (7.50 %), turmeric (6.25 %), sugarcane (3.75 %), aquaculture (2.91 %) and chillies (1.66 %).



**Figure 4.34. Distribution of respondents according to cropping pattern**

**Table 4.39. Distribution of respondents according to cropping pattern (n=240)**

S. No.	Cropping pattern	Before establishment of WUAs		After establishment of WUAs	
		Frequency	Percentage	Frequency	Percentage
1	Paddy	88	36.67	131	54.61
2	Paddy + paddy	41	17.08	18	7.50
3	Paddy + pulses	90	37.50	31	12.91
4	Paddy + maize	4	1.67	25	10.41
5	Sugarcane	5	2.08	9	3.75
6	Turmeric	6	2.50	15	6.25
7	Chillies	4	1.67	4	1.66
8	Aquaculture	2	0.83	7	2.91
TOTAL		240	100	240	100

The possible reasons for changes in cropping pattern after the establishment of water users associations was loss due to YMV attack in pulses made respondents to shift from rice fallow pulses to paddy followed by maize crop. Better availability of water and increased yields resulted more number of respondents to cultivate the crops like turmeric, sugarcane and chillies. Aquaculture was also increased due to less availability of water to some of the tail-end areas and also loss in agriculture made respondents to shift from agriculture to aquaculture which resulted in better profits for them than in agriculture.

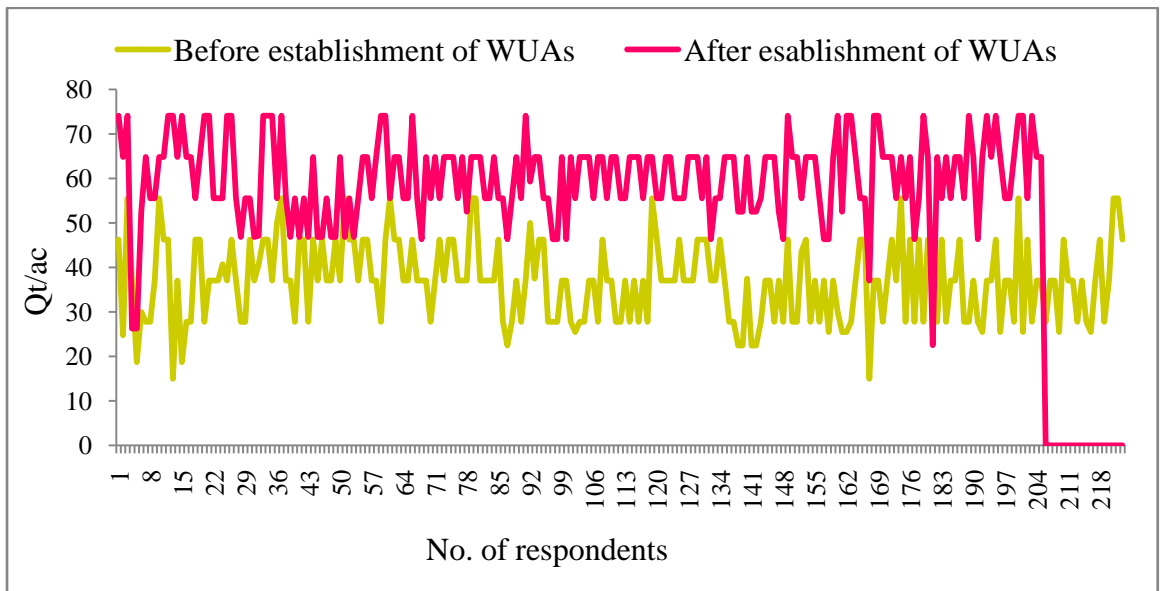
**Null hypothesis ((H<sub>0</sub>) :** There is no difference in yield of crops before and after establishment of water users associations.

**Empirical hypothesis ((H<sub>1</sub>) :** There is a difference in yield of crops before and after establishment of water users associations.

**Table 4.40. Distribution of respondents according to Yield**

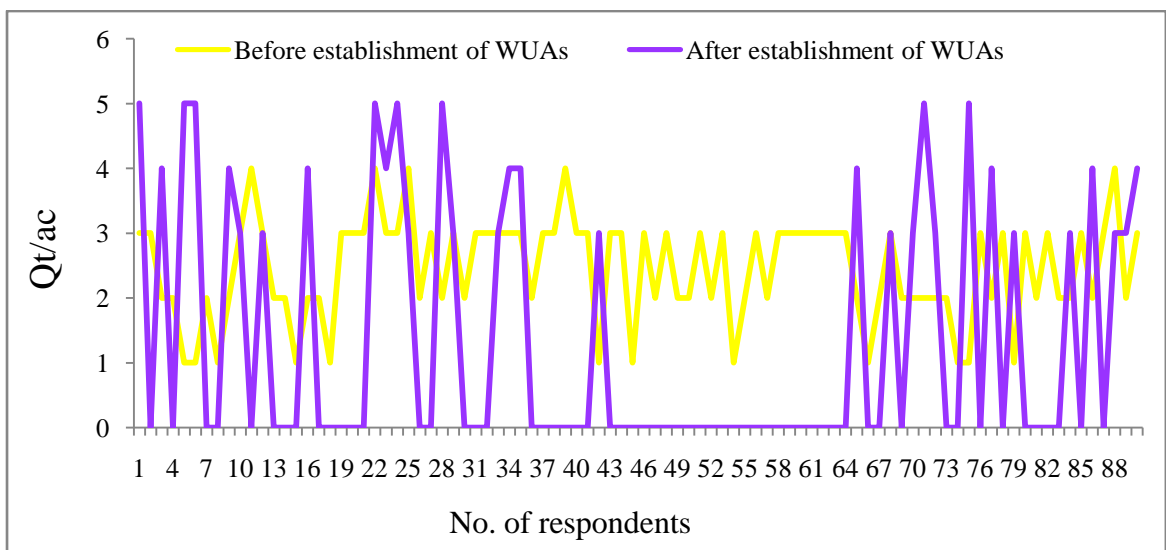
Statistics		Paddy (qt/ha)	Sugarcane (tons/ha)	Turmeric (qt/ha)	Chillies (qt/ha)	Maize (qt/ha)	Pulses (qt/ha)
Mean	Before establishment of WUAs	20	34.80	18.33	22	22	2.4
	No. of respondents	129	5	6	4	4	90
	After establishment of WUAs	32.49	50.50	27.53	20.50	33.60	3.8
	No. of respondents	149	9	15	4	25	31
Pearson Correlation		0.05	0.40	0.11	0.04	0.25	-0.08
Df		222	8	14	3	24	89
t stat		13.57	4.52	7.47	1.71	18.17	5.03
t critical two-tail		1.97	2.30	2.14	3.18	2.06	1.98

Table 4.40. and fig. 4.35, 4.36, 4.37, 4.38, 4.39 and 4.40 indicated the difference in yield of crops. Before the establishment of WUAs the average yield of paddy was 20 qt/ac, sugarcane (34.80 tons/ac), turmeric (18.33 qt/ac), maize (22 qt/ac) and pulses (2.4 qt/ac). After the establishment of WUAs the average yield of paddy was 32.49 qt/ac, sugarcane (50.50 tons/ac), turmeric (27.53 qt/ac), maize (33.60 qt/ac) and pulses (3.8 qt/ac) .was. The increase in yield was due to timely availability of sufficient water through warabandhi schedule, proper management of water, good varieties of seeds used by respondents and also favourable climatic conditions. Since the t stat value is greater than t critical value the null hypothesis is rejected. Hence there is an increase in yield of crops.

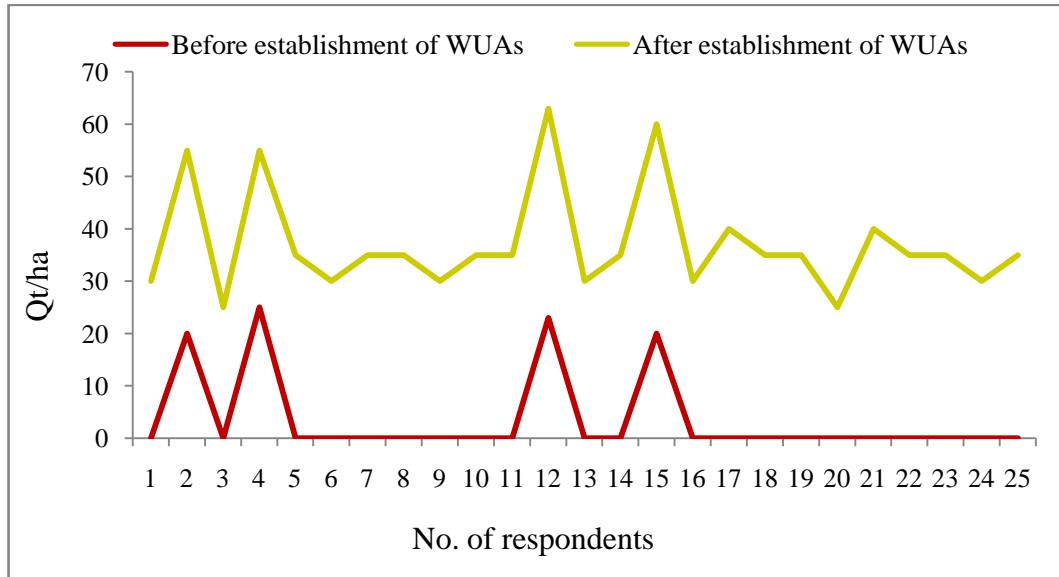


**Figure 4.35. Distribution of respondents according to yield (Paddy)**

In pulses the average yield obtained before the establishment of WUAs was 2.4 qt/ac and after the establishment of WUAs 3.8 qt/ac. Since the t stat value is greater than t critical value the null hypothesis is rejected. Hence there is an increase in yield of pulses. But there exists a negative correlation between before and after establishment of WUAs. This might be due to the majority of the respondents were discontinued growing pulses due to severe YMV attack in the field.

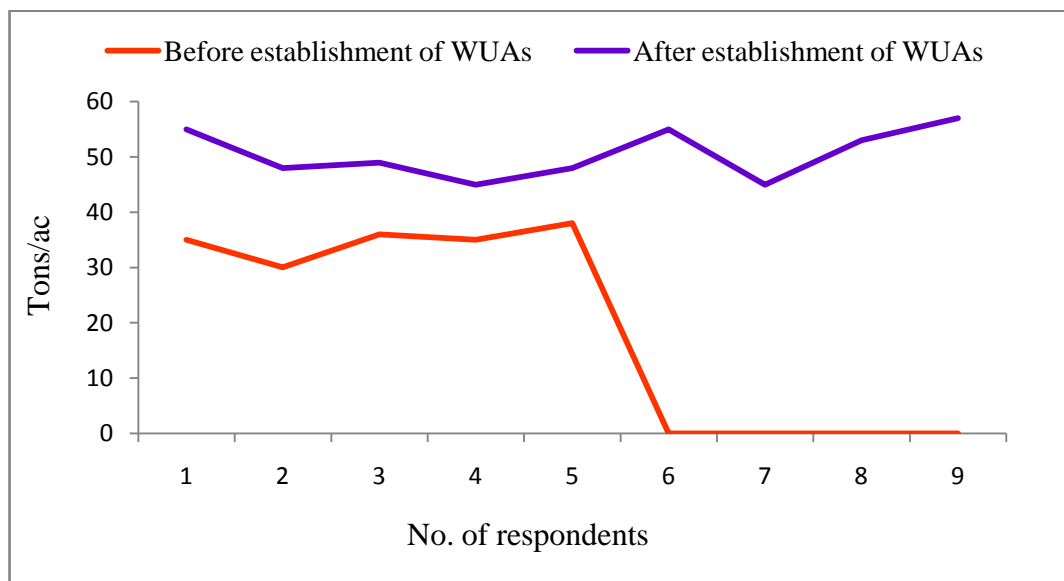


**Figure 4.36. Distribution of respondents according to yield (Pulses)**

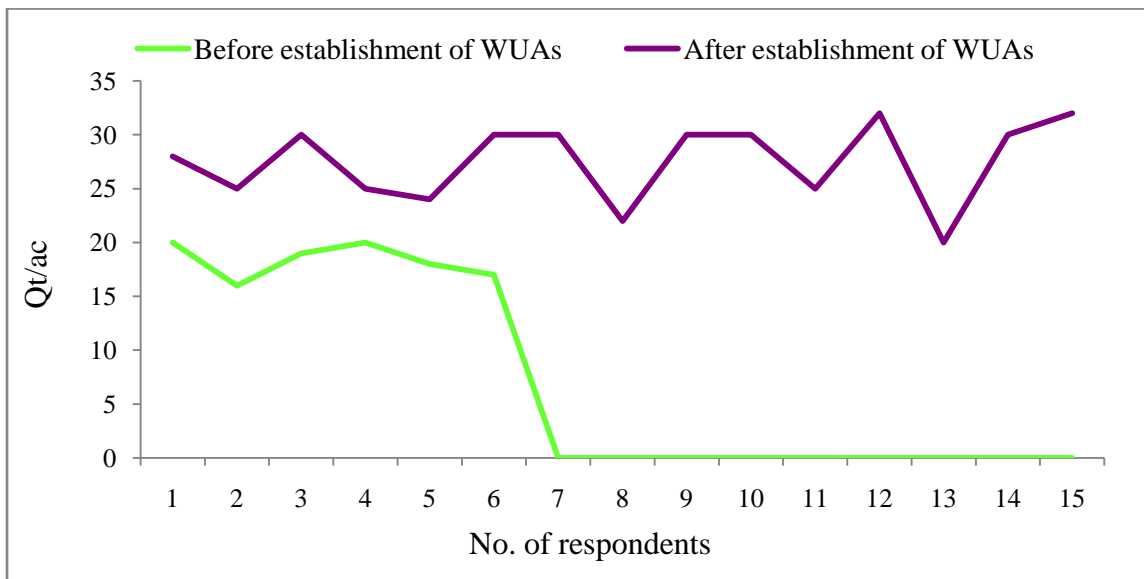


**Figure 4.37. Distribution of respondents according to yield (Maize)**

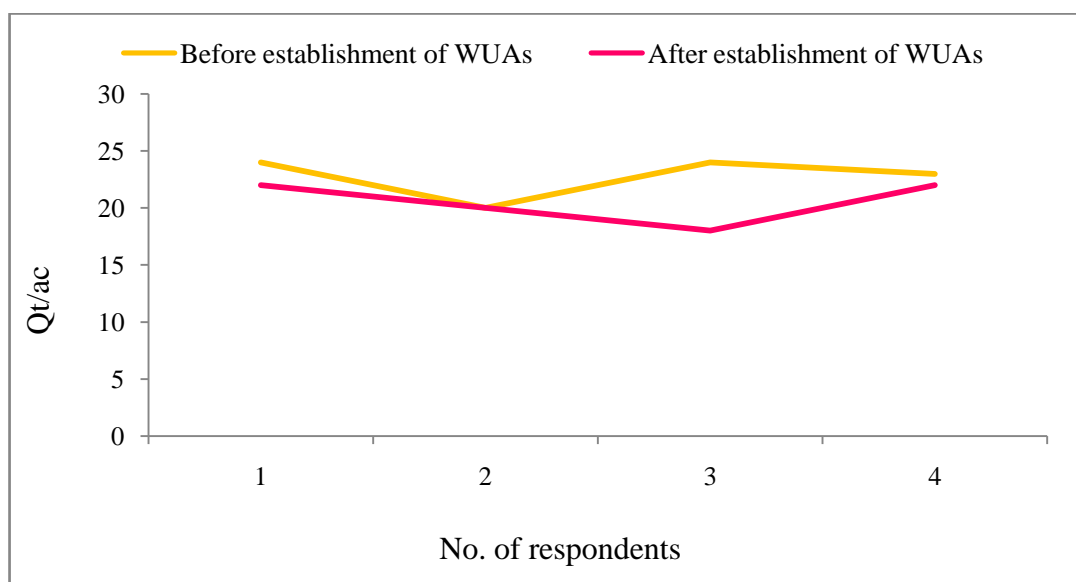
However the chilli crop being cultivated in tail-end areas of Prakasam district the average yield obtained before the establishment of WUAs was 22 qt/ac and after the establishment of WUAs 20.50qt/ac. The decrease in yield was due to since it is a tail-end area there was delay in the availability during crop season and also lack of rainfall. Since the t stat value is less than t critical value the null hypothesis is accepted and there is a much difference in yield of chilli crop.



**Figure 4.38. Distribution of respondents according to yield (Sugarcane)**



**Figure 4.39. Distribution of respondents according to yield (Turmeric)**



**Figure 4.40. Distribution of respondents according to yield (Chillies)**

**Null hypothesis (H<sub>0</sub>) :** There is no difference in income of respondents before and after establishment of water users associations.

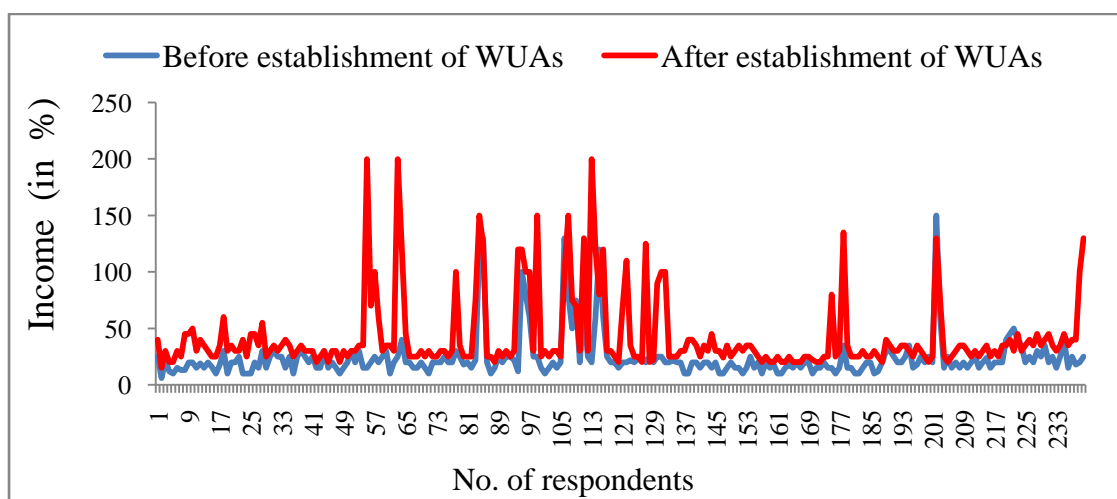
**Empirical hypothesis (H<sub>1</sub>) :** There is a difference in income of respondents before and after establishment of water users associations.

Table 4.41. and fig. 4.41 represented the income of respondents before and after establishment of water users associations. Before establishment of WUAs the average income to the respondents was Rs.24000/- and after establishment of WUAs the average income was Rs.42000/-.

**Table 4.41. Distribution of respondents according to income (n=240)**

Statistics	Before establishment of WUAs	After establishment of WUAs
Mean (in Percentage)	24.14	42.42
Benefit Cost ratio	1:1.24	1:1.42
Pearson Correlation	0.52	
df	239	
t stat	9.90	
t critical two-tail	1.96	

The increase in income was due to increased production and productivity of crop, efficient utilization of water and improved land use pattern. Since the t stat value is greater than t critical value the null hypothesis is rejected. Hence there is an increase in the income of respondents.



**Figure 4.41. Distribution of respondents according to income**

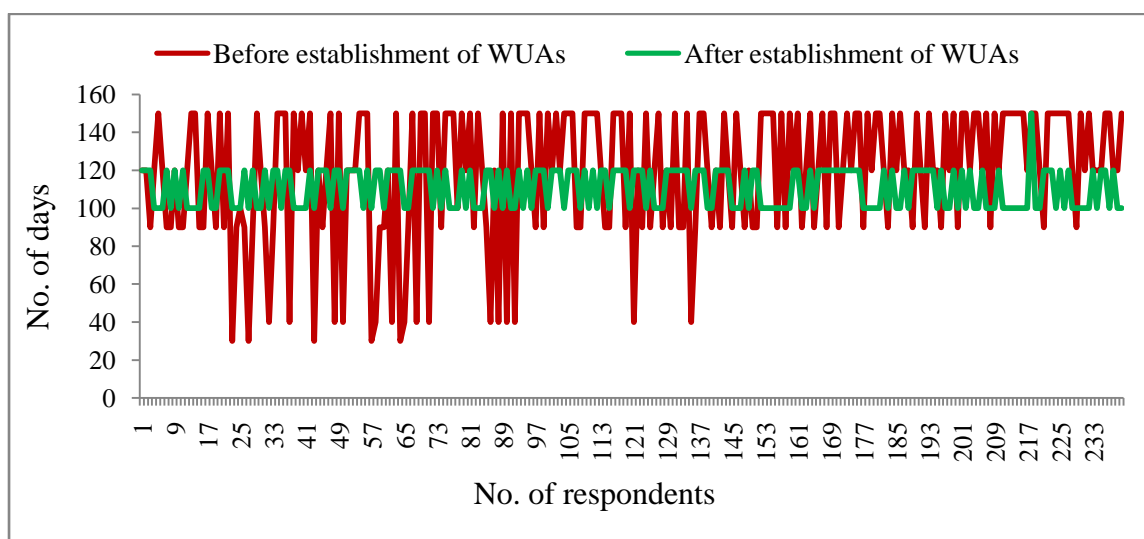
**Null hypothesis ( $H_0$ ) :** There is no difference in employment period for the respondents before and after establishment of water users associations.

**Empirical hypothesis ( $H_1$ ) :** There is a difference in employment period for the respondents before and after establishment of water users associations.

**Table 4.42. Distribution of respondents according to employment generation (n=240)**

<b>Statistics</b>	<b>Before establishment of WUAs</b>	<b>After establishment of WUAs</b>
<b>Mean (days)</b>	120	110
<b>Pearson Correlation</b>	-0.03	
<b>Df</b>	239	
<b>t stat</b>	3.61	
<b>t critical two-tail</b>	1.96	

Table 4.42. and fig. 4.42 represented the employment period (considering both agriculture labour days and employment due to WUAs) for respondents before and after establishment of water users associations. Before establishment of WUAs the average agriculture labour days to the respondents were 120 days and after establishment of WUAs both agriculture labour days and employment due to WUAs the average employment period was 110 days. Due to improved farm mechanization the agriculture labour days have been reduced and the employment have been increased due to repairs, rehabilitation and other maintenance works of canals during summer season. Hence there exists a negative correlation. Since the t stat value is greater than t critical value the null hypothesis is rejected. Hence there is difference in employment period for the respondents.

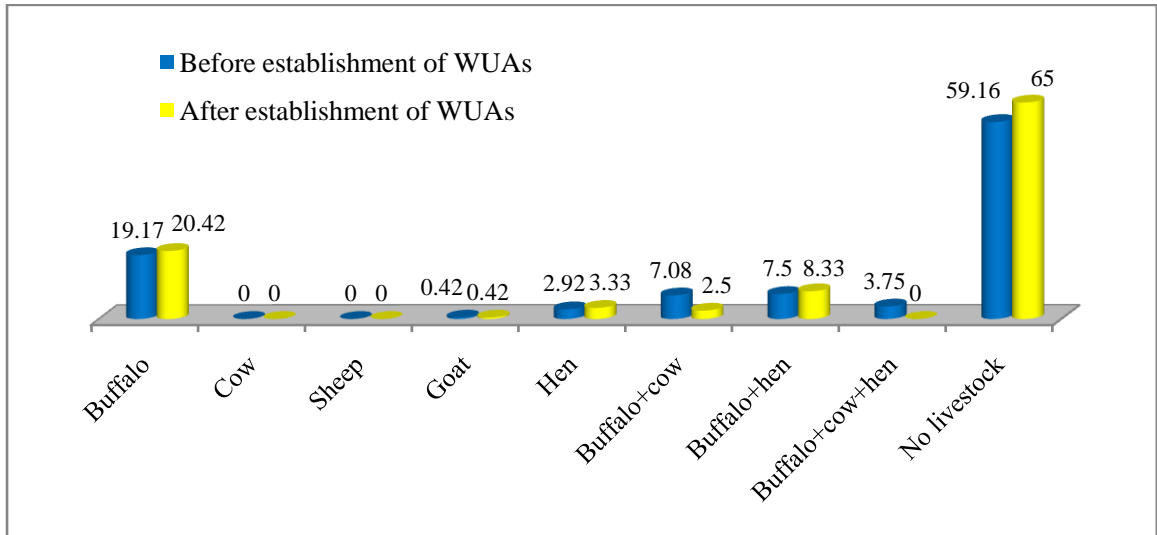


**Figure 4.42. Distribution of respondents according to employment generation**

Table 4.43. and fig. 4.43 represented the livestock possession before and after the establishment of water users associations. It was observed from the table that 59.16 per cent of them had no livestock followed by buffalo (19.17 %), buffalo + hen (7.50 %), buffalo + cow (7.08 %), buffalo + cow + hen (3.75 %), hen (2.42 %), goat (0.42 %) and no sheep and cow before the establishment of WUAs.

**Table 4.43. Distribution of respondents according to livestock possession (n=240)**

S. No.	Livestock	Before establishment of WUAs		After establishment of WUAs	
		Frequency	Percentage	Frequency	Percentage
1	Buffalo	46	19.17	49	20.42
2	Cow	0	0.00	0	0.00
3	Sheep	0	0.00	0	0.00
4	Goat	1	0.42	1	0.42
5	Hen	7	2.92	8	3.33
6	Buffalo + cow	17	7.08	6	2.50
7	Buffalo + hen	18	7.50	20	8.33
8	Buffalo +cow + hen	9	3.75	0	0.00
9	No livestock	142	59.16	156	65.00
TOTAL		240	100	240	100



**Figure 4.43. Distribution of respondents according to livestock**

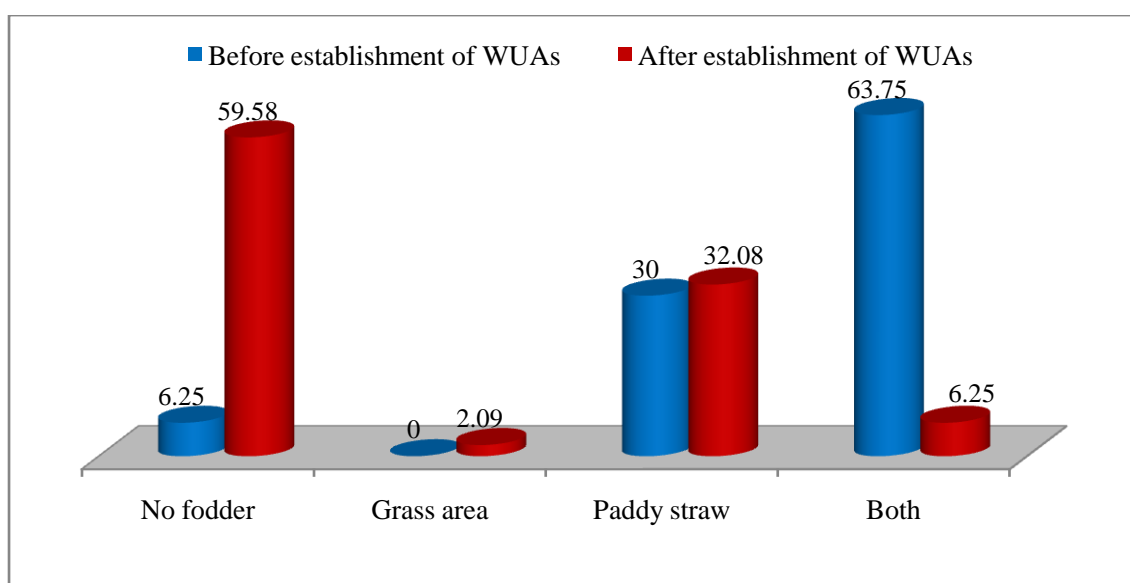
After the establishment of WUAs it was observed that 65.00 per cent of them had no livestock, buffalo (20.42 %), buffalo + hen (8.33 %), hen (3.33 %), buffalo + cow (2.50 %), goat (0.42 %) and no sheep, cow, buffalo + cow + hen. The count of respondents for not possessing livestock has been increased after the establishment of WUAs have been observed. But the number of respondents possessing livestock has been increased after the establishment of WUAs.

The possible reasons for the changes in livestock possession was though there is increase in the number of respondents possessing livestock, the count of livestock with the respondents was reduced when compared with the count of livestock before the establishment of WUAs. The main reason could be due to shortage of labour for maintaining the livestock or high wage rates for the labour. The availability of fodder for the livestock was also reduced to machine harvesting of the crop.

Table 4.44. and fig. 4.44 stated the increased fodder area after the establishment of water users associations. Both grass and paddy straw area before the establishment of WUAs was 63.75 per cent followed by paddy straw (30.00 %), no fodder availability (6.25 %) and no separate increase in grass area. But after the establishment of WUAs no fodder availability was about 59.58 per cent followed by paddy straw (32.08 %), both grass and paddy straw (6.25 %) and grass area (2.09 %).

**Table 4.44. Distribution of respondents according to increased fodder/straw availability (n=240)**

S. No.	Fodder area	Before establishment of WUAs		After establishment of WUAs	
		Frequency	Percentage	Frequency	Percentage
1	No fodder	15	6.25	143	59.58
2	Grass area	0	0.00	5	2.09
3	Paddy straw	72	30.00	77	32.08
4	Both	153	63.75	15	6.25
TOTAL		240	100	240	100



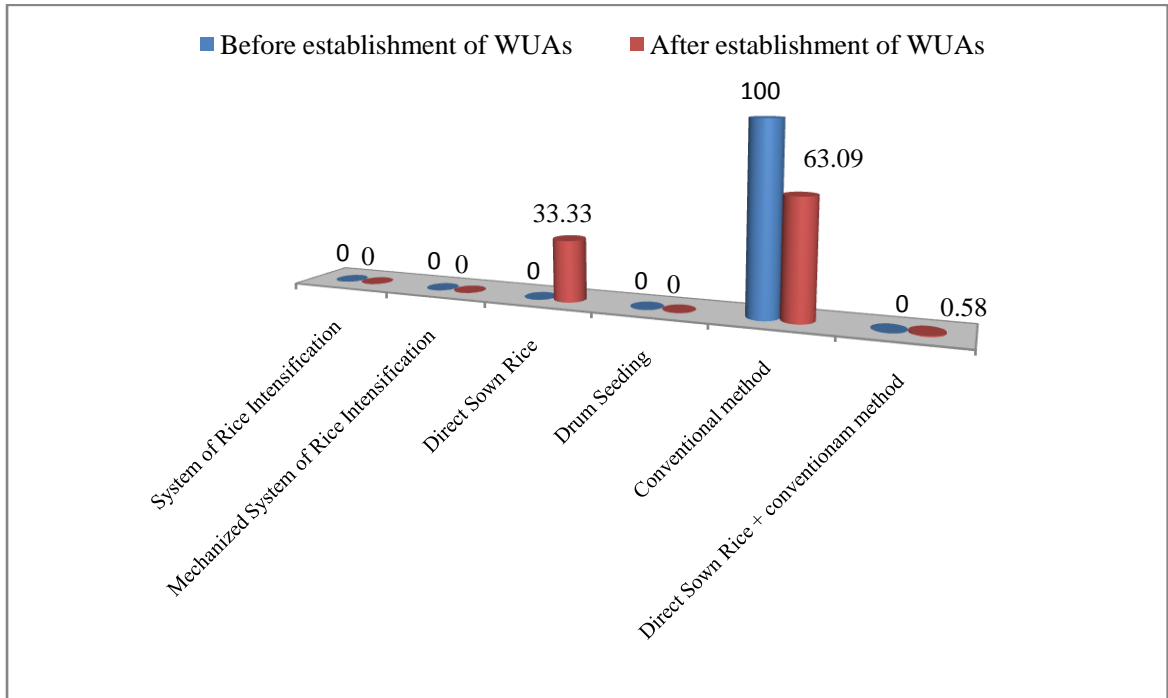
**Figure 4.44. Distribution of respondents according to increased fodder availability**

The possible reason for non availability of fodder/straw for the livestock after the establishment of WUAs increased because in most of the areas the crop was harvested with the machinery. Reduction in livestock possession, easy and timely completion of operations was also the reason for harvesting the crop with machinery and which led to reduced fodder area. The grass area and paddy straw was increased a little bit in few areas for the livestock. In some areas the machinery harvested paddy straw only providing as feed for the livestock.

Table 4.45. and fig. 4.45 indicated the sowing method followed in Krishna delta region. Before the establishment of water users associations everyone followed only the conventional method. But after the establishment of water users associations 63.09 per cent of them followed the conventional method followed by direct sown rice (33.33 %) and both conventional and direct sown rice was 4.58 per cent. Most of the respondents were following the conventional method since many years from their fore fathers. The direct sown rice method was practiced in some places of Krishna western delta area.

**Table 4.45. Distribution of respondents according to sowing method**  
(n=240)

S. No.	Sowing	Before establishment of WUAs		After establishment of WUAs	
		Frequency	Percentage	Frequency	Percentage
1	System of Rice Intensification	0	0.00	0	0.00
2	Mechanized System of Rice Intensification	0	0.00	0	0.00
3	Direct Sown Rice	0	0.00	80	33.33
4	Drum Seeding	0	0.00	0	0.00
5	Conventional method	240	100	149	63.09
6	Conventional method + Direct Sown Rice	0	0.00	11	4.58
TOTAL		240	100	240	100



**Figure 4.45. Distribution of respondents according to sowing method**

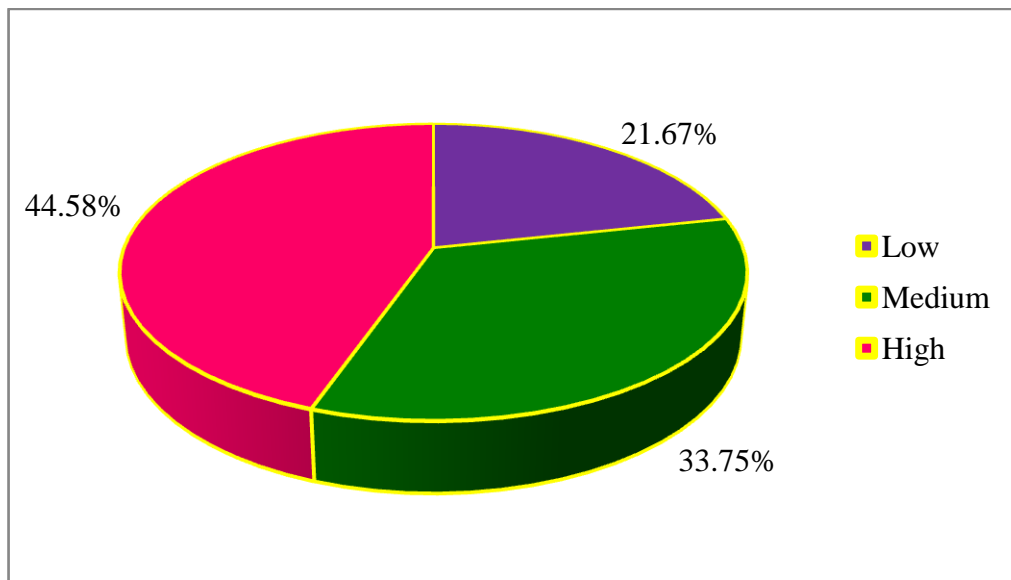
The possible reason for changed sowing method was for efficient use of water, saving labour charges, time and energy finally reduced cost of cultivation. It also helps in better growth of succeeding crops. These aspects have motivated some of the respondents to follow direct sown rice method of sowing. The findings in the above stated direct changes were in line with Abirami *et al.* (2014), Patel (2015) and Pawariya and Chauhan (2017).

## **B) INDIRECT CHANGES**

**Table 4.46. Distribution of respondents according to indirect changes (n=240)**

<b>S. No.</b>	<b>Class interval</b>	<b>Frequency</b>	<b>Percentage</b>
1	Low indirect changes (44-52)	102	42.50
2	Medium indirect changes (53-61)	115	47.92
3	High indirect changes (62-70)	23	9.58
<b>TOTAL</b>		<b>240</b>	<b>100</b>

Table 4.46. and fig. 4.46 represented the indirect changes that have occurred due to the establishment of water users associations in Krishna delta region. The indirect changes were majority of them had medium (47.92 %) followed by high (42.50 %) and low (9.58 %) indirect changes.



**Figure 4.46. Distribution of respondents according to indirect changes**

**Table 4.47. Distribution of respondents according to content analysis of indirect changes (n=240)**

S. No.	Statements	Agree		Undecided		Disagree	
		F	%	F	%	F	%
1.	Increased credit needs	136	56.66	58	24.17	46	19.17
2.	Enhancement of land values	171	71.25	65	27.08	4	1.67
3.	Enhancement of availability of water	129	53.75	72	30.00	39	16.25
4.	Increased wage rates	176	73.33	60	25.00	4	1.67
5.	Reduction in cost of cultivation	58	24.17	39	16.25	143	59.58
6.	Change in economic status	72	30.00	66	27.50	102	42.50
7.	Change in social life	131	54.58	59	24.58	50	20.84
8.	Decrease in migration of farmers	107	44.58	72	30.00	61	25.42
9.	Increased education standards of children	56	23.34	86	35.83	98	40.83
10.	Increased assets	68	28.33	61	25.42	111	46.25
11.	Improved communication behaviour	130	54.17	84	35.00	26	10.83
12.	Development of self respect	106	44.17	94	39.17	40	16.66
13.	Autonomy in decision making	128	53.33	66	27.50	46	19.17
14.	Less water theft	145	60.42	38	15.83	57	23.75
15.	Increased personal empowerment	130	54.17	79	32.92	31	12.92
16.	Increased knowledge on WUE	157	65.42	53	22.08	30	12.50
17.	Improved mechanization	216	90.00	21	8.75	3	1.25
18.	Improved land use pattern	160	66.66	49	20.42	31	12.92
19.	Conjunctive use of canal water, ground water and drain water	124	51.67	86	35.83	30	12.50
20.	Change in knowledge	139	57.92	64	26.66	37	15.42
21.	Change in attitude	164	68.33	43	17.92	33	13.75
22.	Change in skill	111	46.25	75	31.25	54	22.50
23.	Decline in water quality	61	25.42	51	21.25	128	53.33
24.	Increased migration of birds	64	26.67	45	18.75	131	54.58
25.	Rise in ground water levels	9	3.75	144	60.00	87	36.25
26.	Increased fish/aquaculture	134	55.83	67	27.92	39	16.25

Table 4.47. indicated the indirect changes that have occurred with the establishment of water users associations. From this table it was observed that majority of the respondents were agreed that there was improved mechanization (90.00 %), increased wage rates (73.33 %), enhancement of land values (71.72 %), change in attitude (68.533 %), improved land use pattern (66.66 %), increased knowledge on water use efficiency (65.42 %), less water theft (60.42 %), change in knowledge (57.92 %), increased credit needs (56.66 %), increased fish/aquaculture (55.83 %), change in social life (54.58 %), improved communication behaviour and increased personal empowerment (54.17 %), enhancement of availability of water (53.75 %), autonomy in decision making (53.33 %), conjunctive use of canal water, ground water and drain water (51.57 %), change in skill (46.25 %), decrease in migration of farmers (44.58 %) and development of self respect (44.17 %).

About 60.00 per cent of the respondents were undecided that whether there was rise in ground water levels.

Nearly 59.58 per cent of the respondents were disagreed that there was reduction in cost of cultivation, increased migration of birds (54.58 %), decline in water quality (53.33 %), increased assets (46.25 %), change in economic status (42.50 %) and increased education standards of children (40.83 %).

The reasons behind the indirect changes were the mechanization was highly improved with the latest technologies, wages rates were very high due to shortage of labour, land values were increased because of better availability of resources, increased real estate business and the delta region is nearer to the new capital Amaravathi after bifurcation of the state. Attitude of the respondents has changed highly to make better use of available resources and to gain profits, land use pattern was improved a lot in the sense of agriculture, aquaculture and for commercial purposes, Knowledge on water use efficiency was increased with the better communication and contacts with the irrigation and agriculture departments. Less water theft was due to equal distribution of water, timely availability of water, proper management of the system and availability of sufficient water to all the farmers. Increased credit needs due to purchasing of inputs, labour charges and also personal needs.

Change in social life in terms of increased knowledge/ communication, improved economic status and increased respect in society. Communication behaviour was improved with the irrigation and agriculture departments, people's representatives as well as with the society and increased personal empowerment. Enhancement of availability of water was for domestic and industrial purposes. There was no reduction in cost of cultivation due to high cost of inputs, high wage rates for labour either working manually or with machinery. No increase in assets due to high land values and poor financial conditions. Though there is increased income but there was no change in economic status because of high cost of cultivation, less savings and other increased personal expenditure. The findings were in line with the findings of Argade (2010) and Badatya and Mohapatra (2010).

#### **4.5 RELATIONSHIP BETWEEN PERSONAL, SOCIO-ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE FUNCTIONARIES WITH THEIR OPINION AND DIRECT AND INDIRECT CHANGES**

##### **4.5.1 Association between personal, socio- economic and psychological characteristics of the functionaries with the opinion of the respondents of Water Users Associations**

The results of chi-square tests of sixteen personal, socio- economic and psychological characteristics of the respondents with the opinion are presented in the table 4.47.

**Null Hypothesis ( $H_0$ ) :** There was no significant association between personal, socio- economic and psychological characteristics of the respondents with the opinion and both of these are independent.

**Empirical Hypothesis ( $H_1$ ) :** There was a significant association between personal, socio- economic and psychological characteristics of the respondents with the opinion and both of these are dependent.

From table 4.48. it could be observed that age, education, land holding, extension contact, source of information, training received, innovativeness, risk orientation, economic orientation and management orientation showed non-

significant association with the opinion of the respondents. Social participation, perceived work load, information and communication behaviour, cropping pattern, decision making, achievement motivation and management orientation showed significant association with the opinion of the respondents.

**Table 4.48. Association between personal, socio- economic and psychological characteristics of the respondents and opinion (n=240)**

S. No.	Independent variables	Chi square test
1	Age	2.105 <sup>NS</sup>
2	Education	2.105 <sup>NS</sup>
3	Land holding	8.519 <sup>NS</sup>
4	Extension contact	2.244 <sup>NS</sup>
5	Social participation	12.070*
6	Source of information	7.158 <sup>NS</sup>
7	Training received	7.930 <sup>NS</sup>
8	Perceived work load	14.964*
9	Information and communication behaviour	6.918*
10	Cropping pattern	93.881*
11	Decision making	24.652*
12	Innovativeness	6.586 <sup>NS</sup>
13	Risk orientation	5.005 <sup>NS</sup>
14	Achievement motivation	19.720*
15	Economic orientation	6.668 <sup>NS</sup>
16	Management orientation	20.408*

Table 4.49. showed the relationship between age and opinion. With respect to age about 3.80 per cent of young age followed by middle aged (6.20 %) and none of them from old aged respondents had less favourable opinion towards water users associations. Nearly 22.10 per cent of young age followed by middle age (20.40 %) and old age (0.80 %) had moderately favourable opinion. About 23.30 per cent of middle age followed by young age (22.50 %) and old age (0.80 %) had highly favourable opinion towards water users associations.

**Table 4.49. Distribution of respondents according to their age with respect to opinion (n=240)**

OPINION Vs AGE						
OPINION	Category		AGE			Total
			Young	Middle	Old	
Less favourable	F		9	15	0	24
	%		3.80	6.20	0	10.00
Moderately favourable	F		53	49	2	104
	%		22.10	20.40	0.80	43.30
Highly favourable	F		54	56	2	112
	%		22.50	23.30	0.80	46.70
Total		F	116	120	4	240
		%	48.30	50.00	1.70	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.105 <sup>a</sup>	4	.716
Likelihood Ratio	2.497	4	.645
Linear-by-Linear Association	.127	1	.721
N of Valid Cases	240		

Since the chi-square calculated value (2.105) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between age and opinion. Majority of them were middle aged respondents but the age of them did not show any significant association with their opinion. The findings were in line with the findings of Kishore (2006).

**Table 4.50. Distribution of respondents according to their education with respect to opinion**

**(n=240)**

<b>OPINION Vs EDUCATION</b>										
	<b>Category</b>		<b>EDUCATION</b>						<b>Total</b>	
			<b>Illiterate</b>	<b>Primary school</b>	<b>Secondary school</b>	<b>High school</b>	<b>Inter-Mediate</b>	<b>Graduation</b>		<b>Post graduation</b>
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	5	4	5	6	4	0	0	24
		<b>%</b>	2.10	1.70	2.10	2.50	1.70	0.00	0.00	10.00
	<b>Moderately favourable</b>	<b>F</b>	14	22	15	26	17	10	0	104
		<b>%</b>	5.80	9.20	6.20	10.80	7.10	4.20	0.00	43.30
	<b>Highly favourable</b>	<b>F</b>	22	22	16	21	19	10	2	112
		<b>%</b>	9.20	9.20	6.70	8.80	7.90	4.20	0.8	46.70
	<b>Total</b>	<b>F</b>	41	48	36	53	40	20	2	240
		<b>%</b>	17.10	20.00	15.00	22.10	16.70	08.30	0.80	100

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	2.105 <sup>a</sup>	4	.716
Likelihood Ratio	2.497	4	.645
Linear-by-Linear Association	.127	1	.721
N of Valid Cases	240		

Table 4.50. indicated the association between education and opinion. With respect to education majority (2.50 %) of the respondents possessed high school education followed by secondary school, illiterate (2.10 %) and intermediate, primary school had less favourable opinion. Nearly 10.80 per cent of them with high school education followed by (9.20 %), secondary school (6.20 %), illiterate (5.80 %) and graduation (4.20 %) had moderately favourable opinion. About 09.20 per cent of them from primary and illiterate, followed by high school (8.80 %), intermediate (7.10 %), secondary school (6.20 %) and post graduation had (0.80 %) had highly favourable opinion towards water users associations.

Since the chi-square calculated value (2.105) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between education and opinion. The reason might be majority of the respondents possessed high school education followed by primary school education. There may be many reasons to possess less education like financial or personal problems, less awareness, etc. But most of the functionaries were middle aged who were present since the establishment of WUAs and well familiar with the functions of WUAs. So this could be the reason to have favourable opinion towards WUAs though the education did not show any association with their opinion. The findings were in line with the findings of Jeeva *et al.* (2006).

Table 4.51. denoted the association between landholding and opinion. With respect to landholding 3.30 per cent of the respondents were medium and semi-medium landholders followed by small (2.10 %), large (0.80 %) and marginal (0.40 %) landholders had less favourable opinion. About 17.50 per cent of them were medium landholders followed by semi-medium (11.70 %), large (7.50 %), small (5.00 %) and marginal (1.70 %) landholders had moderately favourable opinion. Nearly 16.20 per cent of them were medium landholders followed by semi-medium (13.80 %), large (10.80 %), small (4.20 %) and marginal (1.70 %) landholders had highly favourable opinion towards water users associations.

**Table 4.51. Distribution of respondents according to their landholding with respect to opinion (n=240)**

OPINION Vs LAND HOLDING								
OPINION	Category		LAND HOLDING					Total
			Marginal	Small	Semi-medium	Medium	Large	
Less favourable	F		1	5	8	8	2	24
	%		0.40	2.10	3.30	3.30	0.80	10.00
Moderately favourable	F		4	12	28	42	18	104
	%		1.70	5.00	11.70	17.50	7.50	43.30
Highly favourable	F		4	26	33	39	10	112
	%		1.70	10.80	13.80	16.20	4.20	46.70
Total	F		9	43	69	89	30	240
	%		3.80	17.90	28.80	37.10	12.50	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.519 <sup>a</sup>	8	.384
Likelihood Ratio	8.663	8	.372
Linear-by-Linear Association	1.356	1	.244
N of Valid Cases	240		

Since the chi-square calculated value (8.519) is less than the table value (15.507) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between landholding and opinion. As majority of them were medium and semi-medium landholders, their dependence and intention is to obtain irrigation from the water courses which could be possible through water users associations. This might be the reason for favourable opinion despite of their farm size. The findings were in line with the findings of Thaker and Khare (2003) and Uddin *et al.* (2008).

Table 4.52. indicated the association between the extension contact and opinion. With respect to extension contact 5.40 per cent of the respondents with medium extension contact followed by low (4.20 %) and high (0.40 %) had less favourable opinion. About 25.40 per cent of the respondents with medium extension contact followed by low (17.10 %) and high (0.80 %) had moderately favourable opinion. Nearly 27.90 per cent of the respondents with medium extension contact followed by low (16.20 %) and high (2.50 %) had highly favourable opinion towards water users associations.

**Table 4.52 Distribution of respondents according to their extension contact with respect to opinion (n=240)**

<b>OPINION Vs EXTENSION CONTACT</b>						
	Category	EXTENSION CONTACT			Total	
		Low	Medium	High		
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	10	13	1	24
		<b>%</b>	4.20	5.40	0.40	10.00
	<b>Moderately favourable</b>	<b>F</b>	41	61	2	104
		<b>%</b>	17.10	25.40	0.80	43.30
	<b>Highly favourable</b>	<b>F</b>	39	67	6	112
		<b>%</b>	16.20	27.90	2.50	46.70
<b>Total</b>		<b>F</b>	90	141	9	240
		<b>%</b>	37.50	58.80	3.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.244 <sup>a</sup>	4	.691
Likelihood Ratio	2.357	4	.670
Linear-by-Linear Association	1.045	1	.307
N of Valid Cases	240		

Since the chi-square calculated value (2.244) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between extension contact and opinion. The reason might be the respondents including farmers in that particular jurisdiction were mostly in contact with the president and vice-president of WUAs to obtain information on water releasing and closing dates, digging or rehabilitation of channels etc. But the officials of irrigation and agriculture departments were rarely in contact with them as they were in busy with their administration or other works. This made possible to have favourable opinion but non-significant association between two attributes. The findings were in line with the findings of Reddy (2003).

**Table 4.53. Distribution of respondents according to their social participation with respect to opinion (n=240)**

<b>OPINION Vs SOCIAL PARTICIPATION</b>						
	<b>Category</b>		<b>SOCIAL PARTICIPATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	0	4	20	24
		<b>%</b>	0.00	1.70	8.30	10.00
	<b>Moderately favourable</b>	<b>F</b>	1	2	101	104
		<b>%</b>	0.40	0.80	42.10	43.30
	<b>Highly favourable</b>	<b>F</b>	0	04	108	112
		<b>%</b>	0.00	1.70	45.00	46.70
<b>Total</b>		<b>F</b>	1	10	229	240
		<b>%</b>	0.40	4.20	95.40	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.070 <sup>a</sup>	4	.017
Likelihood Ratio	8.864	4	.065
Linear-by-Linear Association	3.329	1	.068
N of Valid Cases	240		

Table 4.53. represented the association between social participation and opinion. With respect to social participation 08.30 per cent of the respondents with high followed by medium (1.70 %) and none of them from low social participation had less favourable opinion. About 42.10 per cent of the respondents with high social participation followed by medium (0.80 %) and low (0.40 %) had moderately favourable opinion. Nearly 45.00 per cent of the respondents with high social participation followed by medium (1.70 %) had highly favourable opinion towards water users associations.

Since the chi-square calculated value (12.070) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between social participation and opinion. As 95.40 per cent the respondents had high social participation in water users associations there was a significant association between two

attributes. Their participation would help them to involve in discussing and solving the disputes, works to be carried out in their jurisdiction and proper management of irrigation system. The findings were in line with the findings of Chandra *et al.* (2000) and Arifullah ((2014).

**Table 4.54. Distribution of respondents according to their source of information with respect to opinion (n=240)**

OPINION Vs SOURCE OF INFORMATION						
OPINION	Category		SOURCE OF INFORMATION			Total
			Low	Medium	High	
	Less favourable	F	4	15	5	24
		%	1.70	6.20	2.10	10.00
	Moderately favourable	F	24	60	20	104
		%	10.00	25.00	8.30	43.30
	Highly favourable	F	11	73	28	112
		%	4.60	30.40	11.70	46.70
Total	F	39	148	53	240	
	%	16.20	61.70	22.10	100	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.158 <sup>a</sup>	4	.128
Likelihood Ratio	7.287	4	.121
Linear-by-Linear Association	2.984	1	.084
N of Valid Cases	240		

Table 4.54. stated the association between source of information and opinion. With respect to source of information 6.20 per cent of the respondents with medium source of information followed by high (2.10 %) and low (1.70 %) had less favourable opinion. Nearly 25.00 per cent of the respondents with medium source of information followed by high (08.30 %) and low (10.00 %) had moderately favourable opinion. About 30.40 per cent of the respondents with medium source of information followed by high (11.70 %) and low (4.60 %) had highly favourable opinion towards water users associations.

Since the chi-square calculated value (7.158) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between source of information and

opinion. As most of them had less educational qualification, less exposure to mass media and also the major source of information for them were only the representatives of WUAs, all these made reasons to have non-significant association between two attributes. The findings were in line with the findings of Chandra *et al.* (2000).

**Table 4.55. Distribution of respondents according to their training received with respect to opinion (n=240)**

OPINION Vs TRAINING RECEIVED									
	Category		TRAINING RECEIVED					Total	
			No training	1 training	2 trainings	3 trainings	4 trainings		5 trainings
OPINION	Less favourable	F	3	6	10	5	0	0	24
		%	1.20	2.50	4.20	2.10	0.00	0.00	10.00
	Moderately favourable	F	19	20	41	19	04	01	104
		%	7.90	8.30	17.10	7.90	1.70	0.40	43.30
	Highly favourable	F	18	25	32	26	7	4	112
		%	7.50	10.40	13.30	10.80	2.90	1.70	46.70
Total	F	40	51	83	50	11	5	240	
	%	16.70	21.20	34.60	20.80	4.60	2.10	100	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.930 <sup>a</sup>	10	.636
Likelihood Ratio	9.456	10	.489
Linear-by-Linear Association	1.346	1	.246
N of Valid Cases	240		

Table 4.55. indicated the association between training received and opinion. With respect to training received 2.50 per cent of the respondents received 2 trainings followed by 1 training (2.50 %), 3 trainings (2.10 %) and no training received (1.20 %) respondents had less favourable opinion. About 17.10 per cent of respondents received 2 trainings followed by 1 training (8.30 %), 3 trainings (7.90 %), no training received (7.90 %), 4 trainings (1.70 %) and 5 trainings (0.40 %) received respondents had moderately favourable opinion. Similarly 13.30 per cent of respondents received 2 trainings followed by 3

trainings (10.80 %), 1 training (10.40 %), no training received (7.50 %), 4 trainings (2.90 %) and 5 trainings (1.70 %) received respondents had highly favourable opinion towards water users associations.

Since the chi-square calculated value (7.930) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between training received and opinion. Training plays a vital role increasing knowledge, changing attitudes, builds confidence. But the respondents have attended very less number of trainings. It might be due to their uninterest or unavailability at the time of trainings. Besides this the irrigation department also failed to conduct adequate trainings to the respondents on proper management of irrigation system. This could be the reason to have non-significant association between the two attributes. The findings were in line with the findings of Jeeva *et al.* (2006).

Table 4.56. stated the association between perceived workload and opinion. With respect to perceived workload 05.80 per cent of the respondents with medium perceived workload followed by high (2.50 %) and low (1.70 %) had less favourable opinion. Nearly 17.10 per cent of the respondents with low perceived workload followed by high (14.60 %) and medium (11.70 %) had moderately favourable opinion. About 20.40 per cent of the respondents with medium perceived workload followed by high (2.50 %) and low (1.70 %) had highly favourable opinion.

**Table 4.56. Distribution of respondents according to their perceived workload with respect to opinion (n=240)**

<b>OPINION Vs PERCEIVED WORKLOAD</b>						
	<b>Category</b>		<b>PERCEIVED WORKLOAD</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	4	14	6	24
		<b>%</b>	1.70	5.80	2.50	10.00
	<b>Moderately favourable</b>	<b>F</b>	41	28	35	104
		<b>%</b>	17.10	11.70	14.60	43.30
	<b>Highly favourable</b>	<b>F</b>	24	49	39	112
		<b>%</b>	10.00	20.40	16.20	46.70
<b>Total</b>		<b>F</b>	69	91	80	240
		<b>%</b>	28.80	37.90	33.30	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.964 <sup>a</sup>	4	.005
Likelihood Ratio	14.954	4	.005
Linear-by-Linear Association	1.247	1	.264
N of Valid Cases	240		

Since the chi-square calculated value (14.964) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between perceived workload and opinion. Canal maintenance is the major work ahead for the respondents in which the presidents or vice-presidents would involve for 2-3 months before the release of water into canals after that the work pressure would be reduced besides that monitoring the flow of water was done regularly by the representatives at all levels like WUA, DC and PC jurisdiction by the concerned representatives. Canal maintenance works during summer, preparation of warabndhi schedule, proper monitoring of water flow all these will influence the availability of sufficient water to the fields during crop season. Hence more effective the works done by the respondents higher will be the sufficient water quantity received by them. So this might be the reason to have favourable opinion and significant association between two attributes. The findings were in line with the findings of Raju (2000).

Table 4.57. indicated the association between information and communication behaviour and opinion. With respect to information and communication behaviour 03.80 per cent of the respondents with medium followed by low (6.20 %) and none of them from high information and communication behaviour had less favourable opinion. About 21.70 per cent of the respondents with medium followed by low (19.60 %) and high (2.10 %) information and communication behaviour had moderately favourable opinion. Nearly 52.90 per cent of the respondents with medium followed by low (42.50 %) and high (04.60 %) information and communication behaviour had highly favourable opinion towards water users associations.

**Table 4.57. Distribution of respondents according to their information and communication behaviour with respect to opinion (n=240)**

OPINION Vs INFORMATION AND COMMUNICATION BEHAVIOUR						
OPINION	Category		INFORMATION AND COMMUNICATION BEHAVIOUR			Total
			Low	Medium	High	
	Less favourable	F	15	9	0	24
%		6.20	3.80	0.00	10.00	
Moderately favourable	F	47	52	5	104	
	%	19.60	21.70	2.10	43.30	
Highly favourable	F	40	66	6	112	
	%	16.70	27.50	2.50	46.70	
Total		F	102	127	11	240
		%	42.50	52.90	4.60	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.918 <sup>a</sup>	4	.140
Likelihood Ratio	7.886	4	.096
Linear-by-Linear Association	6.058	1	.014
N of Valid Cases	240		

Since the chi-square calculated value (6.918) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between information and communication behaviour and opinion. As there is medium extension contact and source of information towards water management the information and communication behaviour of respondents have not showed any association between two attributes. The findings were not in line with the findings of others.

Table 4.58. stated the association between cropping pattern and opinion. With respect to cropping pattern 7.00 per cent of respondents cultivating paddy followed by chillies (1.70 %) and aquaculture (1.30 %) had less favourable opinion. About 29.60 per cent of respondents cultivating paddy followed by paddy + pulses (4.20 %), paddy + paddy (3.80 %), paddy + maize (2.10 %) and 1.20 per cent of sugarcane, turmeric and aquaculture had moderately favourable

**Table 4.58. Distribution of respondents according to their cropping pattern with respect to opinion**

**(n=240)**

<b>OPINION Vs CROPPING PATTERN</b>											
	Category	<b>CROPPING PATTERN</b>									
		<b>Paddy</b>	<b>Paddy + Paddy</b>	<b>Paddy + Pulses</b>	<b>Paddy + Maize</b>	<b>Sugarcane</b>	<b>Turmeric</b>	<b>Chillies</b>	<b>Aquaculture</b>	<b>Total</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	17	0	0	0	0	0	4	3	24
		<b>%</b>	07.00	0.00	0.00	0.00	0.00	0.00	1.70	1.30	10.00
	<b>Moderately favourable</b>	<b>F</b>	71	9	10	5	3	3	0	3	104
		<b>%</b>	29.60	3.80	4.20	2.10	1.20	1.20	0.00	1.20	43.30
	<b>Highly favourable</b>	<b>F</b>	43	9	21	20	6	12	0	1	112
		<b>%</b>	17.90	3.80	8.80	8.30	2.50	5.00	0.00	0.40	46.70
<b>Total</b>		<b>F</b>	131	18	31	25	9	15	4	7	240
		<b>%</b>	54.60	7.50	12.90	10.40	3.80	6.20	1.70	2.90	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	93.881 <sup>a</sup>	18	.000
Likelihood Ratio	86.214	18	.000
Linear-by-Linear Association	.025	1	.874
N of Valid Cases	240		

opinion. Nearly 17.90 per cent of respondents cultivating paddy followed by paddy + pulses (8.80 %), paddy + maize (8.30 %), turmeric (5.00 %), paddy + paddy (3.80 %), sugarcane (2.50 %) and aquaculture (0.40 %) respondents had highly favourable opinion towards water users associations.

Since the chi-square calculated value (93.881) is greater than the table value (28.869) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between cropping pattern and opinion. The major crop cultivated is paddy in Krishna delta region. The respondents followed the cropping pattern based on water availability. Most of them were able to get sufficient water to their crops. So it is their choice to follow the cropping pattern based availability of resources, soil condition and climatic conditions. The change in cropping pattern either from pulses to maize or agriculture to aquaculture might be to get profits or to compensate the loss. Hence, it showed favourable opinion and significant association between to attributes. The findings were in line with the findings of Raju (2000), Mahapatra (2006) and Badatya and Mohapatra (2010),

Table 4.59. stated the association between decision making and opinion. With respect to decision making 8.80 per cent of the respondents with medium decision making followed by high (0.80 %) and low (0.40 %) had less favourable opinion. About 20.00 per cent of the respondents with medium followed by low (15.40 %) and high (7.90 %) had moderately favourable opinion. Nearly 19.20 per cent of the respondents with high decision making followed by medium (15.40 %) and low (12.10 %) had highly favourable opinion towards water users associations.

**Table 4.59. Distribution of respondents according to their decision making with respect to opinion (n=240)**

<b>OPINION Vs DECISION MAKING</b>						
	<b>Category</b>		<b>DECISION MAKING</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	1	21	2	24
		<b>%</b>	0.40	8.80	0.80	10.00
	<b>Moderately favourable</b>	<b>F</b>	37	48	19	104
		<b>%</b>	15.40	20.00	7.90	43.30
	<b>Highly favourable</b>	<b>F</b>	46	37	29	112
		<b>%</b>	19.20	15.40	12.10	46.70
<b>Total</b>		<b>F</b>	84	106	50	240
		<b>%</b>	35.00	44.20	20.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.652 <sup>a</sup>	4	.000
Likelihood Ratio	27.075	4	.000
Linear-by-Linear Association	.546	1	.460
N of Valid Cases	240		

Since the chi-square calculated value (24.652) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between decision making and opinion. The reason could be most of them reported that there was a high social participation, active participation of respondents in group discussions, scheduling of irrigation, collective action for resolving of disputes all these have helped them to take proper decisions in water management to all the areas. Hence, there is a favourable opinion and significant association between two attributes. The findings were in line with the findings of Kumar (2013).

Table 4.61. represented the association between innovativeness and opinion. With respect to innovativeness 8.30 per cent of the respondents with medium innovativeness followed by low (1.20 %) and high (0.40 %) had less favourable opinion. About 29.20 per cent of the respondents with medium innovativeness followed by high (7.50 %) and low (6.70 %) had moderately favourable opinion. Nearly 28.30 per cent of the respondents with medium innovativeness followed by high (11.70 %) and low (6.70 %) had highly favourable opinion towards water users associations.

**Table 4.60. Distribution of respondents according to their innovativeness with respect to opinion (n=240)**

<b>OPINION Vs INNOVATIVENESS</b>						
	<b>Category</b>		<b>INNOVATIVENESS</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	3	20	1	24
		<b>%</b>	1.20	8.30	0.40	10.00
	<b>Moderately favourable</b>	<b>F</b>	16	70	18	104
		<b>%</b>	6.70	29.20	7.50	43.30
	<b>Highly favourable</b>	<b>F</b>	16	68	28	112
		<b>%</b>	6.70	28.30	11.70	46.70
<b>Total</b>		<b>F</b>	35	158	47	240
		<b>%</b>	14.60	65.80	19.60	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.586 <sup>a</sup>	4	.159
Likelihood Ratio	7.781	4	.100
Linear-by-Linear Association	2.609	1	.106
N of Valid Cases	240		

Since the chi-square calculated value (6.586) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between innovativeness and opinion. The reason could be the respondents had medium source of information, less exposure to mass media, attended less number of trainings and only few of them had good rapport with the irrigation department officials. Whereas in tail-end areas they do not have access to adopt new technologies due to high salinity levels in their soils. The findings were not in line with the findings of others.

Table 4.61. indicated the association between risk orientation and opinion. With respect to risk orientation 05.00 per cent of the respondents with medium risk orientation followed by high (3.80 %) and low (1.20 %) had less favourable opinion. About 30.40 per cent of the respondents with medium risk orientation followed by high (8.80 %) and low (4.20 %) had moderately favourable opinion. Nearly 28.30 per cent of the respondents with medium risk orientation followed by high (11.70 %) and low (6.70 %) had highly favourable opinion towards water users associations.

**Table 4.61. Distribution of respondents according to their risk orientation with respect to opinion (n=240)**

<b>OPINION Vs RISK ORIENTATION</b>						
	<b>Category</b>		<b>RISK ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	3	12	9	24
		<b>%</b>	1.20	5.00	3.80	10.00
	<b>Moderately favourable</b>	<b>F</b>	10	73	21	104
		<b>%</b>	4.20	30.40	8.80	43.30
	<b>Highly favourable</b>	<b>F</b>	16	68	28	112
		<b>%</b>	6.70	28.30	11.70	46.70
<b>Total</b>		<b>F</b>	29	153	58	240
		<b>%</b>	12.10	63.80	24.20	100

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	5.005 <sup>a</sup>	4	.287
Likelihood Ratio	4.842	4	.304
Linear-by-Linear Association	.592	1	.441
N of Valid Cases	240		

Since the chi-square calculated value (5.005) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between risk orientation and opinion. There is no change in opinion of the respondents with the change risk orientation. The water was released timely and made available to all the areas either to agriculture or aquaculture to the maximum extent possible. Hence there is less chance of taking risk for the respondents in Krishna delta. So there is no association between two attributes. The findings were in line with the findings of Jasvinder *et al.* (2014).

Table 4.62 indicated the association between achievement motivation and opinion. With respect to achievement motivation 8.30 per cent of the respondents with medium achievement motivation followed by low (1.20 %) and high (0.49 %) had less favourable opinion. About 20.00 per cent of the

respondents with medium achievement motivation followed by low (17.50 %) and high (5.80 %) had moderately favourable opinion. Nearly 20.80 per cent of the respondents with low achievement motivation followed by medium (16.20 %) and high (9.60 %) had highly favourable opinion towards water users association.

**Table 4.62. Distribution of respondents according to their achievement motivation with respect to opinion (n=240)**

OPINION Vs ACHIEVEMENT MOTIVATION						
	Category		ACHIEVEMENT MOTIVATION			Total
			Low	Medium	High	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	3	20	1	24
		<b>%</b>	1.20	8.30	0.40	10.00
	<b>Moderately favourable</b>	<b>F</b>	42	48	14	104
		<b>%</b>	17.50	20.00	5.80	43.30
	<b>Highly favourable</b>	<b>F</b>	50	39	23	112
		<b>%</b>	20.80	16.20	9.60	46.70
<b>Total</b>		<b>F</b>	95	107	38	240
		<b>%</b>	39.60	44.60	15.80	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.720 <sup>a</sup>	4	.001
Likelihood Ratio	20.611	4	.000
Linear-by-Linear Association	.324	1	.569
N of Valid Cases	240		

Since the chi-square calculated value (19.720) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between achievement motivation and opinion. Every member of WUAs should feel the responsibility in water management for the achievement of good results. The production and productivity of crops has been increased after the establishment of WUAs. The income and employment generation opportunities have been increased. The representatives of WUAs have taken up the responsibility in water management for the achievement of good results. They have improved their communication

behaviour and social life in the society. All these could be the reasons to show significant association between two attributes. The findings were in line with the findings of Obaiah (2004).

Table 4.63. represented the association between economic orientation and opinion. With respect to economic orientation 8.30 per cent of the respondents with high followed by medium (1.70 %) and none of them from low economic orientation had less favourable opinion. about 24.60 per cent of the respondents with high economic orientation followed by medium (17.10 %) and low (1.70 %) had moderately favourable opinion. Nearly 29.60 per cent of the respondents with high economic orientation followed by medium (16.70 %) and low (0.80 %) had highly favourable opinion towards water users associations.

**Table 4.63. Distribution of respondents according to their economic orientation with respect to opinion (n=240)**

<b>OPINION Vs ECONOMIC ORIENTATION</b>						
<b>OPINION</b>	<b>Category</b>		<b>ECONOMIC ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Less favourable</b>	<b>F</b>		0	4	20
<b>%</b>			0.00	1.70	8.30	10.00
<b>Moderately favourable</b>	<b>F</b>		4	41	59	104
	<b>%</b>		1.70	17.10	24.60	43.30
<b>Highly favourable</b>	<b>F</b>		2	40	70	112
	<b>%</b>		0.80	16.70	29.20	46.70
<b>Total</b>		<b>F</b>	6	85	149	240
		<b>%</b>	2.50	35.40	62.10	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.668 <sup>a</sup>	4	.155
Likelihood Ratio	7.600	4	.107
Linear-by-Linear Association	.649	1	.421
N of Valid Cases	240		

Since the chi-square calculated value (6.668) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between economic orientation and opinion. The reason might be though the yields thereby income of the farmers have been increased, the cost of cultivation also have been increased

simultaneously. Every farmer wishes to get more profits with less cost of cultivation. But now-a-days the cost of every input has increased. This may be a reason to have non-significant association with the opinion of respondents. The findings were not in line with the findings of others.

Table 4.64. represented the association between management orientation and opinion. With respect to management orientation 6.20 per cent of the respondents with medium management orientation followed by low (3.30 %) and high (0.40 %) had less favourable opinion. About 24.60 per cent of the respondents with medium management orientation followed by high (13.00 %) and low (5.00 %) had moderately favourable opinion. Nearly 29.20 per cent of the respondents with medium management orientation followed by high (15.00 %) and low (2.50 %) had highly favourable opinion towards water users associations.

**Table 4.64. Distribution of respondents according to their management orientation with respect to opinion (n=240)**

<b>OPINION Vs MANAGEMENT ORIENTATION</b>						
	<b>Category</b>		<b>MANAGEMENT ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>OPINION</b>	<b>Less favourable</b>	<b>F</b>	8	15	1	24
		<b>%</b>	3.30	6.20	0.40	10.00
	<b>Moderately favourable</b>	<b>F</b>	12	59	33	104
		<b>%</b>	5.00	24.60	13.80	43.30
	<b>Highly favourable</b>	<b>F</b>	6	70	36	112
		<b>%</b>	2.50	29.20	15.00	46.70
<b>Total</b>		<b>F</b>	26	144	70	240
		<b>%</b>	10.80	60.00	29.20	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.408 <sup>a</sup>	4	.000
Likelihood Ratio	20.040	4	.000
Linear-by-Linear Association	11.409	1	.001
N of Valid Cases	240		

Since the chi-square calculated value (20.408) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between management orientation and opinion. This might be due to timely releasing water to the fields to most of the areas, effective implementation of warabandhi schedule, good decision making, resolving the water disputes among the farmers, support from members and officials of irrigation department in water management, all these reasons have led to have favourable opinion and significant association between two attributes. The findings were in line with the findings of Kumar (2013).

#### **4.5.2 Association between personal, socio- economic and psychological characteristics of the functionaries and direct changes occurred due to Water Users Associations**

The results of chi-square tests of sixteen personal, socio- economic and psychological characteristics of the respondents with the direct changes are presented in the table 4.65.

**Null Hypothesis (H<sub>0</sub>) :** There was no significant association between personal, socio- economic and psychological characteristics of the respondents with the direct changes and both of these are independent.

**Empirical Hypothesis (H<sub>1</sub>) :** There was a significant association between personal, socio- economic and psychological characteristics of the respondents with the direct changes and both of these are dependent.

**Table 4.65. Association between personal, socio- economic and psychological characteristics of the respondents and direct changes (n=240)**

<b>S. No.</b>	<b>Independent variables</b>	<b>Chi suare test</b>
1	Age	2.731 <sup>NS</sup>
2	Education	2.731 <sup>NS</sup>
3	Land holding	5.370 <sup>NS</sup>
4	Extension contact	6.958 <sup>NS</sup>
5	Social participation	4.061 <sup>NS</sup>
6	Source of information	16.856*
7	Training received	16.436 <sup>NS</sup>

**Table 4.65 (Cont.)**

8	Perceived work load	3.866 <sup>NS</sup>
9	Information and communication behaviour	12.319*
10	Cropping pattern	38.946*
11	Decision making	11.199*
12	Innovativeness	12.874*
13	Risk orientation	2.519 <sup>NS</sup>
14	Achievement motivation	8.388 <sup>NS</sup>
15	Economic orientation	7.225 <sup>NS</sup>
16	Management orientation	7.173 <sup>NS</sup>

From table 4.65. it was be observed that age, education, land holding, extension contact, social participation, training received, perceived work load, risk orientation, achievement motivation, economic orientation and management orientation showed non-significant association with the direct changes. Source of information, information and communication behaviour, cropping pattern, decision making and innovativeness showed significant association with the direct changes occurred due to water users associations.

Table 4.66. indicated the association between age and direct changes. With respect to direct changes 7.50 per cent of the middle aged respondents followed by young (5.80 %) and none of them from old aged indicated the low direct changes. About 25.00 per cent of the middle aged respondents followed by young (21.70 %) and old (0.80 %) indicated medium direct changes. Nearly 20.80 per cent of the young aged respondents, followed by middle (17.50 %) and old (0.80 %) indicated high direct changes due to water users associations.

**Table 4.66. Distribution of respondents according to their age with respect to direct changes (n=240)**

DIRECT CHANGES Vs AGE						
DIRECT CHANGES	Category		AGE			Total
			Young	Middle	Old	
Low	F		14	18	0	32
	%		5.80	7.50	0.00	13.30
Medium	F		52	60	02	114
	%		21.70	25.00	0.80	47.50
High	F		50	42	2	94
	%		20.80	17.50	0.80	39.20
Total	F		116	120	4	240
	%		48.30	50.00	1.70	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.371 <sup>a</sup>	4	.668
Likelihood Ratio	2.895	4	.576
Linear-by-Linear Association	.824	1	.364
N of Valid Cases	240		

Since the chi-square calculated value (2.371) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between age and direct changes. This might be due the direct changes that have occurred were completely due to effective function of the WUAs and their ability to manage the irrigation system. Hence there is a no significant association between two attributes. The findings were in line with the findings of Kantharaju (2011).

Table 4.67. indicated the association between education and direct changes. With respect to education 4.20 per cent of the respondents with no education followed by intermediate (3.30 %), high school (2.50 %), secondary school (1.70 %), primary school (1.20 %) and graduation (0.40 %) indicated low direct changes. About 10.00 per cent of respondents with primary education followed by high school (9.20 %), illiterate (8.80 %), secondary school (8.30 %), intermediate (7.50 %) and graduation (3.80 %) indicated medium direct changes. Nearly 10.40 per cent of the respondents with high school education followed by primary school (8.30 %), intermediate (5.80 %), secondary (5.00 %), illiterate and graduation (4.20 %) and post graduation (0.80 %) indicated high direct changes due to water users associations.

Since the chi-square calculated value (2.371) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between education and direct changes. This could be due to majority of the respondents completed their high school education through which they can manage their financials activities, trainings etc. Rather their effective functioning would results in better changes besides their educational qualification. Hence there is no association between two attributes. The findings were not in line with the findings of others.

**Table 4.67. Distribution of respondents according to their education with respect to direct changes (n=240)**

<b>DIRECT CHANGES Vs EDUCATION</b>										
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>EDUCATION</b>						<b>Total</b>	
			<b>Illiterate</b>	<b>Primary school</b>	<b>Secondary school</b>	<b>High school</b>	<b>Inter-mediate</b>	<b>Graduation</b>		<b>Post graduation</b>
	<b>Low</b>	<b>F</b>	10	3	4	6	8	1	0	32
		<b>%</b>	4.20	1.20	1.70	2.50	3.30	0.40	0.00	13.30
	<b>Medium</b>	<b>F</b>	21	24	20	22	18	09	0	114
		<b>%</b>	8.80	10.00	8.30	9.20	7.50	3.80	0.00	47.50
	<b>High</b>	<b>F</b>	10	21	12	25	14	10	2	94
		<b>%</b>	4.20	8.80	5.00	10.40	5.80	4.20	0.80	39.20
	<b>Total</b>	<b>F</b>	41	48	36	53	40	20	2	240
		<b>%</b>	17.10	20.00	15.00	22.10	16.70	8.30	0.80	100

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	2.371 <sup>a</sup>	4	.668
Likelihood Ratio	2.895	4	.576
Linear-by-Linear Association	.824	1	.364
N of Valid Cases	240		

Table 4.68. represented the association between landholding and direct changes. With respect to landholding 5.00 per cent of the respondents with medium landholding followed by small (2.90 %), semi-medium (2.50 %), large (2.10 %) and marginal (0.80 %) indicated low direct changes. About 18.80 per cent of the respondents with medium landholding followed by semi-medium (13.30 %), small (8.30 %), large (6.20 %) and marginal (0.80 %) indicated medium direct changes. Nearly 13.30 per cent of the respondents with medium landholding followed by semi-medium (12.90 %), small (6.70 %), large (4.20 %) and marginal (2.10 %) indicated high direct changes due to water users associations.

**Table 4.68. Distribution of respondents according to their landholding with respect to direct changes (n=240)**

DIRECT CHANGES Vs LAND HOLDING								
DIRECT CHANGES	Category		LAND HOLDING				Total	
			Marginal	Small	Semi-medium	Medium		Large
Low	F		2	7	6	12	5	32
	%		0.80	2.90	2.50	5.00	2.10	13.30
Medium	F		2	20	32	45	15	114
	%		0.80	8.30	13.30	18.80	6.20	47.50
High	F		5	16	31	32	10	94
	%		2.10	6.70	12.90	13.30	4.20	39.20
Total	F		9	43	69	89	30	240
	%		3.80	17.90	28.80	37.10	12.50	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.370 <sup>a</sup>	8	.717
Likelihood Ratio	5.620	8	.690
Linear-by-Linear Association	.508	1	.476
N of Valid Cases	240		

Since the chi-square calculated value (5.370) is less than the table value (15.507) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between landholding and direct changes. The major function of WUAs is to supply water to the whole

WUA jurisdiction. Despite of their farm size, they work collectively to provide irrigation water timely in their jurisdiction. This might be reason to have non-significant association between two attributes. The findings were not in line with the findings of others.

Table 4.69. indicated the association between extension contact and direct changes. With respect to extension contact 7.10 per cent of the respondents with low followed by medium (6.20 %) and none of them from high extension contact indicated low direct changes. About 27.10 per cent of the respondents with medium extension contact followed by low (18.80 %) and high (1.70 %) indicated medium direct changes. Nearly 25.40 cent of the respondents with medium extension contact followed by low (11.70 %) and high (2.10 %) indicated high direct changes due to water users associations.

**Table 4.69. Distribution of respondents according to their extension contact with respect to direct changes (n=240)**

<b>DIRECT CHANGES VS EXTENSION CONTACT</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>EXTENSION CONTACT</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		17	15	0	32
	<b>%</b>		7.10	6.20	0.00	13.30
<b>Medium</b>	<b>F</b>		45	65	04	114
	<b>%</b>		18.80	27.10	1.70	47.50
<b>High</b>	<b>F</b>		28	61	5	94
	<b>%</b>		11.70	25.40	2.10	39.20
<b>Total</b>	<b>F</b>		90	141	9	240
	<b>%</b>		37.50	58.80	3.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.958 <sup>a</sup>	4	.138
Likelihood Ratio	7.996	4	.092
Linear-by-Linear Association	6.755	1	.009
N of Valid Cases	240		

Since the chi-square calculated value (6.958) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between extension contact and direct changes. The contacts with the officials of irrigation department were comparatively less to most of the members than the Presidents and Vice-presidents. This might be due to shortage of laskers at the field level and the other officials of irrigation department were rarely available because they were busy in their administration works and unavailable at the ground level to provide timely and required information to the respondents. Hence this might be the reason to have non-significant association between two attributes. The findings were in line with the findings of Tiwari *et al.* (2007).

Table 4.70. represented the association between social participation and direct changes. With respect to social participation 12.10 per cent of the respondents with high followed by medium (1.20 %) and none from low social participation indicated low direct changes. About 45.80 per cent of the respondents with high social participation followed by medium (1.70 %) and none from low social participation indicated medium direct changes. Nearly 37.50 per cent of the respondents with high social participation followed by medium (1.20 %) and low (0.40 %) indicated high direct changes due to water users associations.

**Table 4.70. Distribution of respondents according to their social participation with respect to direct changes (n=240)**

<b>DIRECT CHANGES Vs SOCIAL PARTICIPATION</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>SOCIAL PARTICIPATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		0	3	29
<b>%</b>			0.00	1.20	12.10	13.30
<b>Medium</b>	<b>F</b>		0	4	110	114
	<b>%</b>		0.00	01.70	45.80	47.50
<b>High</b>	<b>F</b>		1	3	90	94
	<b>%</b>		0.40	1.20	37.50	39.20
<b>Total</b>	<b>F</b>		1	10	229	240
	<b>%</b>		0.40	4.20	95.40	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.061 <sup>a</sup>	4	.398
Likelihood Ratio	3.859	4	.425
Linear-by-Linear Association	.196	1	.658
N of Valid Cases	240		

Since the chi-square calculated value (4.061) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between social participation and direct changes. This might be due to the person who acts as members of WUAs should not have membership in another organization. But, it could be inferred that farmers should be given chance to take participation in other organizations to get more information regarding farm activities. By that they can implement more ideas and decisions for effective functioning of WUAs. Hence there is no significant association between two attributes. The findings were not in line with the findings of others.

Table 4.71. indicated the association between source of information and direct changes. With respect to source of information 5.40 per cent of the respondents with medium source of information followed by low (5.00 %) and high (2.90 %) indicated low direct changes. About 29.90 per cent of the respondents with medium source of information followed by high (9.60 %) and low (8.30 %) indicated medium direct changes. Nearly 26.970 per cent of the respondents with medium source of information followed by high (9.60 %) and low (2.90 %) indicated high direct changes due to water users associations.

**Table 4.71. Distribution of respondents according to their source of information with respect to direct changes (n=240)**

<b>DIRECT CHANGES Vs SOURCE OF INFORMATION</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>SOURCE OF INFORMATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		12	13	7
<b>%</b>			5.00	5.40	2.90	13.30
<b>Medium</b>	<b>F</b>		20	71	23	114
	<b>%</b>		8.30	29.60	9.60	47.50
<b>High</b>	<b>F</b>		7	64	23	94
	<b>%</b>		2.90	26.70	9.60	39.20
<b>Total</b>	<b>F</b>		39	148	53	240
	<b>%</b>		16.20	61.00	22.10	100

<b>Chi-Square Tests</b>			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.856 <sup>a</sup>	4	.002
Likelihood Ratio	15.868	4	.003
Linear-by-Linear Association	7.201	1	.007
N of Valid Cases	240		

Since the chi-square calculated value (16.856) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between source of information and direct changes. The representatives of WUAs were always available to farmers to provide timely information on water availability and warabandhi schedule. Such that the disputes that arouse could be solved. The presidents were frequently in contact with irrigation officials to acquire information and to discuss the water related issues. This resulted in significant association between two attributes. The findings were in line with the findings of Manjunath (2002) and Badodiya *et al.* (2011).

Table 4.72. indicated the association between training received and direct changes. With respect to training received 5.00 per cent of the respondents with no training followed by 2 trainings (03.80 %), 1 training (2.50 %) and 3 trainings (2.10 %) indicated low direct changes. About 17.50 per cent of the respondents with 2 trainings followed by 1 training (10.80 %), 3 trainings (10.40 %), no

training (05.80 %), 4 trainings (2.50 %) and 5 trainings (0.40 %) indicated medium direct changes. Nearly 13.30 per cent of the respondents with 2 trainings followed by 3 trainings (8.30 %), 1 training (7.90 %), no training (5.80 %), 4 trainings (2.10 %) and 5 trainings (1.70 %) indicated high direct changes due to water users associations.

**Table 4.72. Distribution of respondents according to their training received with respect to direct changes (n=240)**

DIRECT CHANGES Vs TRAINING RECEIVED									
DIRECT CHANGES	Category		TRAINING RECEIVED					Total	
			No training	1 training	2 trainings	3 trainings	4 trainings		5 trainings
Low	F		12	6	9	5	0	0	32
	%		5.00	2.50	3.80	2.10	0.00	0.00	13.30
Medium	F		14	26	42	25	6	1	114
	%		5.80	10.80	17.50	10.40	2.50	0.40	47.50
High	F		14	19	32	20	5	4	94
	%		5.80	7.90	13.30	8.30	2.10	1.70	39.20
Total	F		40	51	83	50	11	5	240
	%		16.70	21.20	34.60	20.80	4.60	2.10	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.436 <sup>a</sup>	10	.088
Likelihood Ratio	16.283	10	.092
Linear-by-Linear Association	6.253	1	.012
N of Valid Cases	240		

Since the chi-square calculated value (16.436) is less than the table value (18.307) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between training received and direct changes. This might be due to there are inadequate training facilities for the respondents from the irrigation department or concerned officials. The respondents also attended very less number of trainings. But their experience as representatives of WUAs in its functioning and maintaining the irrigation system has facilitated them to have better direct changes. Hence there is no significant association between two attributes. The findings were not in line with the findings of others.

Table 4.73. represented the association between perceived workload and direct changes. With respect to perceived workload 4.60 per cent of the respondents with high and low perceived workload followed by medium (4.10 %) indicated low direct changes. About 19.60 per cent of the respondents with medium perceived workload followed by low (14.60 %) and high (13.30 %) indicated medium direct changes. Nearly 37.90 per cent of the respondents with medium perceived workload followed by high (33.30 %) and high (28.80 %) indicated high direct changes due to water users associations.

**Table 4.73. Distribution of respondents according to their perceived workload with respect to direct changes (n=240)**

<b>DIRECT CHANGES Vs PERCEIVEDWORKLOAD</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>PERCEIVED WORKLOAD</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		11	10	11	32
	<b>%</b>		4.60	4.10	4.60	13.30
<b>Medium</b>	<b>F</b>		35	47	32	114
	<b>%</b>		14.60	19.60	13.30	47.50
<b>High</b>	<b>F</b>		23	34	37	94
	<b>%</b>		9.60	14.20	15.40	39.20
<b>Total</b>	<b>F</b>		69	91	80	240
	<b>%</b>		28.80	37.90	33.30	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.866 <sup>a</sup>	4	.424
Likelihood Ratio	3.887	4	.421
Linear-by-Linear Association	1.822	1	.177
N of Valid Cases	240		

Since the chi-square calculated value (3.866) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between perceived workload and direct changes. Since the workload is only during the summer season *viz.*, before the release of water into canals and after that the work pressure will be reduced. Comparative to presidents and vice-presidents the workload was also less to the other members of WUAs. Hence it did not show any association between two attributes. The findings were not in line with the findings of others.

Table 4.74. stated the association between information and communication behaviour and direct changes. With respect to information and communication behaviour 08.80 per cent of the respondents with low followed by medium (4.60 %) and none of them from high information and communication behaviour indicated low direct changes. About 24.20 per cent of the respondents with medium information and communication behaviour followed by low (21.20 %) and high (21.10 %) indicated medium direct changes. Nearly 24.20 per cent of the respondents with medium information and communication behaviour followed by low (12.50 %) and high (2.50 %) indicated high direct changes due to water users associations.

**Table 4.74. Distribution of respondents according to their information and communication behaviour with respect to direct changes**  
(n=240)

<b>DIRECT CHANGES Vs INFORMATION AND COMMUNICATION BEHAVIOUR</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>INFORMATION AND COMMUNICATION BEHAVIOUR</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		21	11	0
<b>%</b>			8.80	4.60	0.00	13.30
<b>Medium</b>	<b>F</b>		51	58	5	114
	<b>%</b>		21.20	24.20	2.10	47.50
<b>High</b>	<b>F</b>		30	58	60	94
	<b>%</b>		12.50	24.20	2.50	39.20
<b>Total</b>	<b>F</b>		102	127	11	240
	<b>%</b>		42.50	52.90	4.60	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.319 <sup>a</sup>	4	.015
Likelihood Ratio	13.595	4	.009
Linear-by-Linear Association	11.644	1	.001
N of Valid Cases	240		

Since the chi-square calculated value (12.319) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between information and communication behaviour and direct changes. The reason might be the major source of information for the respondents were representatives of WUAs, lasker, Assistant Engineer of irrigation department. The communication behaviour was mainly through mobiles between the WUAs representatives which is an effective way for quick dessimination of information followed by group discussions between WUAs to resolve the water disputes. Their high social participation in water management, effective utilization of information received on maintenance of canals, channels and effective water utilization for their crops all these reasons resulted to have significant association between two attributes. The findings were in line with the findings of Soto-Garcia *et al* (2013) and Leshan (2017).

Table 4.75. represented the association between cropping pattern and direct changes. With respect to cropping pattern 11.20 per cent of the paddy growing respondents, followed by paddy + pulses and aquaculture (0.80 %) and chillies (0.40 %) growing respondents indicated low direct changes. About 26.20 per cent of paddy growing respondents followed by paddy + maize (5.80 %), paddy + paddy (4.60 %), paddy + pulses (4.20 %), turmeric (2.90 %), sugarcane and aquaculture (1.70 %) and chillies (0.40 %) growing respondents indicated medium direct changes. Nearly 17.00 per cent of paddy growing respondents followed by paddy + pulses (7.90 %), paddy + maize (4.60 %), paddy + paddy (2.90 %), turmeric (3.30 %), sugarcane (2.10 %), chillies (0.80 %) and aquaculture (0.40 %) growing respondents indicated high direct changes due to water users associations.

**Table 4.75. Distribution of respondents according to their cropping pattern with respect to direct changes (n=240)**

<b>DIRECT CHANGES Vs CROPPING PATTERN</b>											
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>CROPPING PATTERN</b>								
			<b>Paddy</b>	<b>Paddy + Paddy</b>	<b>Paddy + Pulses</b>	<b>Paddy + Maize</b>	<b>Sugarcane</b>	<b>Turmeric</b>	<b>Chillies</b>	<b>Aquaculture</b>	<b>Total</b>
<b>Low</b>	<b>F</b>		27	0	2	0	0	0	1	2	32
	<b>%</b>		11.20	0.00	0.80	0.00	0.00	0.00	0.40	0.80	13.30
<b>Medium</b>	<b>F</b>		63	11	10	14	4	7	1	4	114
	<b>%</b>		26.20	4.60	4.20	5.80	1.70	2.90	0.40	1.70	47.50
<b>High</b>	<b>F</b>		41	7	19	11	5	8	2	1	94
	<b>%</b>		17.00	2.90	7.90	4.60	2.10	3.30	0.80	0.40	39.20
<b>Total</b>	<b>F</b>		131	18	31	25	9	15	4	7	240
	<b>%</b>		54.58	7.50	12.90	10.42	3.80	6.20	1.70	2.92	100

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	38.946 <sup>a</sup>	18	.003
Likelihood Ratio	47.222	18	.000
Linear-by-Linear Association	2.993	1	.084
N of Valid Cases	240		

Since the chi-square calculated value (38.946) is greater than the table value (28.869) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between cropping pattern and direct changes. The respondents followed the cropping pattern based on water availability. Nearly 83.75 per cent of the respondents were able to utilize the available water for kharif season crop where as during rabi season most of the farmers grow pulse crop which doesnot require irrigation. The tail-end areas receive about 50-75 per cent of the irrigation through warabandhi schedule. Due to better utilization of available resources either for growing crops or for aquaculture the yield and income of farmers has been increased. This might be the reason to have significant association between to attributes. The findings were in line with the findings of Mini (2006), Gandhi and Namboodiri (2009) and Badatya and Mohapatra (2010).

Table 4.76. stated the association between decision making and direct changes. With respect to decision making 08.80 per cent of respondents with medium decision making followed by low (3.30 %) and high (1.20 %) indicated low direct changes. About 20.40 cent of respondents with medium decision making followed by low (18.80 %) and high (8.30 %) indicated medium direct changes. Nearly 15.00 per cent of respondents with medium decision making followed by low (12.90 %) and high (11.20 %) indicated high direct changes due to water users associations

**Table 4.76. Distribution of respondents according to their decision making with respect to direct changes (n=240)**

DIRECT CHANGES Vs DECISION MAKING						
DIRECT CHANGES	Category		DECISION MAKING			Total
			Low	Medium	High	
Low	F		8	21	3	32
	%		3.30	8.80	1.20	13.30
Medium	F		45	49	20	114
	%		18.80	20.40	8.30	47.50
High	F		31	36	27	94
	%		12.90	15.00	11.20	39.20
Total	F		84	106	50	240
	%		35.00	44.20	20.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.199 <sup>a</sup>	4	.024
Likelihood Ratio	11.134	4	.025
Linear-by-Linear Association	1.610	1	.204
N of Valid Cases	240		

Since the chi-square calculated value (11.199) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between decision making and direct changes. The reason might be there is high social participation and active involvement of all the presidents, vice-presidents and interested members in planning of warabandhi schedule, water management, at the time of conflicts meetings were arranged and discussed the issues to settle the disputes. Appropriate decisions were taken in water management with consultation of the respondents and the officials of irrigation department for the development of concerned WUA jurisdiction. This might be the reason for a significant association between decision making and direct changes. The findings were in line with the findings of Badatya and Mohapatra (2010).

Table 4.77. represented the association between innovativeness and direct changes. With respect to innovativeness 9.60 per cent of the respondents with medium innovativeness followed by low (2.50 %) and high (1.20 %) indicated low direct changes. About 32.10 per cent of the respondents with medium innovativeness followed by low (8.00 %) and high (6.70 %) indicated medium direct changes. Nearly 24.20 per cent of the respondents with medium innovativeness followed by high (11.70 %) and low (3.30 %) indicated high direct changes due to water users associations.

**Table 4.77. Distribution of respondents according to their innovativeness with respect to direct changes (n=240)**

<b>DIRECT CHANGES Vs INNOVATIVENESS</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>INNOVATIVENESS</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		6	23	3
<b>%</b>			2.50	9.60	1.20	13.30
<b>Medium</b>	<b>F</b>		21	77	16	114
	<b>%</b>		8.80	32.10	6.70	47.50
<b>High</b>	<b>F</b>		8	58	28	94
	<b>%</b>		3.30	24.20	11.70	39.20
<b>Total</b>	<b>F</b>		35	158	47	240
	<b>%</b>		14.60	65.80	19.60	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.874 <sup>a</sup>	4	.012
Likelihood Ratio	13.089	4	.011
Linear-by-Linear Association	10.572	1	.001
N of Valid Cases	240		

Since the chi-square calculated value (12.874) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between innovativeness and direct changes. Some of the respondents in tail-end areas follow water conservation practices like digging farm ponds and shifted to aquaculture with the available water in order to compensate the loss in agriculture. The avenue plantation along the bunds of the canals was followed in few areas of the Krishna delta area. This practice adds income to the concerned WUA. Since many years the respondents follow only the conventional method for sowing but in recent years few of them were practicing the direct sown rice. All these reasons have results to have a significant association between the two attributes. The findings were in line with the findings of Rajkumar *et al.* (2014).

Table 4.78. denoted the association between risk orientation and direct changes. With respect to direct changes 8.80 per cent of the respondent with medium risk orientation followed by high (3.30 %) and low (1.20 %) indicated low direct changes. About 31.20 per cent of the respondent with medium risk orientation followed by high (9.60 %) and low (6.70 %) indicated medium direct changes. Nearly 23.80 per cent of the respondent with medium risk orientation followed by high (11.20 %) and low (4.20 %) indicated high direct changes.

**Table 4.78. Distribution of respondents according to their risk orientation with respect to direct changes (n=240)**

DIRECT CHANGES Vs RISK ORIENTATION						
DIRECT CHANGES	Category		RISK ORIENTATION			Total
			Low	Medium	High	
Low	F		3	21	8	32
	%		1.20	8.80	3.30	13.30
Medium	F		16	75	23	114
	%		6.70	31.20	9.60	47.50
High	F		10	57	27	94
	%		4.20	23.80	11.20	39.20
Total	F		29	153	58	240
	%		12.10	63.80	24.20	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.519 <sup>a</sup>	4	.641
Likelihood Ratio	2.525	4	.640
Linear-by-Linear Association	.529	1	.467
N of Valid Cases	240		

Since the chi-square calculated value (2.519) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between risk orientation and direct changes. This might be due to the respondents were receiving sufficient irrigation water to the maximum extent and resulted in increased yields and profits. The warabandhi also implemented as per schedule to reduce the disputes. Though the presidents and vice-presidents invest the money for rehabilitation

works they receive their amount from the government with some delay. Hence, there is no much access for them to take risk involved activities. This resulted in non-significant association between two attributes. The findings were not in line with the findings of others.

Table 4.79. stated the association between achievement motivation and direct changes. With respect to achievement motivation 6.70 per cent of the respondents with medium achievement motivation followed by low (5.40 %) and high (1.20 %) indicated low direct changes. About 21.70 per cent of the respondents with low achievement motivation followed by medium (20.40 %) and high (5.40 %) indicated medium direct changes. Nearly 17.50 per cent of the respondents with medium achievement motivation followed by low (12.50 %) and high (0.20 %) indicated high direct changes due to water users associations.

**Table 4.79. Distribution of respondents according to their achievement motivation with respect to direct changes (n=240)**

<b>DIRECH CHANGES Vs ACHIEVEMRNT MOTIVATION</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>ACHIEVEMENT MOTIVATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		13	16	3	32
	<b>%</b>		5.40	6.70	1.20	13.30
<b>Medium</b>	<b>F</b>		52	49	13	114
	<b>%</b>		21.70	20.40	5.40	47.50
<b>High</b>	<b>F</b>		30	42	22	94
	<b>%</b>		12.50	17.50	9.20	39.20
<b>Total</b>	<b>F</b>		95	107	38	240
	<b>%</b>		39.60	44.60	15.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.388 <sup>a</sup>	4	.078
Likelihood Ratio	8.290	4	.082
Linear-by-Linear Association	5.088	1	.024
N of Valid Cases	240		

Since the chi-square calculated value (8.388) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between achievement motivation and direct changes. Due to inadequate trainings efforts were not done to motivate the respondents for the achievement of better results and they were also satisfied with the increased yields and powers delegated to them in irrigation management. This might be the reason to have non-significant association between two attributes. The findings were in line with the findings of Sivanarayana and Jayaramireddy (1994).

Table 4.80. stated the association between economic orientation and direct changes. With respect to economic orientation 99.20 per cent of the respondents with high economic orientation followed by medium (4.20 %) and none of them from low economic orientation low indicated low direct changes. About 28.30 per cent of the respondents with high economic orientation followed by medium (16.70 %) and high (2.50 %) indicated medium direct changes. Nearly 24.60 per cent of the respondents with high economic orientation followed by medium (14.60 %) and of them none from low economic orientation indicated high direct changes due to water users associations.

**Table 4.80. Distribution of respondents according to their economic orientation with respect to direct changes (n=240)**

<b>DIRECT CHSNGES Vs ECONOMIC ORIENTATION</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>ECONOMIC ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		0	10	22
<b>%</b>			0.00	04.20	99.20	13.30
<b>Medium</b>	<b>F</b>		6	40	68	114
	<b>%</b>		02.50	16.70	28.30	47.50
<b>High</b>	<b>F</b>		0	35	59	94
	<b>%</b>		0.00	14.60	24.60	39.20
<b>Total</b>	<b>F</b>		6	85	149	240
	<b>%</b>		2.50	35.40	62.10	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.225 <sup>a</sup>	4	.124
Likelihood Ratio	9.525	4	.049
Linear-by-Linear Association	.000	1	.992
N of Valid Cases	240		

Since the chi-square calculated value (7.225) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between economic orientation and direct changes. The increased cost of cultivation compensated the increased yields and income. Some respondents in tail-end areas have shifted to aquaculture to reduce the agriculture losses. If all the WUAs follow the avenue plantation along the bunds of canals in their jurisdiction they can get income from that produce which can be utilized for its development. But only few WUAs were practicing the avenue plantation. This might be the reason to have non-significant association between two attributes. The findings were in line with the findings of Raja (2004).

Table 4.81. represented the association management orientation and direct changes. With respect to management orientation 7.90 per cent of the respondents with medium management orientation followed by high (4.60 %) and low (0.80 %) indicated low direct changes. About 28.80 per cent of the respondents with medium management orientation followed by high (11.20 %) and low (7.50 %) indicated medium direct changes. Nearly 23.30 per cent of the respondents with medium management orientation followed by high (13.30 %) and low (2.50 %) indicated high direct changes due to water users associations.

**Table 4.81. Distribution of respondents according to their management orientation with respect to direct changes (n=240)**

<b>DIRECT CHANGES VS MANAGEMENT ORIENTATION</b>						
<b>DIRECT CHANGES</b>	<b>Category</b>		<b>MANAGEMENT ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		2	19	11	32
	<b>%</b>		0.80	7.90	4.60	13.30
<b>Medium</b>	<b>F</b>		18	69	27	114
	<b>%</b>		7.50	28.80	11.20	47.50
<b>High</b>	<b>F</b>		6	56	32	94
	<b>%</b>		2.50	23.30	13.30	39.20
<b>Total</b>	<b>F</b>		26	144	70	240
	<b>%</b>		10.80	60.00	29.20	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.173 <sup>a</sup>	4	.127
Likelihood Ratio	7.288	4	.121
Linear-by-Linear Association	.784	1	.376
N of Valid Cases	240		

Since the chi-square calculated value (7.173) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between management orientation and direct changes. The reason might be in tail-ends areas the WUAs functionaries have failed to supply sufficient water to their fields. In most of the cases not all the members of WUAs would take responsibility in implementation of works, rehabilitation of water courses/canals etc. In some tail-end areas there was no good coordination with irrigation and revenue departments. All these have resulted in non-significant association between two attributes. The findings were not in line with the findings of others.

### 4.5.3 Association between personal, socio- economic and psychological characteristics of the functionaries and indirect changes occurred due to Water Users Associations

The results of chi-square tests of sixteen personal, socio- economic and psychological characteristics of the respondents with the indirect changes are presented in the table 4.82

**Null Hypothesis (H<sub>0</sub>) :** There was no significant association between personal, socio- economic and psychological characteristics of the respondents with the indirect changes and both of these are independent.

**Empirical Hypothesis (H<sub>1</sub>) :** There was a significant association between personal, socio- economic and psychological characteristics of the respondents with the indirect changes and both of these are dependent.

**Table 4.82. Association between of personal, socio- economic and psychological characteristics of the respondents and indirect changes (n=240)**

S. No.	Independent variables	Chi square test
1	Age	2.852 <sup>NS</sup>
2	Education	2.852 <sup>NS</sup>
3	Land holding	2.852 <sup>NS</sup>
4	Extension contact	6.584 <sup>NS</sup>
5	Social participation	15.612*
6	Source of information	11.274*
7	Training received	8.777 <sup>NS</sup>
8	Perceived work load	9.094 <sup>NS</sup>
9	Information and communication behaviour	13.841*
10	Cropping pattern	51.484*
11	Decision making	11.075*
12	Innovativeness	23.240*
13	Risk orientation	6.082 <sup>NS</sup>
14	Achievement motivation	10.004*
15	Economic orientation	6.950 <sup>NS</sup>
16	Management orientation	17.552*

From table 4.82. it was be observed that age, education, land holding, extension contact, training received, perceived work load, risk orientation and economic orientation showed non-significant association with the indirect changes. Social participation, source of information, information and communication behaviour, cropping pattern, decision making, innovativeness, achievement motivation and management orientation showed significant association with the indirect changes occurred due to water users associations.

**Table 4.83. Distribution of respondents according to their age with respect to indirect changes (n=240)**

INDIRECT CHANGES Vs AGE						
INDIRECT CHANGES	Category		AGE			Total
			Young	Middle	Old	
Low	F		24	28	0	52
	%		10.00	11.70	0.00	21.70
Medium	F		37	43	1	81
	%		15.40	17.90	0.40	33.80
High	F		55	49	3	107
	%		22.90	20.40	1.20	44.60
Total	F		116	120	4	240
	%		48.30	50.00	1.70	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.852 <sup>a</sup>	4	.583
Likelihood Ratio	3.588	4	.465
Linear-by-Linear Association	.131	1	.717
N of Valid Cases	240		

Table 4.83. represented the association between age and indirect changes. With respect to age 11.70 per cent of the respondents with middle age followed by young (10.00 %) and none of them from old age indicated low indirect changes. About 17.90 per cent of the respondents with middle age followed by young (15.40 %) and old (0.40 %) indicated medium indirect changes. Nearly 22.90 per cent of the respondents with young age followed by middle (20.90 %) and old (1.20 %) indicated high indirect changes due to water users associations.

Since the chi-square calculated value (2.852) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between age and indirect changes. It resulted that there was neither increase nor decrease in indirect changes that have occurred due to WUAs with the change in age of the respondents. This might be reason to have non-significant association between two attributes. The findings were in line with the findings of Babu (2004) and Swetha *et al.* (2014).

Table 4.84. denoted the association between education and indirect changes. With respect to education 5.00 per cent the respondents with primary school education followed by intermediate (4.60 %), illiterate (4.20 %), high school (3.80 %), secondary school (2.90 %) and graduation (1.20 %) indicated low indirect changes. About 7.10 per cent of the respondents with high school education and illiterates, followed by primary (6.20 %), secondary school (5.40 %), intermediate (4.20 %), graduation (3.30 %) and post graduation (0.40 %) indicated medium indirect changes. Nearly 11.20 per cent of the respondents with high school education followed by primary school (8.80 %), intermediate (7.90 %), secondary school (6.70 %), illiterate (5.80 %), graduation (03.30 %) and post graduation (0.40 %) indicated high indirect changes due to water users associations.

Since the chi-square calculated value (2.852) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between education and indirect changes. Most of the respondents were educated up to high school but it resulted that there was neither increase nor decrease in indirect changes that have occurred due to WUAs with the change in education of the respondents. This might be reason to have non-significant association between two attributes. The findings were in line with the findings of Swetha *et al.* (2014).

**Table 4.84. Distribution of respondents according to their education with respect to indirect changes**

**(n=240)**

<b>INDIRECTCHANGES Vs EDUCATION</b>										
<b>INDIRECT CHANGES</b>	<b>Category</b>		<b>EDUCATION</b>						<b>Total</b>	
			<b>Illiterate</b>	<b>Primary school</b>	<b>Secondary school</b>	<b>High school</b>	<b>Inter-mediate</b>	<b>Graduation</b>		<b>Post graduation</b>
	<b>Low</b>	<b>F</b>	10	12	7	9	11	3	0	52
		<b>%</b>	4.20	5.00	2.90	3.80	4.60	1.20	0.00	21.70
	<b>Medium</b>	<b>F</b>	17	15	13	17	10	8	1	81
		<b>%</b>	7.10	6.20	5.40	7.10	4.20	3.30	0.40	33.80
	<b>High</b>	<b>F</b>	14	21	16	27	19	9	1	107
		<b>%</b>	5.80	8.80	6.70	11.20	7.90	3.80	0.40	44.60
	<b>Total</b>	<b>F</b>	41	48	36	53	40	20	2	240
		<b>%</b>	17.10	20.00	15.00	22.10	16.70	8.30	0.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.852 <sup>a</sup>	4	.583
Likelihood Ratio	3.588	4	.465
Linear-by-Linear Association	.131	1	.717
N of Valid Cases	240		

Table 4.85. stated the association between landholding and indirect changes. With respect to landholding 09.20 per cent of the respondents with medium landholdings followed by semi-medium (06.20 %), large (3.30 %), small (2.50 %) and marginal (0.40 %) indicated low indirect changes. About 12.50 per cent of the respondents with medium landholdings followed by semi-medium (9.60 %), small (5.80 %), large (4.60 %) and marginal (1.20 %) indicated medium indirect changes. Nearly 15.40 per cent of the respondents with medium landholdings followed by semi-medium (12.90 %), small (9.60 %), large (4.60 %) and marginal (2.10 %) indicated high indirect changes due to water users associations.

**Table 4.85. Distribution of respondents according to their landholding with respect to indirect changes (n=240)**

INDIRECT CHANGES Vs LAND HOLDING								
INDIRECT CHANGES	Category		LAND HOLDING				Total	
			Marginal	Small	Semi-medium	Medium		Large
Low	F		1	6	15	22	8	52
	%		0.40	2.50	6.20	9.20	3.30	21.70
Medium	F		3	14	23	30	11	81
	%		1.20	5.80	9.60	12.50	4.60	33.80
High	F		5	23	31	37	11	107
	%		2.10	9.60	12.90	15.40	4.60	44.60
Total	F		9	43	69	89	30	240
	%		3.80	17.90	28.80	37.10	12.50	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.083 <sup>a</sup>	8	.850
Likelihood Ratio	4.281	8	.831
Linear-by-Linear Association	3.728	1	.053
N of Valid Cases	240		

Since the chi-square calculated value (4.083) is less than the table value (15.507) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between landholding and

indirect changes. Most of the respondents were medium and semi-medium landholders. But their farm size did not infer the increase or decrease in indirect changes occurred due to functioning of WUAs. Hence it showed no association between two attributes. The findings were in line with the findings of Manoj (2008).

Table 4.86. represented the association between extension contact and indirect changes. With respect to extension contact 10.80 per cent of the respondents with medium and low and none of them from high extension contact indicated low indirect changes. About 20.80 per cent of the respondents with medium extension contact followed by low (11.70 %) and high (1.20 %) indicated medium indirect changes. Nearly 27.10 per cent of the respondents with medium extension contact followed by low (15.00 %) and high (2.50 %) indicated high indirect changes due to water users associations.

**Table 4.86. Distribution of respondents according to their extension contact with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs EXTENSION CONTACT</b>						
	<b>Category</b>		<b>EXTENSION CONTACT</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>INDIRECT CHANGES</b>	<b>Low</b>	<b>F</b>	26	26	00	52
		<b>%</b>	10.80	10.80	0.00	21.70
	<b>Medium</b>	<b>F</b>	28	50	03	81
		<b>%</b>	11.70	20.80	01.20	33.80
	<b>High</b>	<b>F</b>	36	65	06	107
		<b>%</b>	15.00	27.10	02.50	44.60
<b>Total</b>		<b>F</b>	90	141	09	240
		<b>%</b>	37.50	58.80	03.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.584 <sup>a</sup>	4	.160
Likelihood Ratio	8.249	4	.083
Linear-by-Linear Association	4.831	1	.028
N of Valid Cases	240		

Since the chi-square calculated value (6.584) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between extension contact and indirect changes. As there was no much extension contact to all the respondents with the irrigation officials it resulted in non-significant association between two attributes. The findings were in line with the findings of Manoj (2008).

Table 4.87. indicated the association between social participation and indirect changes. With respect to social participation 18.80 per cent of the respondents with high social participation followed by medium (2.90 %) and none of them from low social participation indicated low indirect changes. About 33.30 per cent of the respondents with high social participation followed by medium (0.40 %) and none of them from low social participation indicated medium indirect changes. Nearly 43.30 per cent of the respondents with high social participation followed by medium (0.80 %) and low (0.40 %) indicated high indirect changes due to water users associations.

**Table 4.87. Distribution of respondents according to their social participation with respect to indirect changes (n=240)**

INDIRECT CHANGES Vs SOCIAL PARTICIPATION						
INDIRECT CHANGES	Category		SOCIAL PARTICIPATION			Total
			Low	Medium	High	
	Low	F	0	7	45	52
%		0.00	02.90	18.80	21.70	
Medium	F	0	1	80	81	
	%	0.00	0.40	33.30	33.80	
High	F	1	2	104	107	
	%	0.40	0.80	43.30	44.60	
Total	F	1	10	229	240	
	%	0.40	4.20	95.40	100	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.612 <sup>a</sup>	4	.004
Likelihood Ratio	12.967	4	.011
Linear-by-Linear Association	4.028	1	.045
N of Valid Cases	240		

Since the chi-square calculated value (15.612) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between social participation and indirect changes. Most of the respondents had high social participation, involved in discussions, decision making and irrigation management. This helped them to have more exposure and to develop self respect in the society. These might be the reasons to have significant association between two attributes. The findings were in line with the findings of Elavarasi *et al.* (2014).

Table 4.88. indicated the association between source of information and indirect changes. With respect to source of information 11.20 per cent of the respondents with medium source of information followed by low (6.20 %) and high (4.20 %) indicated low indirect changes. About 20.00 per cent of the respondents with medium source of information followed by high (7.50 %) and low (6.20 %) indicated medium indirect changes. Nearly 30.40 per cent of the respondents with medium source of information followed by high (10.40 %) and low (3.80 %) indicated high indirect changes due to water users associations.

**Table 4.88. Distribution of respondents according to their source of information with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs SOURCE OF INFORMATION</b>						
	<b>Category</b>		<b>SOURCE OF INFORMATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>INDIRECT CHANGES</b>	<b>Low</b>	<b>F</b>	15	27	10	52
		<b>%</b>	6.20	11.20	4.20	21.70
	<b>Medium</b>	<b>F</b>	15	48	18	81
		<b>%</b>	6.20	20.00	7.50	33.80
	<b>High</b>	<b>F</b>	9	73	25	107
		<b>%</b>	3.80	30.40	10.40	44.60
<b>Total</b>		<b>F</b>	39	148	53	240
		<b>%</b>	16.20	61.70	22.10	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.274 <sup>a</sup>	4	.024
Likelihood Ratio	11.207	4	.024
Linear-by-Linear Association	5.667	1	.017
N of Valid Cases	240		

Since the chi-square calculated value (11.274) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association source of information and indirect changes. It indicated that with the information received from available irrigation department officials the representatives of WUAs implemented proper actions to reduce the water theft among farmers. The information received from personal and impersonal cosmopolite sources regarding farming or water management also helped to improve their social life like increased knowledge, improved communication behaviour among them. All these reasons resulted to have significant association between two attributes. The findings were in line with the findings of Abirami *et al.* (2014).

Table 4.89. denoted the association between training received and indirect changes. With respect to training received 7.90 per cent of the respondents with 2 trainings followed by 1 training (4.60 %), 3 trainings (4.60 %), no trainings (4.20 %) and 4 trainings (0.40 %) indicated low indirect changes. About 11.20 per cent of the respondents with 2 trainings followed by 3 trainings (9.60 %), 1 training (5.40 %), no trainings (5.00 %), 4 trainings (1.70 %) and 5 trainings (0.80 %) indicated medium indirect changes. Nearly 15.40 per cent of the respondents with 2 trainings followed by 1 training (11.20 %), no trainings (7.50 %), 3 trainings (6.70 %), 4 trainings (2.50 %) and 5 trainings (1.20 %) indicated high indirect changes due to water users associations.

**Table 4.89. Distribution of respondents according to their training received with respect to indirect changes (n=240)**

INDIRECT CHANGES Vs TRAINING RECEIVED									
INDIRECT CHANGES	Category		TRAINING RECEIVED					Total	
			No training	1 training	2 trainings	3 trainings	4 trainings		5 trainings
Low	F		10	11	19	11	1	0	52
	%		4.20	4.60	7.90	4.60	0.40	0.00	21.70
Medium	F		12	13	27	23	04	2	81
	%		5.00	5.40	11.20	9.60	1.70	0.80	33.80
High	F		18	27	37	16	6	3	107
	%		7.50	11.20	15.40	6.70	2.50	1.20	44.60
Total	F		40	51	83	50	11	5	240
	%		16.70	21.20	34.60	20.80	4.60	2.10	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.777 <sup>a</sup>	10	.553
Likelihood Ratio	10.054	10	.436
Linear-by-Linear Association	.021	1	.886
N of Valid Cases	240		

Since the chi-square calculated value (8.777) is less than the table value (18.307) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between training received and indirect changes. It resulted that there was no change in indirect changes with the training received by the respondents. Because the respondents had attended the very less number of trainings or meetings held within WUAs or with the irrigation department. This might be the reason to have no association between two attributes. The findings were not in line with the findings of others.

Table 4.90. represented the association between perceived workload and indirect changes. With respect to perceived workload 10.40 per cent of the respondents with medium perceived workload followed by low (7.50 %) and high (3.80 %) indicated low indirect changes. About 12.90 per cent of the respondents with medium perceived workload followed by low and high

(10.40 %) indicated medium indirect changes. Nearly 17.10 per cent of the respondents with medium perceived workload followed by high (16.70 %) and low (10.80 %) indicated high indirect changes due to water users associations.

**Table 4.90. Distribution of respondents according to their perceived workload with respect to indirect changes (n=240)**

INDIRECT CHANGES Vs PERCEIVED WORKLOAD						
INDIRECT CHANGES	Category		PERCEIVED WORKLOAD			Total
			Low	Medium	High	
Low	F		18	25	9	52
	%		7.50	10.40	3.80	21.70
Medium	F		25	25	31	81
	%		10.40	10.40	12.90	33.80
High	F		26	41	40	107
	%		10.80	17.10	16.70	44.60
Total	F		69	91	80	240
	%		28.80	37.90	33.30	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.094 <sup>a</sup>	4	.059
Likelihood Ratio	9.870	4	.043
Linear-by-Linear Association	4.611	1	.032
N of Valid Cases	240		

Since the chi-square calculated value (9.094) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between perceived workload and indirect changes. There is no change in indirect changes with the perceived workload of respondents because the canal works carried out only during summer that too with the machinery. So there is no much workload for them. Hence it showed no association between two attributes. The findings were not in line with the findings of others.

Table 4.91. represented the association between information and communication behaviour and indirect changes. With respect to information and communication behaviour 12.50 per cent of the respondents with low followed by medium (8.80 %) and high (0.40 %) information and communication behaviour indicated low indirect changes. About 16.70 per cent of the respondents with low followed by medium (15.40 %) and high (1.70 %) information and communication behaviour indicated medium indirect changes. Nearly 28.80 per cent of the respondents with medium followed by low (13.30 %) and high (2.50 %) information and communication behaviour indicated high indirect changes due to water users associations.

**Table 4.91. Distribution of respondents according to their information and communication behaviour with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs INFORMATION AND COMMUNICATION BEHAVIOUR</b>						
<b>INDIRECT CHANGES</b>	<b>Category</b>		<b>INFORMATION AND COMMUNICATION BEHAVIOUR</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		30	21	1	52
	<b>%</b>		12.50	8.80	0.40	21.70
<b>Medium</b>	<b>F</b>		40	37	4	81
	<b>%</b>		16.70	15.40	1.70	33.80
<b>High</b>	<b>F</b>		32	69	6	107
	<b>%</b>		13.30	28.80	2.50	44.60
<b>Total</b>	<b>F</b>		102	127	11	240
	<b>%</b>		42.50	52.90	4.60	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.841 <sup>a</sup>	4	.008
Likelihood Ratio	14.185	4	.007
Linear-by-Linear Association	11.835	1	.001
N of Valid Cases	240		

Since the chi-square calculated value (13.841) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between information and communication behaviour and indirect changes due to water users associations. The respondents had good source of information which resulted in change in their knowledge, attitude and also to improve their communication behaviour. More exposure can help them to adopt latest technologies, increased knowledge on water use efficiency like conjunctive use of canal, ground and drain water for different purposes and good decision making. The findings were in line with the findings of Soto-Garcia *et al* (2013) and Leshan (2017).

Table 4.92. reported the association between cropping pattern and indirect changes. With respect to cropping pattern 17.00 per cent of the paddy growers followed by paddy + paddy (02.10 %), paddy + pulses (0.80 %), paddy + maize, sugarcane, turmeric and chillies (0.40 %) growers indicated low indirect changes. About 18.60 per cent of the paddy growers followed by paddy + maize (5.00 %), paddy + paddy (03.30 %), paddy + pulses (2.50 %), turmeric (2.10 %), chillies and sugarcane (1.20 %) growers indicated medium indirect changes. Nearly 19.10 per cent of the paddy growers followed by paddy + pulses (9.60 %), paddy + maize (5.00 %), turmeric (03.80 %), sugarcane (3.30 %) paddy + paddy (02.10 %) and aquaculture (1.70 %) growers indicated high indirect changes due to water users associations.

Since the chi-square calculated value (51.484) is greater than the table value (28.869) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between cropping pattern and indirect changes. The cropping pattern followed according to the availability of water to their fields. Thereby the land use pattern was improved by the respondents either for agriculture or aquaculture or for commercial purposes. Timely and sufficient availability of water resulted in increased yields and income. Due to shortage of labour the farm mechanization improved a lot in their farm activities. Hence it showed a significant association between two attributes. The findings were in line with the findings of Mahapatra (2006), Raju *et al.* (2006) and Badatya and Mohapatra (2010).

**Table 4.92. Distribution of respondents according to their cropping pattern with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES</b>		<b>INDIRECT CHANGES Vs CROPPING PATTERN</b>									
		<b>CROPPING PATTERN</b>									
		<b>Category</b>	<b>Paddy</b>	<b>Paddy + Paddy</b>	<b>Paddy + Pulses</b>	<b>Paddy + Maize</b>	<b>Sugarcane</b>	<b>Turmeric</b>	<b>Chillies</b>	<b>Aquaculture</b>	<b>Total</b>
<b>Low</b>	<b>F</b>	41	5	2	1	1	1	1	0	52	
	<b>%</b>	17.00	2.10	0.80	0.40	0.40	0.40	0.40	0.00	21.50	
<b>Medium</b>	<b>F</b>	44	8	6	12	0	5	3	3	81	
	<b>%</b>	18.60	3.30	2.50	5.00	0.00	2.10	1.20	1.20	33.90	
<b>High</b>	<b>F</b>	46	5	23	12	8	9	0	4	107	
	<b>%</b>	19.10	2.10	9.60	5.00	3.30	3.80	0.00	1.70	44.60	
<b>Total</b>		<b>F</b>	131	18	31	25	9	15	4	7	240
		<b>%</b>	54.70	7.50	12.90	10.40	3.80	6.20	1.70	2.90	100

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>Df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	51.484 <sup>a</sup>	18	.000
Likelihood Ratio	58.585	18	.000
Linear-by-Linear Association	9.893	1	.002
N of Valid Cases	240		

Table 4.93. represented the association between decision making and indirect changes. With respect to decision making 11.70 per cent of the respondents with medium decision making followed by low (8.30 %) and high (1.70 %) indicated low indirect changes. About 16.70 per cent of the respondents with medium decision making followed by low (10.40 %) and high (6.70 %) indicated medium indirect changes. Nearly 16.20 per cent of the respondents with low decision making followed by medium (15.80 %) and high (12.50 %) indicated high indirect changes due to water users associations.

**Table 4.93. Distribution of respondents according to their decision making with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs DECISION MAKING</b>						
<b>INDIRECT CHANGES</b>	<b>Category</b>		<b>DECISION MAKING</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		20	28	4	52
	<b>%</b>		8.30	11.70	1.70	21.70
<b>Medium</b>	<b>F</b>		25	40	16	81
	<b>%</b>		10.40	16.70	6.70	33.80
<b>High</b>	<b>F</b>		39	38	30	107
	<b>%</b>		16.20	15.80	12.50	44.60
<b>Total</b>	<b>F</b>		84	106	50	240
	<b>%</b>		35.00	44.20	20.80	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.075 <sup>a</sup>	4	.026
Likelihood Ratio	12.249	4	.016
Linear-by-Linear Association	2.765	1	.096
N of Valid Cases	240		

Since the chi-square calculated value (11.075) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between decision making and indirect changes. The WUAs representatives had sufficient powers to make

necessary decisions regarding irrigation management. Sometimes there is a chance for them to follow autonomy in decision making for implementing the minor works under their jurisdiction. This helped them to build their self confidence and also personal empowerment. Hence the decision making had showed a significant association with indirect changes. The findings were in line with the findings of Badatya and Mohapatra (2010).

**Table 4.94. Distribution of respondents according to their innovativeness with respect to indirect changes (n=240)**

INDIRECT CHANGES Vs INNOVATIVENESS						
INDIRECT CHANGES	Category		INNOVATIVENESS			Total
			Low	Medium	High	
Low	F		9	41	2	52
	%		3.80	17.10	0.80	21.70
Medium	F		11	60	10	81
	%		4.60	25.00	4.20	33.80
High	F		15	57	35	107
	%		6.20	23.80	14.60	44.60
Total	F		35	158	47	240
	%		14.60	65.80	19.60	100

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.240 <sup>a</sup>	4	.000
Likelihood Ratio	25.309	4	.000
Linear-by-Linear Association	11.794	1	.001
N of Valid Cases	240		

Table 4.94. stated the association between innovativeness and indirect changes. With respect to innovativeness 17.10 per cent of the respondents with medium innovativeness followed by low (3.80 %) and high (0.80 %) indicated low indirect changes. About 25.00 per cent of the respondents with medium innovativeness followed by low (4.60 %) and high (4.20 %) indicated medium indirect changes. Nearly 23.80 per cent of the respondents with medium innovativeness followed by high (14.60 %) and low (6.20 %) indicated high indirect changes due to water users associations.

Since the chi-square calculated value (23.240) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between innovativeness and indirect changes. The farmers have followed the improved land use pattern because in some of the tail-end areas due delay in water availability or loss in agriculture made respondents to practice aquaculture. They were practicing innovative technologies like direct sown rice, paddy followed by maize cropping pattern, farm ponds which resulted in increased yields and income. It helped in better economic conditions of the respondents. Hence a significant association was seen between two attributes. The findings were in line with the findings of Obaiah and Raju (2008).

Table 4.95. indicated the association between risk orientation and indirect changes. With respect to risk orientation 15.00 per cent of the respondents with medium risk orientation followed by high (3.80 %) and low (2.90 %) indicated low indirect changes. About 18.30 per cent of the respondents with medium risk orientation followed by high (10.00 %) and low (5.40 %) indicated medium indirect changes. Nearly 30.40 per cent of the respondents with medium risk orientation followed by high (10.40 %) and low (3.80 %) indicated medium indirect changes due to water users associations.

**Table 4.95. Distribution of respondents according to their risk orientation with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs RISK ORIENTATION</b>						
<b>INDIRECT CHANGES</b>	<b>Category</b>		<b>RISK ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>Low</b>	<b>F</b>		7	36	9	52
	<b>%</b>		2.90	15.00	3.80	21.70
<b>Medium</b>	<b>F</b>		13	44	24	81
	<b>%</b>		5.40	18.30	10.00	33.80
<b>High</b>	<b>F</b>		9	73	25	107
	<b>%</b>		3.80	30.40	10.40	44.60
<b>Total</b>	<b>F</b>		29	153	58	240
	<b>%</b>		12.10	63.80	24.10	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.082 <sup>a</sup>	4	.193
Likelihood Ratio	6.214	4	.184
Linear-by-Linear Association	1.057	1	.304
N of Valid Cases	240		

Since the chi-square calculated value (6.082) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between risk orientation and indirect changes. It inferred that there was neither increase nor decrease in indirect changes with the risk orientation of the respondents. This might be reason to have non-significant association between two attributes. The findings were in line with other Elavarasi *et al.* (2014).

Table 4.96. represented the association between achievement motivation and indirect changes. With respect to achievement motivation 12.50 per cent of the respondents with medium achievement motivation followed by low (7.90 %) and high (1.20 %) indicated low indirect changes. About 15.80 per cent of the respondents with low achievement motivation followed by medium (12.90 %) and high (5.00 %) indicated medium indirect changes. Nearly 19.20 per cent of the respondents with medium achievement motivation followed by low (15.80 %) and high (9.60 %) indicated high indirect changes.

**Table 4.96. Distribution of respondents according to their achievement motivation with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs ACHIEVEMENT MOTIVATION</b>						
	<b>Category</b>		<b>ACHIEVEMENT MOTIVATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
<b>INDIRECT CHANGES</b>	<b>Low</b>	<b>F</b>	19	30	3	52
		<b>%</b>	7.90	12.50	1.20	21.70
	<b>Medium</b>	<b>F</b>	38	31	12	81
		<b>%</b>	15.80	12.90	5.00	33.80
	<b>High</b>	<b>F</b>	38	46	23	107
		<b>%</b>	15.80	19.20	9.60	44.60
<b>Total</b>	<b>F</b>	95	107	38	240	
	<b>%</b>	39.60	44.60	15.80	100	

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.004 <sup>a</sup>	4	.040
Likelihood Ratio	10.691	4	.030
Linear-by-Linear Association	2.702	1	.100
N of Valid Cases	240		

Since the chi-square calculated value (10.004) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between achievement motivation and indirect changes. It might be due to there was change in social life of respondents, increased economic status due to increased yields and income. Development of self respect, personal empowerment, good decision making, improved communication behaviour, increased land values and assets due increased fertility of the soils with sufficient water availability and decreased migration of farmers due to employment generation in water users associations all these reasons led to have a significant association between two attributes. The findings were in line with the findings of Suneetha (2004) and Manoj (2008).

Table 4.97. indicated the association between economic orientation and indirect changes. With respect to economic orientation 15.80 per cent of the respondents with high economic orientation followed by medium (5.00 %) and low (0.80 %) indicated low indirect changes. About 18.30 per cent of the respondents with high economic orientation followed by medium (14.20 %) and low (1.20 %) indicated medium indirect changes. Nearly 27.90 per cent of the respondents with high economic orientation followed by medium (16.20 %) and low (0.40 %) indicated high indirect changes due to water users associations.

**Table 4.97. Distribution of respondents according to their economic orientation with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs ECONOMIC ORIENTATION</b>						
<b>INDIRECT CHANGES</b>	<b>Category</b>		<b>ECONOMIC ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		2	12	38
<b>%</b>			0.80	5.00	15.80	21.70
<b>Medium</b>	<b>F</b>		3	34	44	81
	<b>%</b>		1.20	14.20	18.30	33.80
<b>High</b>	<b>F</b>		1	39	67	107
	<b>%</b>		0.40	16.20	27.90	44.60
<b>Total</b>	<b>F</b>		6	85	149	240
	<b>%</b>		2.50	35.40	62.10	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.950 <sup>a</sup>	4	.139
Likelihood Ratio	7.410	4	.116
Linear-by-Linear Association	.180	1	.672
N of Valid Cases	240		

Since the chi-square calculated value (6.950) is less than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is accepted and there is no association between economic orientation and indirect changes. Because the increased credit needs, wage rates of labours, personal expenditure and high cost of cultivation have neutralized the increased income. Hence the economic orientation did not show any association with indirect changes. The findings were not in line with the findings of others.

Table 4.98. represented the association between management orientation and indirect changes. With respect to management orientation 15.40 per cent of the respondents with medium management orientation followed by low (4.20 %) and high (02.10 %) indicated low indirect changes. About 19.60 per cent of the respondents with medium management orientation followed by high (10.00 %) and low (4.20 %) indicated medium indirect changes. Nearly 25.00 per cent of the respondents with medium management orientation followed by high (17.10 %) and low (2.50 %) indicated high indirect changes due to water users associations.

**Table 4.98. Distribution of respondents according to their management orientation with respect to indirect changes (n=240)**

<b>INDIRECT CHANGES Vs MANAGEMENT ORIENTATION</b>						
<b>INDIRECT CHANGES</b>	<b>Category</b>		<b>MANAGEMENT ORIENTATION</b>			<b>Total</b>
			<b>Low</b>	<b>Medium</b>	<b>High</b>	
	<b>Low</b>	<b>F</b>		10	37	5
<b>%</b>			4.20	15.40	2.10	21.70
<b>Medium</b>	<b>F</b>		10	47	24	81
	<b>%</b>		4.20	19.60	10.00	33.80
<b>High</b>	<b>F</b>		6	60	41	107
	<b>%</b>		2.50	25.00	17.10	44.60
<b>Total</b>	<b>F</b>		26	144	70	240
	<b>%</b>		10.80	60.00	29.20	100

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.552 <sup>a</sup>	4	.002
Likelihood Ratio	19.576	4	.001
Linear-by-Linear Association	16.617	1	.000
N of Valid Cases	240		

Since the chi-square calculated value (17.552) is greater than the table value (9.488) at 0.05 % level of significance, it was concluded that the null hypothesis is rejected and there is an association between management orientation and indirect changes. Majority of the respondents were middle aged and well known about functions of WUAs. The management of aquatic weeds in canals and drainage water system for free flow of sufficient water to tail-end areas, increased knowledge on water use efficiency and skill on different aspects of irrigation management, equal and timely distribution of water with effective implementation of warabandhi and resolved water disputes all these aspects led to have a significant association between two attributes. The findings were in line with the findings of Chackacherry (2014).

## 4.6 STRENGTHS, WEAKNESS, OPPORTUNITIES AND CHALLENGES OF WATER USERS ASSOCIATIONS AS PERCEIVED BY THE FUNCTIONARIES OF WATER USER ASSOCIATIONS AND OFFICIALS OF IRRIGATION DEPARTMENT

### 4.6.1 Strengths, weaknesses, opportunities and challenges of water users associations as perceived by the functionaries of water user association

This objective provides the detailed information on important strengths, weaknesses, opportunities and challenges (SWOC) of water users association and irrigation department separately.

**Table 4.99. SWOC analysis of water users associations**

S. No.	Statements	Total score	Mean score	Rank
<b>a) Strengths</b>				
1.	Involvement of WUAs in water management	6836.36	28.48	1
2.	Sufficient water is available during crop season	10563.64	44.01	3
3.	Equity in the distribution of irrigation water among head reach, middle and tail end areas	12118.18	50.49	5
4.	Increased crop yields	11445.45	47.68	4
5.	Freedom of cropping pattern within the limits of allocated water	12681.82	52.84	6
6.	Number of irrigations to the crop has been increased	13809.09	57.53	8
7.	Increased water use efficiency by implementation of warabandhi schedule	13309.09	55.45	7
8.	Good support from irrigation department officials	10518.18	43.82	2
9.	Improved the efficiency and performance of irrigation systems	19245.45	80.18	11
10.	Increase in social relations among farmers	17545.45	73.10	10
11.	Reduced water disputes	14736.36	61.40	9
<b>b) Weaknesses</b>				
1.	Allocation of insufficient funds	6400.00	26.66	1
2.	Inadequate Training facilities	7990.909	33.29	2
3.	Late release of funds	9454.545	39.39	3
4.	Poor quality of works	11545.45	48.10	4
5.	Lack of cooperation among water users associations	12409.09	51.70	7

<b>S. No.</b>	<b>Statements</b>	<b>Total score</b>	<b>Mean score</b>	<b>Rank</b>
6.	Inadequate infrastructure facilities	11781.82	49.09	5
7.	Non involvement of members of WUA in management of water users associations	14972.73	62.38	8
8.	Low educational qualifications of members of WUAs	12154.55	50.64	6
9.	Lack of trust between WUAs and Irrigation engineers	16072.73	66.96	9
10.	Short duration of tenure of elected members of WUAs	17863.64	74.43	10
<b>c) Opportunities</b>				
1.	Empowerment of farmers to manage irrigation system	10257.14	42.73	1
2.	Facilitates the effective implementation of warabandhi schedule	11642.86	48.51	2
3.	Enhancement of productivity of crops growing in Krishna delta region	14314.29	59.64	4
4.	Resolution of disputes among farmers	12828.57	53.45	3
5.	Improved decision making based on local knowledge	14528.57	60.53	5
6.	Active involvement of all classes of farmers	14757.14	61.48	6
7.	Development of good linkages between farmers and irrigation department officials	16700.00	69.58	7
<b>d) Challenges</b>				
1.	Equal distribution of water among head middle and tail-end areas	9463.636	39.43	2
2.	Improving the drainage networks	9700.00	40.41	3
3.	Management of aquatic weeds	7463.63	31.09	1
4.	Involvement of political leaders in day to day activities of WUAs	12363.64	51.51	6
5.	Eliminate the members engaged in corruption	14645.45	61.02	7
6.	Enhancement of knowledge about irrigation schemes and programmes to farmers	11972.73	49.88	5
7.	Development of friendly relationship among water users associations	15163.64	63.18	8
8.	Reduce water logging and salinity	18327.27	76.36	11
9.	Increase in production of water intense crops	16027.27	66.78	10
10.	Weak institutional setup	11800.00	49.16	4
11.	Involvement of women participation in decision making	15736.36	65.56	9

**Table 4.100. Percentage positions and their corresponding Garrett table values for SWOC analysis of water users associations**

<b>Rank</b>	<b>Percentage positions</b>	<b>Garrett values</b>	<b>Rank</b>	<b>Percentage positions</b>	<b>Garrett values</b>
<b>Strengths</b>					
1.	28.48	62	7.	55.45	48
2.	43.82	54	8.	57.53	47
3.	44.01	53	9.	61.40	45
4.	47.68	52	10.	73.10	38
5.	50.49	51	11.	80.18	34
6.	52.84	49	-		
<b>Weaknesses</b>					
1.	26.66	63	6.	50.64	51
2.	33.29	59	7.	51.70	50
3.	39.39	56	8.	62.38	44
4.	48.10	51	9.	66.96	42
5.	49.09	51	10.	74.43	47
<b>Opportunities</b>					
1.	42.73	54	5.	60.53	45
2.	48.51	51	6.	61.48	45
3.	53.45	49	7.	69.58	40
4.	59.64	46	-		
<b>Challenges</b>					
1.	31.09	60	7.	61.02	45
2.	39.43	56	8.	63.18	44
3.	40.41	55	9.	66.78	42
4.	49.166	51	10.	65.56	42
5.	49.88	51	11.	76.36	36
6.	51.51	50	-		

Table 4.99. indicated the SWOC of water users associations. Lower the mean score of the statement higher will be the priority given by the respondents. The ranks were given according to the priority given by the WUAs representatives.

## **Strengths**

Involvement of water users associations (28.48), good support from the irrigation department officials (43.82); sufficient water is available during crop season (44.01); increased crop yields (47.68); equity in the distribution of irrigation water among head reach, middle and tail end areas (50.49); freedom of cropping pattern within the limits of allocated water (52.84); increased water use efficiency by implementation of warabandhi schedule (55.45); number of irrigations to the crop have been increased (57.53); reduced water disputes (61.40); increase in social relations among farmers (73.10) and Improved the efficiency and performance of irrigation systems (80.18) were the major strengths of water users associations.

The probable reasons might be there should be some system of management of water at the grass root level. So the farmers have come forward to take the responsibility of water management. The irrigation department officials have provided information water availability during crop season and tried to their maximum extent for equal distribution of water which enhanced increase in yields. Through the implementation of warabandhi schedule by water users associations the number of irrigations has been increased and disputes among the farmers have been reduced by developing social relations among farmers. The efficiency and performance of irrigation systems also has been improved through water users associations.

## **Weaknesses**

Allocation of insufficient funds (26.66); inadequate training facilities (33.29); inadequate maintenance of drains (39.39); poor quality of works (48.10); inadequate infrastructure facilities (49.09); low educational qualifications of members of WUAs (50.64); lack of cooperation among water users associations (51.70); non involvement of members of WUA in management of water users associations (62.38); lack of trust between WUAs and irrigation engineers (66.96) and short duration of tenure of elected members of WUAs (74.43).

The probable reasons might be due to deficit funds in the government there was insufficient allocation of funds to the water users association for its operation and maintenance works. There are inadequate training facilities for the farmers and maintenance of drains due to shortage of irrigation officials and labours. Majority of the members of WUAs were educated up to high school level of education and lack of cooperation among WUAs was due to disputes regarding water availability to their jurisdiction. Maximum the president and vice-presidents were only involved and take responsibility of the water management might be due to their interest, more knowledge than the members or they belonged to high class people of the society. There is a lack of trust on irrigation engineers due to their poor quality of works in canals construction.

### **Opportunities**

Empowerment of farmers to manage irrigation system (42.73); facilitates the effective implementation of warabandhi schedule (48.51); resolution of disputes among farmers (53.45); enhancement of productivity of crops growing in Krishna delta region (59.64); improved decision making based on local knowledge (60.53); active involvement of all classes of farmers (61.48) and development of good linkages between farmers and irrigation department officials (69.58).

The probable reasons might be to provide sufficient irrigation water to their crops the farmers were empowered to manage the irrigation system. Through water users associations the warabandhi was implemented to supply water to till tail-end areas so that water disputes can be resolved to some extent. Due to sufficient water availability the productivity of crops has been increased. Farmers have improved their decision making ability with good coordination among WUAs and irrigation and agriculture departments. The higher designations in the organizational structure of water users associations were headed by the high class people of the society.

## Challenges

Management of aquatic weeds (31.09); equal distribution of water among head middle and tail-end areas (39.43); improving the drainage networks (40.41); enhancement of knowledge about irrigation schemes and programmes to farmers (49.88); weak institutional setup (49.16); involvement of political leaders in day to day activities of WUAs (51.51); eliminate the members engaged in corruption (61.02); development of friendly relationship among water users associations (63.18); involvement of women participation in decision making (65.56); increase in production of water intense crops (66.78) and reduce water logging and salinity (76.36).

The probable reasons might be the aquatic weeds are the main problem which obstructs the free flow of water into water courses so the drainage networks have to be managed properly. The irrigation and agriculture departments should plan and conduct the training programmes related to irrigation schemes so that users can make effective use of them. The involvement of political leaders in activities of WUAs helps to solve the problems when the situation is out of the hands of WUAs and irrigation officials. The friendly relationship among WUAs reduces the disputes among them. The women should also be included in the decision making activities in order to encourage their participation. To reduce the logging and salinity problem, the irrigation and agriculture departments should provide alternate solutions to overcome the problem. The findings were in line with findings of Agenzia Regionale Per La Protezione Dell'Ambiente (2011), Arun *et al.* (2012), Rai *et al.* (2012)

#### 4.6.2 Strengths, weaknesses, opportunities and challenges of water users associations as perceived by the officials of irrigation department

**Table 4.101. SWOC analysis of irrigation department officials**

S. No.	Statements	Total score	Mean score	Rank
<b>a) Strengths</b>				
1.	Improved the efficiency and performance of irrigation systems	1618.18	40.45	3
2.	Sufficient water is available during crop season	1818.18	45.45	4
3.	Equity in the distribution of irrigation water among head reach, middle and tail end areas	1881.81	47.04	6
4.	Increased crop yields	2590.90	64.77	8
5.	Freedom of cropping pattern within the limits of allocated water	2818.18	70.45	9
6.	Number of irrigations to the crop has been increased	3209.09	80.22	11
7.	Increased water use efficiency by implementation of warabandhi schedule	3181.81	79.54	10
8.	Good support from irrigation department official	1418.18	35.45	2
9.	Involvement of WUAs in water management	1409.09	35.22	1
10.	Increase in social relations among farmers	1845.45	46.13	5
11.	Reduced water disputes	1963.63	49.09	7
<b>b) Weaknesses</b>				
1.	Allocation of insufficient funds	545.45	13.63	1
2.	Inadequate training facilities	1627.27	40.68	4
3.	Inadequate maintenance of drains	1627.27	40.68	3
4.	Poor quality of works	2318.18	57.95	7
5.	Lack of cooperation among water users associations	3345.45	83.63	10
6.	Inadequate infrastructure facilities	2036.36	50.90	6
7.	Non involvement of members of WUA in management of water users associations	1081.81	27.04	2
8.	Low educational qualifications of members of WUAs	2027.27	50.68	5
9.	Lack of trust between WUAs and Irrigation engineers	2763.63	69.09	8
10.	Short duration of tenure of elected members of WUAs	3290.90	82.27	9
<b>c) Opportunities</b>				
1.	Empowerment of farmers to manage irrigation system	1542.85	38.57	1
2.	Facilitates the effective implementation of warabandhi schedule	2114.28	52.85	4

<b>S. No.</b>	<b>Statements</b>	<b>Total score</b>	<b>Mean score</b>	<b>Rank</b>
3.	Enhancement of productivity of crops growing in Krishna delta region	2785.71	69.64	6
4.	Resolution of disputes among farmers	2085.71	52.14	3
5.	Improved decision making based on local knowledge	1742.85	43.57	2
6.	Active involvement of all classes of farmers	2328.57	58.21	5
7.	Development of good linkages between farmers and irrigation department officials	320.00	80.00	7
<b>d) Challenges</b>				
1.	Improving the drainage networks	1109.09	27.72	1
2.	Management of aquatic weeds	1745.45	43.63	5
3.	Development of friendly relationship among water users associations	1645.45	41.13	4
4.	Enhancement of knowledge about irrigation schemes and programmes to farmers	2318.18	57.95	6
5.	Eliminate the members engaged in corruption	3163.63	79.09	10
6.	Weak institutional setup	1509.09	37.72	3
7.	Increase in production of water intense crops	2354.54	58.86	7
8.	Reduce water logging and salinity	3409.09	85.22	11
9.	Involvement of women participation in decision making	2454.54	61.36	8
10.	Equal distribution of water among head middle and tail-end areas	1436.36	35.90	2
11.	Involvement of political leaders in day to day activities of WUAs	270.00	67.50	9

**Table 4.102. Percentage positions and their corresponding Garrett table values for SWOC analysis of irrigation officials**

Rank	Percentage positions	Garrett values	Rank	Percentage positions	Garrett values
<b>Strengths</b>					
1.	35.22	58	7.	49.09	51
2.	35.45	58	8.	64.77	43
3.	40.45	55	9.	70.45	40
4.	45.45	53	10.	79.54	34
5.	46.13	52	11.	80.22	34
6.	47.04	52	-		
<b>Weaknesses</b>					
1.	13.63	72	6.	50.90	50
2.	27.04	62	7.	57.95	47
3.	40.68	55	8.	69.09	40
4.	40.68	55	9.	82.27	32
5.	50.68	50	10.	83.63	31
<b>Opportunities</b>					
1.	38.57	56	5.	58.21	46
2.	43.57	53	6.	69.64	40
3.	52.14	49	7.	80.00	33
4.	52.85	49	-		
<b>Challenges</b>					
1.	27.72	62	7.	58.86	46
2.	35.90	58	8.	61.36	44
3.	37.72	57	9.	67.50	41
4.	41.13	55	10.	79.09	34
5.	43.63	54	11.	85.22	30
6.	57.95	47	-		

Table 4.101. indicated the SWOC of officials of irrigation department. Lower the mean score of the statement higher will be the priority given by the officials of irrigation department. The ranks were given according to the priority given by them.

### **Strengths**

Involvement of WUAs in water management (35.22); good support from irrigation department official (35.44); improved the efficiency and performance of irrigation systems (40.45); sufficient water is available during crop season (45.45); increase in social relations among farmers (46.13); equity in the

distribution of irrigation water among head reach, middle and tail end areas (47.04); reduced water disputes (49.09); increased crop yields (64.77); freedom of cropping pattern within the limits of allocated water (70.45); increased water use efficiency by implementation of warabandhi schedule (79.54) and number of irrigations to the crop has been increased (80.22) were the major strengths of irrigation officials.

The probable reasons might be the irrigation department enhancement of WUAs to involve in water management at the field level by giving good support to them. The irrigation officials were striving to make available irrigation water to all the users till the tail-end areas and conduct meetings to settle the water disputes and to improve knowledge on water use efficiency. Through proper implementation of warabandhi schedule the number of irrigations has been increased.

### **Weaknesses**

Allocation of insufficient funds (13.63); non involvement of members of WUA in management of water users associations (27.04); inadequate maintenance of drains (40.68); inadequate training facilities (40.68); low educational qualifications of members of WUAs (50.68); inadequate infrastructure facilities (50.90); poor quality of works (57.95); lack of trust between WUAs and irrigation engineers (69.09); lack of cooperation among water users associations (82.27) and short duration of tenure of elected members of WUAs (83.63).

The probable reasons might be the insufficient funds were the main weakness as represented by the irrigation officials because due to insufficient funds the forwarded proposals were accepted very tediously by the government. Due to poor quality of works done by the contractors lack of trust was seen on irrigation engineers. The irrigation officials were taking responsibility to enhance the cooperation among WUAs.

## **Opportunities**

Facilitates the effective implementation of warabandhi schedule (38.57); improved decision making based on local knowledge (43.57); empowerment of farmers to manage irrigation system (52.14); resolution of disputes among farmers (52.85); active involvement of all classes of farmers (58.12); enhancement of productivity of crops growing in Krishna delta region (69.64) and development of good linkages between farmers and irrigation department officials (80.00).

The probable reasons might be to reduce the water disputes the implementation of warabandhi schedule plays a major role and enhances the productivity of crops. The irrigation department officials provide their support in empowerment of farmers in water management and encourage the farmers to have good linkages with the department.

## **Challenges**

Improving the drainage networks (27.72); equal distribution of water among head middle and tail-end areas (35.90); weak institutional set up (37.72); development of friendly relationship among water users associations (41.13); management of aquatic weeds (43.43); enhancement of knowledge about irrigation schemes and programmes to farmers (57.95); increase in production of water intense crops (58.86); involvement of women participation in decision making (61.36); involvement of political leaders in day to day activities of WUAs (67.50); eliminate the members engaged in corruption (79.90); reduce water logging and salinity (85.22).

The major challenge faced by the irrigation officials was to improve drainage networks and supplying of equal distribution of water to all the users. To enhance the weak institutional set up. To manage the aquatic weeds to allow free flow of water from canals to fields. Another challenge is to improve the knowledge on irrigation schemes by conducting trainings to farmers. To encouragement the women to participate in decision making. To reduce the logging and salinity problems in tail-end areas remedial measures should be provided to farmers.

#### **4.7 DEVELOPMENT OF STRATEGIES FOR SUSTAINABILITY OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA OF ANDHRA PRADESH**

Keeping view on the above mentioned strengths, weakness, opportunities and challenges of water users associations particularly weakness and challenges the strategy was developed for the effective functioning of water users associations for better improvement of farmers.

1. The funds released from the government are insufficient and very tedious to carry out their works and for new proposals applied. In fact the presidents were bearing the expenditure before the release of funds from the government. The government should release sufficient funds timely so that the operation and maintenance works can be carried out timely which help in timely availability of water to their fields.
2. There are inadequate training facilities for the farmers. The irrigation and agriculture departments should plan for conducting need based trainings and meetings on irrigation schemes and programmes to improve the knowledge and skills of farmers to get benefited from the schemes and to follow the latest technologies.
3. The quality of construction works done by the contractors was considered under poor condition. So the government and irrigation department should be careful in selecting the irrigation engineers and contractors. Regular monitoring should be done during construction of works. So that the farmers can also have trust in irrigation engineers.
4. Efforts must be made to improve the education levels of people or the educated people must be given preference for electing the WUAs representatives. So that they are be better able to calculate the appropriate budget for new proposals, operation and maintenance works in water users associations.
5. The irrigation department should motivate all the members through conducting more trainings and meetings to build cooperation among the water users association and preparing them to take participation in water management.

6. The representatives of water users associations and the irrigation department should collectively pay attention on management of aquatic weeds. Frequent monitoring should be done on its management for flow of water and see that all the areas are supplied with equal distribution of water. The equal distribution can be done by reducing the overflow or lavish use of water at head reach areas.
7. The institutional set up of irrigation department should be enhanced for better delivery of their services. Due to shortage of laskers and other officials there is a necessity of the recruitment to provide better services to the farmers.
8. Special training programmes should be held and motivate the women to come forward and involve in decision making and other activities. Efforts should be made and encourage the women also to take lead role.
9. Proper action must be taken by the government to see that the water users associations get their share of money from the revenue department that was collected through water tax from the farmer.
10. Members who are engaged in corruption must be eliminated and efforts must be made to develop transparency in work. The political leaders must be in regular touch with the people and know the functioning of WUAs and support should be given to WUAs for its effective functioning and in solving their problems.

The findings were in line with the findings of AHT Group AG Management and Engineering (2013).

#### **4.8 EMPERICAL MODEL OF THE STUDY**

Figure 4.47 indicated the relationship between profile characteristics of the water users associations and opinion. There was a significant relationship between age, education, land holding, extension contact, source of information, training received, information and communication behaviour, innovativeness, risk orientation and economic orientation with the opinion of the respondents. Social participation, perceived work load, cropping pattern, decision making, achievement motivation and management orientation showed non-significant association with the opinion of the respondents of water users associations.

It implied that age, education, land holding, extension contact, source of information, training received, information and communication behaviour, innovativeness, risk orientation and economic orientation were significantly associated with the opinion of the functionaries of water users associations.

Figure 4.47 indicated the relationship between profile characteristics of the water users associations and direct changes. There was a significant relationship between age, education, land holding, extension contact, social participation, training received, perceived work load, risk orientation, achievement motivation, economic orientation and management orientation with the direct changes due to water users associations. Source of information, information and communication behaviour, cropping pattern, decision making, innovativeness showed non-significant association with the direct changes occurred due to water users associations.

It implied that age, education, land holding, extension contact, social participation, training received, perceived work load, risk orientation, achievement motivation, economic orientation and management orientation were significantly associated with the direct changes of water users associations.

Figure 4.47 indicated the relationship between profile characteristics of the water users associations and indirect changes. There was a significant relationship between age, education, land holding, extension contact, training received, perceived work load, risk orientation and economic orientation with the indirect changes due to water users associations. Social participation, source of information, information and communication behaviour, cropping pattern, decision making, innovativeness, achievement motivation and management orientation showed non-significant association with the indirect changes occurred due to water users associations.

It implied that age, education, land holding, extension contact, training received, perceived work load, risk orientation and economic orientation were significantly associated with the indirect changes of water users associations.

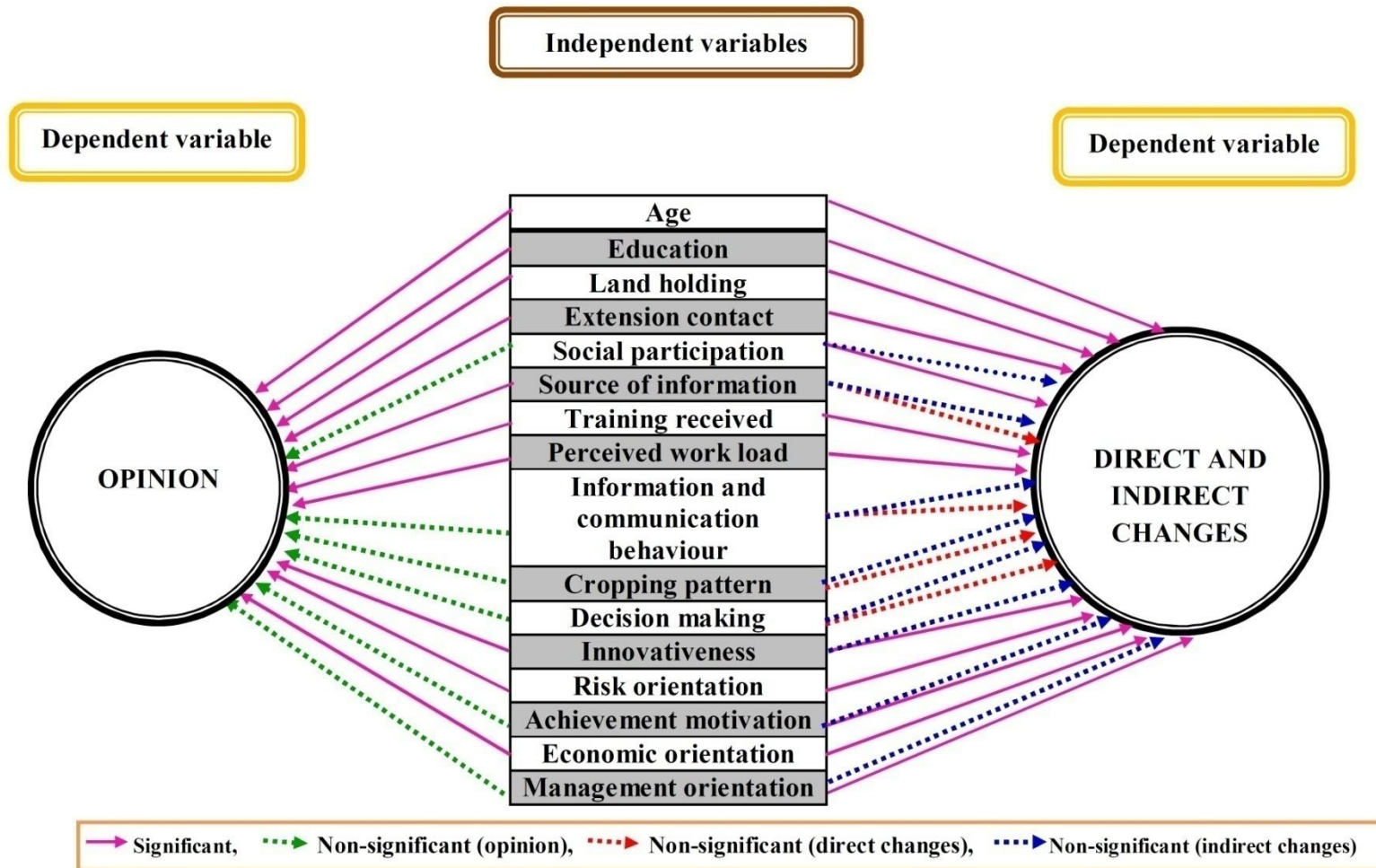


Figure 4.47 Empirical model of the study

## Chapter – V

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### *Summary and Conclusions*

## **CHAPTER V**

# **SUMMARY AND CONCLUSIONS**

### **INTRODUCTION**

Participatory Irrigation Management generally implies participation of irrigators in the management of the irrigation system and is generally interpreted ‘All aspects’ includes planning, design, construction, operation and maintenance, financing, decision rules and the monitoring and evaluation of the irrigation system. ‘All levels’ means the primary, secondary and tertiary (and subsidiary) levels of water distribution network in the irrigation systems.

The empowering of Water User Associations (WUA) as an institution is necessary to promote Participatory Irrigation Management and devolution of irrigation management authority. Assumption of irrigation management responsibilities only by effective WUAs can result in realization of the Participatory Irrigation Management and objectives. The act provided the basis for the introduction of Participatory Irrigation Management and constitution of different Farmers’ Organisations including WUAs in Andhra Pradesh. The legal framework created out of the APFMIS Act resulted in creation of farmers’ organisations at different levels of irrigation system like Water User Associations (WUA), Distributory Committee (DC) and Project Committee (PC).

For sustainable development of Water Users Associations, there is a need to know the opinion of the functionaries towards WUAs, impact of WUAs and also the strengths, weakness, opportunities and challenges of Water Users Associations. Keeping these aspects in view, the study entitled with “A study on impact if water users association in Krishna delta of Andhra Pradesh” is designed with the following objectives.

- 5.1 To study the Personal, Socio- economic and Psychological characteristics of the functionaries.
- 5.2 To know the functioning of the project committees, distributory committees and Water Users Associations.
- 5.3 To study the opinion of the functionaries towards Water Users Associations.
- 5.4 To know the impact of Water Users Associations in Krishna delta in terms of direct and indirect changes.
- 5.5 To study the relationship between Personal, Socio- economic and Psychological characteristics of the functionaries with their opinion and direct and indirect changes.
- 5.6 To elicit the strengths, weakness, opportunities and challenges of Water Users Associations as perceived by the functionaries of Water User Association and Irrigation Department.
- 5.7 To develop strategies for sustainability of Water Users Associations in Krishna delta of Andhra Pradesh.

## **METHODOLOGY**

Krishna delta region was selected for the present study. From Krishna eastern delta Kankipadu, Mudinepalli, Kruthivenu and Denduluru similarly, From Krishna western delta Duggirala, Kuchipudi and Chirala distributory committees were selected. From the selected DCs a total 240 water users associations functionaries from 40 WUAs were selected as respondents finally.

The personal, socio- economic and psychological characteristics of the respondents were age, education, landholding, extension contact, social participation, source of information, training received, perceived workload, information and communication behaviour, cropping pattern, decision making, innovativeness, risk orientation, achievement motivation, economic orientation and management orientation were selected as independent variables and opinion, direct and indirect changes were selected as dependent variables. The data was collected using a well structured interview schedule and analyzed with appropriate statistical tools and significant findings were given below.

## **SALIENT FINDINGS**

### **5.1 PERSONAL, SOCIO- ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE FUNCTIONARIES**

The personal, socio- economic and psychological characteristics of the respondents were 70 per cent of the respondents were found to be middle aged followed by old aged (29.58 %) and only 0.42 per cent of the respondents were under young aged category in Krishna delta area.

Majority of the respondents possessed high school education (22.08 %) followed by those with primary school (20.00 %), illiterate (17.08 %), intermediate (16.67 %), middle school education (15.00 %), graduation (08.34 %) and post graduation education (0.83 %) in the study area.

Majority of the respondents had medium (37.08 %) landholdings, followed by semi-medium (28.75 %), large (13.33), small (17.92 %) large (12.50 %) and a meagre portion of the respondents were under marginal (3.75 %) category.

About 58.75 per cent of the respondents had medium level of extension contact, followed by low (37.50 %) and high (3.75 %) level of extension contact.

Majority (95.42 %) of the respondents had high level of social participation followed by medium (04.17 %) and low (0.41 %) level of social participation in water users associations in Krishna delta area.

About 61.67 per cent of the respondents had medium level of source of information followed by high (22.08 %) and low (16.25 %) source of information.

Majority (34.58 %) of the respondents had attended two meetings/trainings followed by only one meeting/training (21.25 %), three (20.84 %). About 16.67 per cent of respondents had not attended any meetings/trainings, only 04.58 per cent attended four meetings/trainings and nearly 02.08 per cent of the respondents had attended five meetings/trainings.

About 37.92 per cent of the respondents had medium level of perceived workload, followed by high (33.33 %) and low (28.75 %) level of perceived workload of the respondents of water users associations in Krishna delta area.

Nearly 52.92 per cent of the respondents had medium level of information and communication behaviour, followed by low (42.50 %) and high (04.58 %) level of information and communication behaviour.

About 54.61 per cent of the respondents cultivate only paddy crop in karif season. Rest of them followed the cropping sequence of paddy +pulses (12.91 %), paddy + maize (10.41 %), paddy + paddy (07.50 %) turmeric (06.25 %), sugarcane (03.75 %), aquaculture (02.91 %) and chillies (01.67 %).

Nearly 44.17 per cent of the respondents had medium level of decision making, followed by low (35.00 %) and high (20.83 %) level of decision making.

Majority (65.84 %) of the respondents had medium level of innovativeness, followed by high (19.58 %) and low (14.58 %) level of innovativeness.

About (63.75 %) of the respondents had medium level of risk orientation, followed by high (24.17 %) and low (12.08 %) level risk orientation.

Majority (48.75 %) of the respondents had medium level of achievement motivation, followed by high (27.50 %) and high (23.75 %) level of achievement motivation.

Majority (62.08 %) of the respondents had high level of economic orientation, followed by medium (35.42 %) and low (02.50 %) level of economic orientation.

Majority (60.00 %) of the respondents had medium level of management orientation, followed by high (29.17 %) and low (10.83 %) level of management orientation.

## **5.2 FUNCTIONING OF THE PROJECT COMMITTEES, DISTRIBUTORY COMMITTEES AND WATER USERS ASSOCIATIONS**

The primarily functions performed by project committee were maintaining a list of the distributory committees and water users associations in its area of operation (100.00 %), approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the competent authority (95.00 %), approve a plan for the maintenance of irrigation system including the major drains within its area of operation (90.42 %), maintain an inventory of the distributory and drainage systems in its area of operation (82.08 %), maintenance works with the funds of the committee from time to time and regular water budgeting (75.83 %), promote economy in the use of water (60.42 %), maintain accounts, cause annual audit of its accounts, social audits and other records as may be prescribed (45.42 % ), conduct general body meetings as may be prescribed (22.08 % ) and encourage avenue plantations and modernization of agriculture in its area of operation (10.83 %).

The primarily functions performed by distributory committee were maintain a register of water users associations and an inventory of the irrigation system in the area of its operation, including drains (95.83 %), resolve disputes, if any, between the water users associations in its area of operation (94.17 %), maintain accounts, cause annual audit, social audits and other records as may be prescribed (90.00 %), regulate the use of water among the various water users associations under its area of operation and monitor the flow of water for irrigation (83.75 %), promote economy in the use of water allocated (81. 25 %), conduct general body meetings and abide by the decisions of the project committee (77.50 %), preparation of operational plan based on its entitlement, area, soil, cropping pattern (76.25 %), assist in the conduct of elections to the managing committee (73.75 %), maintenance works with the funds of the committee from time to time (66.67 %), maintenance of both distributaries and medium drains within its area of operation (65.42 %) and encourage avenue plantations and modernization of agriculture in its area of operation (15.83 %).

The primarily functions performed by water users associations were Maintain an inventory of irrigation system, registers of landholders and co-opted members (96.25 %), Resolve disputes (95.50 %), Conduct general body meetings, water budgeting as prescribed (90.83 %), Maintain accounts, records and social audits (90.00 %), Prepare and implement warabandhi schedule and regulation of water schedule (89.17 %), Abide decisions of distributory committee and project committee (87.08 %), Prepare a plan for maintenance of irrigation system (82.50 %), Assistance in conduct of elections and managing committee (75.83 %), Monitor flow of water for irrigation (74.17 %), Raise resources and promote economy in the use of water allocated (69.58 %), Maintain feeder channels of minor irrigation tanks (66.67 %). Assistance to revenue department in collection of water rates (57.08 %) was partially performed and Encourage avenue plantation was the function non-performed by most (69.17 %) of the water users associations.

### **5.3 OPINION OF THE FUNCTIONARIES TOWARDS WATER USERS ASSOCIATIONS**

Majority of the respondents were highly favourable (46.67 %) followed by favourable (43.33 %) and less favourable (10.00 %) towards water users associations.

Majority (72.08 %) of them were strongly agreed to that crop yields were increased due to economic use of irrigation and Water Users Associations helps in restoring the confidence of the farmers in the irrigation system (72.08 %), there was a need of conducting technical training programmes particularly on efficient and effective water application practices and their impacts on environment (64.58 %).

About 35.83 per cent of them were agreed that Water Users Associations system gives freedom for the members to be effective and efficient, Water Users Associations promote economy in the use of water allocated (32.50 %), Water Users Associations implement the warabandi schedule for each irrigation season and Water Users Associations is one of the best associates for Participatory Irrigation Management (27.92 %).

Majority (48.33 %) of the respondents disagreed for the statement involvement of MGNREGS workers in canal rehabilitation followed by Management Committee meetings were not conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management (46.25 %), Participatory Irrigation Management contributed to increase disputes among stakeholders (42.92 %), avenue planting along the canals bringing about improvement in environment, etc. (41.67 %),

#### **5.4 IMPACT OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA IN TERMS OF DIRECT AND INDIRECT CHANGES**

##### **A) DIRECT CHANGES**

Majority (47.50 %) of the respondents had medium level of direct changes, followed by high (39.17 %) and low (13.33 %) level of direct changes for the respondents of water users associations in Krishna delta area.

About 60.83 per cent of the respondents said that they get water up to six months during the crop season, followed by 3-4 months (38.75 %), 1-2 months (0.42 %) and none of them said that water availability was for less than one month.

About 50.83 per cent of them said that they get water quantity at 75-50 per cent followed by full capacity (40.00 %), 50-25 per cent (09.17 %) and none of them were from less than 25 per cent.

About 83.75 per cent of them told that they utilize water only for one crop followed by aquaculture (12.50 %), two crops (03.75 %) and none of them used were for drinking water.

Majority (49.58 %) of the respondents had employment generation during cleaning of drains, followed by repairs and rehabilitation (35.8 %), warabandhi schedule (12.50 %) and no employment (02.08 %).

Nearly 44.58 per cent of them said that warabandhi was implemented excellently followed by good (37.92 %), average (13.33 %), and poor (04.17 %).

About 45.83 per cent of the respondents reported that rehabilitation of water courses were maintained at good level followed by excellent (34.17 %), average (16.67 %) and 03.33 per cent reported at poor level.

About 38.75 per cent of them had reported that the tail-end areas get water up to 75-50 per cent followed by full capacity (31.67 %), 50-25 per cent (22.50 %) and less than 25 per cent (07.08 %).

About 55.42 per cent of the respondents reported that they arrange the meetings and settle the disputes during conflicts followed by no disputes, everyone use water only when his turn comes (40.83 %) and leave people to fight and settle on their own (03.75 %).

About 83.33 per cent of them said that the WUA jurisdiction was benefited followed by village level (11.25 %), house/family (05.00 %) and individual (0.42 %).

Nearly 49.58 per cent of them reported that WUAs had participated excellently in water management followed by good (37.08 %), average (10.00 %) and poor (03.34 %).

Nearly 57.08 per cent of the respondents said that they had sufficient powers followed by undecided (28.34 %) and insufficient (14.58 %).

About 45.92 per cent of them reported there were good relations among WUAs, Irrigation and Revenue departments followed by average (25.83 %), poor (15.00 %) and excellent (13.75 %).

The avenue plantation in Krishna delta area was poor (43.75 %) followed by average (30.42 %), good (21.66 %) and excellent (04.17 %).

Majority of the respondents were medium landholders and the average acerage of respondents before establishment of WUAs was 6.07 ac and after establishment of WUAs it was 6.05 ac.

The cropping intensity of paddy before the establishment of WUAs was 55.83 per cent, paddy followed by pulses (37.50 %), paddy followed by maize (01.67 %) and others (05.00 %). After the establishment of water users associations the cropping intensity of paddy was in 62.08 per cent, paddy followed by pulses (12.92 %), paddy followed by maize (10.42 %) and others (14.58 %).

Before the establishment of WUAs the average yield of paddy was 20 qt/ac, sugarcane (34.80 tons/ac), turmeric (18.33 qt/ac), maize (22 qt/ac) and pulses (2.4 qt/ac). After the establishment of WUAs the average yield of paddy was 32.49 qt/ac, sugarcane (50.50 tons/ac), turmeric (27.53 qt/ac), maize (33.60 qt/ac) and pulses (3.8 qt/ac). The increase in yield was due to timely availability of sufficient water through warabandhi schedule, proper management of water. In tail-end areas the yield of chillies has been reduced due to insufficient water availability and reduced number of respondents in growing pulses was observed due to YMV attack to the crop.

Before establishment of WUAs the average income to the respondents was about 24 per cent and after establishment of WUAs the average income was 42 per cent. The increase in income was due to increased production and productivity of crop, efficient utilization of water and improved land use pattern.

Before establishment of WUAs the average agriculture labour days to the respondents were 120 days and after establishment of WUAs both agriculture labour days and employment due to WUAs the average employment period was 110 days. Due to improved farm mechanization the agriculture labour days have been reduced and the employment have been increased due to repairs, rehabilitation and other maintenance works of canals during summer season.

Nearly 59.16 per cent of them had no livestock followed by buffalo (19.17 %), buffalo + hen (07.50 %), buffalo + cow (07.08 %), buffalo + cow + hen (03.75 %), hen (02.42 %), goat (0.42 %) and no sheep and cow before the establishment of WUAs. But after the establishment of WUAs it was observed

that 65.00 per cent of them had no livestock, buffalo (20.42 %), buffalo + hen (08.33 %), hen (03.33 %), buffalo + cow (02.50 %), goat (0.42 %) and no sheep, cow, buffalo + cow + hen.

Both grass and paddy straw area before the establishment of WUAs was 63.75 per cent followed by paddy straw (30.00 %), no fodder availability (06.25 %) and no separate increase in grass area. But after the establishment of WUAs no fodder availability was about 59.58 per cent followed by paddy straw (32.08 %), both grass and paddy straw (06.25 %) and grass area (02.09 %).

Before the establishment of water users associations everyone followed only the conventional method. But after the establishment of water users associations 63.09 per cent of them followed the conventional method followed by direct sown rice (33.33 %) and both conventional and Direct Sown Rice was 04.58 per cent.

## **B) INDIRECT CHANGES**

.The indirect changes were majority of them had medium (47.92 %) followed by high (42.50 %) and low (09.58 %) indirect changes.

Majority of the respondents were agreed that there was improved mechanization (90.00 %), increased wage rates (73.33 %), enhancement of land values (71.72 %), change in attitude (68.533 %), improved land use pattern (66.66 %), increased knowledge on water use efficiency (65.42 %), less water theft (60.42 %), change in knowledge (57.92 %), increased credit needs (56.66 %), increased fish/aquaculture (55.83 %), change in social life (54.58 %), improved communication behaviour and increased personal empowerment (54.17 %), enhancement of availability of water (53.75 %), autonomy in decision making (53.33 %), conjunctive use of canal water, ground water and drain water (51.57 %), change in skill (46.25 %), decrease in migration of farmers (44.58 %) and development of self respect (44.17 %).

About 60.00 per cent of the respondents were undecided that whether there was rise in ground water levels.

Nearly 59.58 per cent of the respondents were disagreed that there was reduction in cost of cultivation, increased migration of birds (54.58 %), decline in water quality (53.33 %), increased assets (46.25 %), change in economic status (42.50 %) and increased education standards of children (40.83 %).

## **5.5 RELATIONSHIP BETWEEN PERSONAL, SOCIO-ECONOMIC AND PSYCHOLOGICAL CHARACTERISTICS OF THE FUNCTIONARIES WITH THEIR OPINION AND DIRECT AND INDIRECT CHANGES**

The variables such as social participation, perceived workload, information and communication behaviour, cropping pattern, decision making, achievement motivation and management orientation showed significant association. Age, education, land holding, extension contact, source of information, training received, innovativeness, risk orientation and economic orientation showed non-significant association with the opinion of the respondents.

The variables such as source of information, information and communication behaviour, cropping pattern, decision making and innovativeness showed significant association. Age, education, land holding, extension contact, social participation, training received, perceived workload, risk orientation, economic orientation, achievement motivation and management orientation showed non-significant association with the direct changes.

The variables such as social participation, source of information, information and communication behaviour, cropping pattern, decision making, innovativeness, achievement motivation and management orientation showed significant association. Age, education, land holding, extension contact, training received, perceived work load, risk orientation and economic orientation showed non-significant association with the indirect changes.

## **5.6 STRENGTHS, WEAKNESS, OPPORTUNITIES AND CHALLENGES OF WATER USERS ASSOCIATIONS AS PERCEIVED BY THE FUNCTIONARIES OF WATER USER ASSOCIATION AND IRRIGATION DEPARTMENT**

### **5.6.1 Strengths, weakness, opportunities and challenges of water users associations as perceived by the functionaries of water user association**

The major strengths expressed by the respondents were involvement of water users associations; good support from the irrigation department officials; sufficient water is available during crop season; increased crop yields; equity in the distribution of irrigation water among head reach, middle and tail end areas; freedom of cropping pattern within the limits of allocated water; increased water use efficiency by implementation of warabandhi schedule; number of irrigations to the crop have been increased; reduced water disputes; increase in social relations among farmers and Improved the efficiency and performance of irrigation systems.

The prime weaknesses expressed by the respondents were allocation of insufficient funds; inadequate training facilities; inadequate maintenance of drains; poor quality of works; inadequate infrastructure facilities; low educational qualifications of members of WUAs; lack of cooperation among water users associations; non involvement of members of WUA in management of water users associations; lack of trust between WUAs and irrigation engineers; and short duration of tenure of elected members of WUAs.

The possible opportunities for the WUA respondents were empowerment of farmers to manage irrigation system; facilitates the effective implementation of warabandhi schedule; resolution of disputes among farmers; enhancement of productivity of crops growing in Krishna delta region; improved decision making based on local knowledge; active involvement of all classes of farmers and development of good linkages between farmers and irrigation department officials.

The major challenges faced by the respondents were Management of aquatic weeds; equal distribution of water among head middle and tail-end areas; improving the drainage networks; enhancement of knowledge about irrigation schemes and programmes to farmers; weak institutional setup; involvement of political leaders in day to day activities of WUAs; eliminate the members engaged in corruption; development of friendly relationship among water users associations; involvement of women participation in decision making; increase in production of water intense crops and reduce water logging and salinity.

### **5.6.2 Strengths, weakness, opportunities and challenges of water users associations as perceived by the officials of irrigation department**

The prime strengths perceived by the irrigation officials were involvement of WUAs in water management; good support from irrigation department official; improved the efficiency and performance of irrigation systems; sufficient water is available during crop season; increase in social relations among farmers; equity in the distribution of irrigation water among head reach, middle and tail end areas; reduced water disputes; increased crop yields; freedom of cropping pattern within the limits of allocated water; increased water use efficiency by implementation of warabandhi schedule and number of irrigations to the crop has been increased.

The major weaknesses perceived by the irrigation officials were allocation of insufficient funds; non involvement of members of WUA in management of water users associations; inadequate maintenance of drains; inadequate training facilities; low educational qualifications of members of WUAs; inadequate infrastructure facilities; poor quality of works; lack of trust between WUAs and irrigation engineers; lack of cooperation among water users associations and short duration of tenure of elected members of WUAs.

The opportunities as perceived by the irrigation officials were WUAs facilitates the effective implementation of warabandhi schedule; improved decision making based on local knowledge; empowerment of farmers to manage irrigation system; resolution of disputes among farmers; active involvement of

all classes of farmers; enhancement of productivity of crops growing in Krishna delta region and development of good linkages between farmers and irrigation department officials.

The major challenges faced by the irrigation department officials were improving the drainage networks; equal distribution of water among head middle and tail-end areas; weak institutional set up; development of friendly relationship among water users associations; management of aquatic weeds; enhancement of knowledge about irrigation schemes and programmes to farmers; increase in production of water intense crops; involvement of women participation in decision making; involvement of political leaders in day to day activities of WUAs; eliminate the members engaged in corruption and to reduce water logging and salinity.

## **5.7 STRATEGIES FOR SUSTAINABILITY OF WATER USERS ASSOCIATIONS IN KRISHNA DELTA OF ANDHRA PRADESH**

1. The government should release sufficient funds timely so that the operation and maintenance works can be carried out timely which help in timely availability of water to their fields.
2. Regular monitoring should be done during construction of works. So that the farmers can also have trust in irrigation engineers.
3. The irrigation department should motivate all the members through conducting more trainings and meetings to build cooperation among the water users association and prepare them to take part in water management.
4. The institutional set up of irrigation department should be enhanced for better delivery of their services. Due to shortage of laskers and other officials there is a necessity for the recruitment of officials.
5. Proper action must be taken by the government and see that the water users associations get their share of money from the revenue department that was collected through water tax from the farmers.

## 5.8 IMPLICATIONS OF THE STUDY

Based on the above findings of the study the following implications are made.

1. From the study it was observed that majority of the respondents were middle aged. Hence there is a need to attract youth to involve in management of water system and in decision making for effective functioning.
2. Majority of the respondents possessed only high school education only. Hence efforts must be made to improve the level of education of the respondents which contributes to increase their knowledge level, change in positive attitude and better understanding towards water users associations.
3. It was found that most of the respondents were medium landholders those who had agriculture as their main occupation of the family had depended on their land for their livelihood. So the irrigation and agriculture departments should conduct trainings/meetings on improved land use pattern based on availability of resources.
4. The study revealed that majority of the respondents attended less number of trainings, medium extension contact, source of information, information and communication behaviour due to shortage of laskers, irrigation officials. Hence there is a need to recruit them immediately to be available at the field level to provide their service to the farmers.
5. The findings of the study stated that majority of the respondents had medium decision making, innovativeness, risk orientation, achievement motivation management orientation and attended less number of trainings. So there is a need to encourage the farmers to participate in training programmes and group discussions and take part in decision making and involve in water management. So that they can improve their knowledge and decision making ability in functioning of WUAs.
6. All these can be improved by building self confidence, exposing and motivating them to adopt latest technologies and improving managerial qualities of respondents through conducting more number of training programmes.

7. The respondents had high social participation and economic orientation. Keeping this in mind, appropriate extension strategies should be designed to improve more participation of the respondents and to gain better results from water users associations.
8. The findings of the study revealed that majority of the respondents had highly favourable opinion on WUAs and medium direct and indirect changes due to water users associations. This was due to sufficient availability of water through warabandhi implementation. Yield, income employment generation has been increased after the establishment of water users associations. More efforts should be made to supply sufficient water to tail-end areas also by reducing the overflow or lavish use of water at head reach areas.
9. The strategy which can be put into practice have been developed based on strengths, weaknesses, opportunities and challenges as expressed by the representatives of water users associations and officials of irrigation department. Based on the priority given by them proper action must be taken to enhance and improve the strengths, weaknesses, opportunities and challenges of water users associations.

## **5.9 SUGGESTIONS FOR FTURE RESEARCH**

1. The present study was conducted in only Krishna delta region. Hence further studies can be conducted in other areas.
2. The study was conducted with only selected independent variables. So further research may be conducted by including some more independent variables to probe their impact on the dependent variables.
3. Limited sample size was selected for the study. Hence the other studies can be taken up with large sample size.
4. Further research can be conducted in other areas with same objectives to generalize the results.
5. The studies like constraint analysis of water users associations can also be taken up.
6. The ex-post facto research design was used in the present study. The other research designs can also be used for future studies.
7. The comparative analysis with other states on functioning of water users associations can also be studied.

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**\* Original not seen**

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Note: The literature is cited as per the “Thesis Guidelines” prescribed by Acharya N. G. Ranga Agricultural University, Guntur

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# *Appendices*

## Appendix – A



**ACHARYA N. G. RANGA AGRICULTURAL UNIVERSITY**  
**DEPARTMENT OF AGRICULTURAL EXTENSION**  
**AGRICULTURAL COLLEGE, BAPATLA**

**Topic: “A Study on Impact of Water Users Associations in Krishna  
Delta of Andhra Pradesh”**

**INTERVIEW SCHEDULE**

**PART -A**

Respondent No.

**I) For Seeking of General Information**

1. Name of the Respondent :
2. Designation :
3. Village :
4. Water Users Association No. :
5. Distributory Committee No. :
6. District :

**II) Profile Characteristics of Farmers**

1. AGE (In completed years) :

**2. EDUCATION**

- a) No Schooling (Illiterate) :
- b) Primary School (1-5) :
- c) Middle School (6-7) :
- d) High School (8-10) :
- e) Inter mediate :
- f) Graduation :
- g) Post Graduation :

### 3. LAND HOLDING (acres)

- a) Marginal farmers ( below 1.00 ha) :
- b) Small farmers (1.01 to 2.00 ha) :
- c) Semi medium (2.01 to 4.00 ha) :
- d) Medium (4.01 to 10.00 ha) :
- e) Large ( above 10.00 ha) :

**4. EXTENSION CONTACT:** The following statements given below represent the extension contact of farmers. Please indicate your frequency of contact

S. No.	Source	Frequency of contact		
		Frequently (3)	Occasionally (2)	Rarely (1)
1.	WUA Member			
2.	WUA Vice-President			
3.	WUA President			
4.	Distributor Committee Chairman			
5.	Project Committee Chairman			
6.	Lasker			
7.	Assistant Engineer (AE)			
8.	Assistant Executive Engineer (AEE)			
9.	Deputy Executive Engineer (DEE)			
10.	Executive Engineer (EE)			
11.	Superindent Engineer (SE)			
12.	MPEO/AEO/MAO/ADA			
13.	Scientists of ANGRAU			
14.	Political leaders (MLA)			

**5. SOCIAL PARTICIPATION:** The following statements given below represent the social participation of farmers. Please indicate your extent of participation

S. No.	Name of the organization	Membership		Extent of Participation		
		Member (2)	Non-member (1)	Regular (3)	Occasional (2)	Never (1)
1.	Water Users Association					
2.	Distributor Committee meetings					
3.	Project Committee meetings					
4.	Gram Panchayat/ Sabha					
5.	SHG's/DWCRA					
6.	PACS					
7.	MGNREGS					
8.	Farmers clubs					
9.	Youth clubs					
10.	Others					

**6. SOURCE OF INFORMATION:** The following statements given below represent the source of information of farmers. Please indicate your frequency of getting information

S. No.	Sources	Frequency of getting information			
		Most often (4)	Often (3)	Sometimes (2)	Never (1)
<b>I</b>	<b>Personal Localite</b>				
1.	Family members				
2.	Neighbours				
3.	Friends/relatives				
<b>II</b>	<b>Personal Cosmopolite</b>				
1.	Representatives of WUA				

2.	Officials of Irrigation Department				
3.	Other line department officials				
<b>III</b>	<b>Impersonal Cosmopolite</b>				
1.	Television				
2.	Newspaper				
3.	Magazine				
4.	Internet				
5.	Others if any (specify)				

## 7. TRAINING RECEIVED

S. No.	Date	Title of the training programme	Duration	Organized by
1.				
2.				
3.				

**8. PERCEIVED WORK LOAD:** The following statements given below represent the perceived work load of farmers. Please indicate your level of agreement or disagreement

S. No.	Statement	SA (5)	A (4)	U D (3)	D A (2)	SDA (1)
1.	I feel pressured only during the Warabandhi schedule					
2.*	I feel busy or rushed with the maintenance of record work					
3.*	I feel that amount of work I did interfered was not well done					
4.	I feel that the number of requests, complaints, problems dealt with were more than expected					
5.	I feel pressured during repairs and rehabilitation works of the canal					
6.*	I feel unsatisfactory with settlement of complaints or disputes					

**9. INFORMATION AND COMMUNICATION BEHAVIOUR:** Please indicate your answer for the following by putting a tick (✓) mark

**I. Information Input Behaviour**

S. No.	Category	Frequently (3)	Sometimes (2)	Never (1)
<b>a)</b>	<b>Personal localite sources</b>			
1.	Friends			
2.	Neighbours			
3.	WUA members			
4.	Local leader			
5.	SHG members			
6.	Panchayaths			
7.	Cooperatives			
8.	Farm organizations			
9.	Others			
<b>b)</b>	<b>Personal cosmopolite sources</b>			
1.	WUA President			
2.	WUA Vice-President			
3.	Distrybutory Committee Chairman			
4.	Project Committee Chairman			
5.	Irrigation officials			
6.	Agricultural officials			
7.	Scientists of ANGRAU/KVK/RARS			
8.	NGO's			
9.	Bank personnels			
10.	Demonstrations			
11.	Field day/field trips			
12.	Trainings			
13.	Study tours			
<b>c)</b>	<b>Impersonal cosmopolite sources</b>			
1.	Radio			
2.	Television			
3.	Newspapers			
4.	Mobile phones			
5.	Internet			
6.	Agribusiness centres			
7.	Agricultural magazines			
8.	Krishimela/ exhibitions			
9.	Agri portals			

## II. Information Processing Behaviour

<b>a) Information Evaluation Behaviour</b>				
<b>S. No.</b>	<b>Statements</b>	<b>Yes (2)</b>	<b>No (1)</b>	
1.	Discussing with family members			
2.	Discussing with neighbours			
3.	Discussing with local leaders			
4.	Discussing with fellow farmers			
5.	Discussing with WUA members			
6.	Discussing with WUA President/Vice-President			
7.	Discussing with Distributory/ Project Committee Chairman			
8.	Discussing with extension personnel			
9.	Judging in the light of past experience			
10.	Judging by considering the degree of complexity			
11.	Considering its economic feasibility.			
12.	Accepted as such			
<b>b) Information Storage Behaviour</b>				
<b>S. No.</b>	<b>Statements</b>	<b>Yes (2)</b>	<b>No (1)</b>	
1.	Memorizing			
2.	Taking down in a notebook or diary			
3.	Preserve the printed literatures like leaflets, bulletins, booklets etc			
4.	Saving in tablet and mobile phone			
5.	Recording the information in voice recorders			
6.	By maintaining information received as it is in files			
7.	Saving in computer			
8.	Storing in external hard disk /pen drive			
9.	Recording the information in CDs and DVDs			
10.	Preserve newspaper cuttings			
11.	Storing files in Google drive/email for easy online access			
<b>c) Information Utilization Behaviour</b>				
<b>S. No.</b>	<b>Statements</b>	<b>Regularly (3)</b>	<b>Occasionally (2)</b>	<b>Never (1)</b>
1.	Selection of seeds for planting on canal bunds			
2.	Application of herbicides for management of aqua weeds			
3.	Planning the date of release of irrigation water			
4.	Scheduling irrigation			

<b>S. No.</b>	<b>Statements</b>	<b>Regularly (3)</b>	<b>Occasionally (2)</b>	<b>Never (1)</b>
5.	Canal rehabilitation works like desilting etc.			
<b>d) Information Transformation Behaviour</b>				
1.	Preparing success stories			
2.	CD-ROM			
3.	Developing songs music, drama			
4.	Adding personal experience to the information			
5.	Preparing written materials or handouts			
6.	Developing PowerPoint presentations			
7.	Preparing lectures in local language			
8.	Developing information boards			
9.	Preparing charts ,graphs, posters etc			

### **III. Information Output / Dissemination Behaviour**

<b>S. No.</b>	<b>Method of disseminating information</b>	<b>Regularly (3)</b>	<b>Occasionally (2)</b>	<b>Never (1)</b>
1.	Group Discussion with WUA members			
2.	Conducting field days			
3.	Group discussion with fellow farmers			
4.	Group Discussion with extension workers			
5.	Demonstrations			
6.	Farmers training programmes			
7.	Phone calls			
8.	e learning modules			
9.	Film shows			
10.	Conducting workshops			
11.	Participating farm broadcasts			
12.	Farm and Home visits			

<b>S. No.</b>	<b>Method of disseminating information</b>	<b>Regularly (3)</b>	<b>Occasionally (2)</b>	<b>Never (1)</b>
13.	Campaigns			
14.	Writing in newspapers			
15.	Sending SMS/voice mails			
16.	Agricultural exhibitions			
17.	Posters, leaflets, bulletins			

#### 10. CROPPING PATTERN:

<b>S. No</b>	<b>Season</b>	<b>Crop/ Aquaculture</b>	<b>Area cultivated (ac)</b>	<b>Irrigation practiced</b>	
				<b>Canal (2)</b>	<b>Canal + pumpset (1)</b>
1.	Kharif				
2.	Rabi				
3.	Summer				

**11. DECISION MAKING:** The following statements given below represent the decision making behaviour of farmers. Please indicate your level of agreement or disagreement

<b>S. No.</b>	<b>Decision/Activity</b>	<b>SA (5)</b>	<b>A (4)</b>	<b>UD (3)</b>	<b>DA (2)</b>	<b>SDA (1)</b>
1.	I believe effective communication is the key factor for good decision making					
2.	I feel that it is better to plan the activities in advance about agricultural water management					
3.	I am a person to consider the pros and cons of WUAs in advance					
4.*	I act with hesitation in taking decisions with time sense					
5.*	I am a person to act with consensus to take decisions					
6.*	I am a person to don't believe the importance of evaluation for effective decision making					

**12. INNOVATIVENESS:** The following statements given below represent the innovativeness of farmers. Please indicate your level of agreement or disagreement

S. No.	Statements	SA (5)	A (4)	UD (3)	DA (2)	SDA (1)
1.	Women participation in WUAs can improve the system					
2.	I try to keep myself up to date with information on new water conservation practices					
3.*	Though the water conservation practices are profitable I am not interested in any of them					
4.*	Training does not make better life in future					
5.	If the irrigation department officials provides a talk/training would you attend					
6.	It is better to cultivate water use efficient crops for better utility of water					
7.	Somehow I believe that following warabandhi schedule is beneficial to all farmers					
8.*	It is difficult to practice less water used rice production technology					

**13. RISK ORIENTATION:** The following statements given below represent the risk orientation behaviour of farmers. Please indicate your level of agreement or disagreement

S. No.	Statements	SA (5)	A (4)	UD (3)	DA (2)	SDA (1)
1.*	The farmer should completely depend on canal water for growing crops					
2.	The president should take risk in resolving disputes among farmers regarding water					
3.*	A farmer should grow crop in a small area to avoid water problems					
4.	A farmer should grow water use efficient crops to avoid water problems					
5.*	The WUA/President only should bare the amount for cleaning of drains, repairs and rehabilitation works till the government release funds					
6.	A farmer who is willing to take greater risks than the average farmer usually have better financial condition					

**14. ACHIEVEMENT MOTIVATION:** The following statements given below represent the achievement motivation of farmers. Please indicate your level of agreement or disagreement

S. No.	Statements	SA (5)	A (4)	UD (3)	DA (2)	SDA (1)
1.*	What we know is enough and there is no need of learning new skills for betterment					
2.	One should think always be ahead of other WUAs					
3.	Work should be first priority even if one cannot get adequate rest during warabandhi schedule					
4.	A farmer should perceive that no obstacle can stop him from performing work better					
5*	There is no need to put more efforts because everything is determined by god.					
6*	The way things are happening now a day's discourages one to work hard.					
7*	It is better to adjust with the quantity of water received than to be struggling for more.					

**15. ECONOMIC ORIENTATION:** The following statements given below represent the economic orientation of farmers. Please indicate your level of agreement or disagreement

S. No.	Statements	SA (5)	A (4)	UD (3)	DA (2)	SDA (1)
1.	A farmer should work towards economic gains					
2.	In addition to making a reasonable amount of profit, the enjoyment of farming life is also important					
3.*	Farmers should plan for only one crop in a year for efficient utilization of water released from warabandhi schedule					
4.	WUAs president and members should generate new ideas for the improvement of irrigation system					
5.	Waste lands can be used as cultivable lands for efficient use of land and water					

**16. MANAGEMENT ORIENTATION:** The following statements given below represent the management orientation of farmers. Please indicate your level of agreement or disagreement

S. No.	Statements	SA (5)	A (4)	UD (3)	DA (2)	SDA (1)
1	Equal allocation of water or optimization of irrigation scheduling to everyone is possible					
2.*	There is injudicious and lavish use of water by few farmers					
3.	There is undue interference of political leaders in operation and maintenance of irrigation schedule					
4.*	It is difficult to manage during cleaning of drains and repairs and rehabilitation works					
5.	Accordingly the records and registers of WUA are maintained					

### III a) FUNCTIONS OF PROJECT COMMITTEE

S. No.	Functions of Project Committee	Fully performed		Partially performed		Non-performed	
		f	%	f	%	f	%
1	Approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the Competent Authority						
2	Approve a plan for the maintenance of irrigation system including the major drains within its area of operation						
3	Maintain a list of the Distributory Committees and Water Users Associations in its area of operation						
4	Maintain an inventory of the Distributory and Drainage Systems in its area of operation						
5	Maintenance works with the funds of the committee from time to time and regular water budgeting						
6	Resolve disputes if any, between the Distributory Committees						

S. No.	Functions of Project Committee	Fully performed		Partially performed		Non-performed	
		f	%	f	%	f	%
7	Promote economy in the use of water						
8	Maintain accounts, cause annual audit of its accounts, social audits and other records as may be prescribed						
9	Conduct General Body Meetings as may be prescribed						
10	Encourage avenue plantations and modernization of agriculture in its area of operation						

### III b) FUNCTIONS OF DISTRIBUTORY COMMITTEE

S. No.	Functions of Distributory Committee	Fully performed		Partially performed		Non-performed	
		f	%	f	%	f	%
1	Preparation of operational plan based on its entitlement, area, soil, cropping pattern						
2	Maintenance of both distributaries and medium drains within its area of operation						
3	Regulate the use of water among the various Water Users Associations under its area of operation and monitor the flow of water for irrigation						
4	Resolve disputes, if any, between the Water Users Associations in its area of operation						
5	Maintain a register of Water Users Associations and an inventory of the irrigation system in the area of its operation, including drains						
6	Maintenance works with the funds of the committee from time to time						
7	Promote economy in the use of water allocated						
8	Maintain accounts, cause annual audit, social audits and other records as may be prescribed						

S. No.	Functions of Distributory Committee	Fully performed		Partially performed		Non-performed	
		f	%	f	%	f	%
9	Conduct General Body Meetings and abide by the decisions of the Project Committee						
10	Assist in the conduct of elections to the Managing Committee						
11	Encourage avenue plantations and modernization of agriculture in its area of operation						

### III c) FUNCTIONS OF WATER USERS ASSOCIATIONS

S. No.	Functions of WUAs	Fully performed (3)	Partially performed (2)	Non-performed (1)
1	Prepare and implement warabandhi schedule and regulation of water schedule			
2	Prepare a plan for maintenance of irrigation system			
3	Resolve disputes			
4	Monitor flow of water for irrigation			
5	Maintain an inventory of irrigation system, registers of landholders and co-opted members			
6	Maintain accounts, records and social audits			
7	Raise resources and promote economy in the use of water allocated			
8	Assistance in conduct of elections and managing committee			
9	Assistance to revenue department in collection of water rates			
10	Conduct general body meetings, water budgeting as prescribed			

<b>S. No.</b>	<b>Functions of WUAs</b>	<b>Fully performed (3)</b>	<b>Partially performed (2)</b>	<b>Non-performed (1)</b>
11	Abide decisions of distributory committee and project committee			
12	Encourage avenue plantation			
13	Maintain feeder channels of minor irrigation tanks			

**PART -B**

**I. OPINION OF THE RESPONDENTS TOWARDS WATER USERS ASSOCIATIONS**

The following statements given below represent the opinion of farmers.

Please indicate your level of agreement or disagreement

<b>S. No.</b>	<b>Statement</b>	<b>SA (5)</b>	<b>A (4)</b>	<b>UD (3)</b>	<b>DA (2)</b>	<b>SDA (1)</b>
1.	There is increase in crop yields due to economic use of irrigation					
2.	There is timely delivery of water in relation to crop requirements and farmers agricultural programmes					
3.	There is equity in delivery of water to upstream, midstream and tail-end sections of farmers					
4.	Participatory Irrigation Management provides opportunity for changing of cropping pattern Rice-Pulses, Rice-Maize					
5.	Water Users Associations promote economy in the use of water allocated					
6.	The Pattiseema Lift Irrigation scheme is largely beneficial to the farmers in the Krishna Delta area					
7.	Water Users Associations implement the warabandi schedule for each irrigation season					
8.	Water Users Associations helps in restoring the confidence of the farmers in the irrigation system					
9.	Cleaning of drains and its maintenance requires technical capabilities					
10.*	Participatory Irrigation Management contributed to increase disputes among stakeholders					
11.	The water from Pattiseema project stabilizes 12 lakh acres besides meeting the second crop requirements of Krishna Delta area					
12.*	Proper communication skills are not required among the associations for its effective functioning					
13.	The Water Users Associations system gives freedom for the members to be effective and efficient					
14.	There is need of conducting technical training programmes particularly on efficient and					

<b>S. No.</b>	<b>Statement</b>	<b>SA (5)</b>	<b>A (4)</b>	<b>UD (3)</b>	<b>DA (2)</b>	<b>SDA (1)</b>
	effective water application practices and their impacts on environment					
15.	Incentives should be given to less water used rice production technology users					
16.	All important decisions on water regulating and allocation are being discussed in the presence of all Water Users Associations members and I&CAD officials					
17.	Involvement of MGNREGS workers in canal rehabilitation					
18.*	Management Committee meetings are not conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management					
19.	Water Users Associations is one of the best associates for Participatory Irrigation Management					
20.	Though there is displacement of more people in the project area it is important to have Polavaram Project					
21.	Local political play a big role in the way of functioning of Water Users Associations					
22.	Avenue planting along the canals bringing about improvement in environment, etc.					

**\* Negative statement**

## **II. IMPACT OF WATER USERS ASSOCIATIONS (Direct and Indirect Changes)**

Please indicate the most appropriate answer from the alternative given under each of the following statements

### **A. DIRECT CHANGES**

#### **1. Availability of sufficient irrigation water throughout the crop growth period**

- |                    |     |
|--------------------|-----|
| All the six months | (4) |
| 3-4 months         | (3) |
| 1-2 months         | (2) |
| <1 month           | (1) |

#### **2. Availability of sufficient quantity of water**

- |               |     |
|---------------|-----|
| Full capacity | (4) |
| 50-75 %       | (3) |
| 25-50 %       | (2) |
| <25 %         | (1) |

#### **3. Utilization of available water**

- |                      |     |
|----------------------|-----|
| Grown two crops      | (4) |
| Grown one crop       | (3) |
| Used for aquaculture | (2) |
| Only for drinking    | (1) |

#### **4. Employment generation during**

- |                            |     |
|----------------------------|-----|
| Cleaning of drains         | (4) |
| Repairs and rehabilitation | (3) |
| Warabandhi schedule        | (2) |
| No employment              | (1) |

#### **5. Implementation of Warabandhi schedule**

- |           |     |
|-----------|-----|
| Excellent | (4) |
| Good      | (3) |
| Average   | (2) |
| Poor      | (1) |

## **6. Rehabilitation of water courses/canals**

Excellent	(4)
Good	(3)
Average	(2)
Poor	(1)

## **7. Availability of irrigation water for the farmers of tail end areas**

Full capacity	(4)
50-75 %	(3)
25-50 %	(2)
<25 %	(1)

## **8. Resolving water disputes**

No disputes, everyone use water only when his turn comes	(3)
During conflicts arrange meeting and settle	(2)
Leave people to fight and settle on their own	(1)

## **9. Benefit due to WUA**

WUA jurisdiction	(4)
Village level	(3)
In House/Family	(2)
Individual	(1)

## **10. Participation of WUAs in water management**

Excellent	(4)
Good	(3)
Average	(2)
Poor	(1)

## **11. Delegation of powers to WUAs in water management**

Sufficient	(3)
Undecided	(2)
Insufficient	(1)

**12. Enhancement of coordination among WUAs, Irrigation and Revenue departments**

Excellent	(4)
Good	(3)
Average	(2)
Poor	(1)

**13. Avenue plantation along the bunds of the canal**

Excellent	(4)
Good	(3)
Average	(2)
Poor	(1)

**14. Please indicate your answer for the questions given below**

S. No.	Statement	Before (1997) establishment of WUA (1)	After (1997) establishment of WUA (2)
1.	Increased irrigated area (ac)		
2.	Change in cropping intensity		
3.	Change in cropping pattern		
	a) Paddy		
	b) Paddy + Pulses		
	c) Paddy + Maize		
	d) Sugarcane		
	e) Chillies		
4.	Increase in yield (in bags)		
	a) Paddy		
	b) Pulses		
	i. Blackgram		
	ii. Greengram		
	c) Maize		
	d) Sugarcane		
	e) Chillies		
	f) Cotton		
5.	Increased income		
6.	Employment generation (man days/year)		
7.	Increased livestock		
	a) Buffalo		
	b) Cow		
	c) Sheep		
	d) Goat		

S. No.	Statement	Before (1997) establishment of WUA (1)	After (1997) establishment of WUA (2)
	e) Poultry		
	f) Others		
8.	Increased fodder availability		
	a) Area under grass		
	b) Paddy straw		
9.	Enhancement of area under less water used rice production technologies		
	a) System of Rice Intensification (SRI)		
	b) Mechanized System of Rice Intensification (MSRI)		
	c) Direct Sown Rice (DSR)		
	d) Drum Seeding		
	e) Conventional method		

## 2. INDIRECT CHANGES

S. No.	Statements	Agree	Undecided	Disagree
1.	Increased credit needs			
	a) Purchasing of inputs			
	b) Labour charges			
	c) Personal needs			
2.	Enhancement of land values			
3.	Enhancement of water necessity			
	a) Domestic purposes			
	b) Industrial purposes			
4.	Increased wage rates			
5.	Reduction in cost of cultivation			
	a) Decreased quantity of fertilizers			
	b) Decreased purchasing of water			
	c) Any others			
6.	Change in economic status			
	a) Increased assets			
	b) Increase in income			
	c) Increase in savings			
7.	Change in social life			
	a) Increased knowledge/ communication			
	b) Improved economic status			
	c) Increased respect in society			

S. No.	Statements	Agree	Undecided	Disagree
8.	Decrease in migration of farmers			
	a) Availability of work for agricultural labourers			
	b) Availability of water to the fields			
9.	Increased education standards of children			
10.	Increased assets			
	a) Better economic conditions			
	b) Increased land values			
11.	Improved communication behaviour			
12.	Development of self respect			
13.	Autonomy in decision making			
14.	Less water theft			
	a) Equal distribution of water			
	b) Timely availability of water			
	c) Proper management of the system			
	d) Availability of sufficient water to all the farmers			
15.	Increased personal empowerment			
16.	Increased knowledge on WUE			
17.	Improved mechanization			
18.	Improved land use pattern for			
	a) Agriculture			
	b) Commercial Purpose			
	c) Aquaculture			
19.	Conjunctive use of canal water, ground water and drain water			
20.	Change in knowledge			
21.	Change in attitude			
22.	Change in skill			
23.	Decline in water quality			
24.	Increased migration of birds			
25.	Rise in ground water levels			
26.	Increased fish/aquaculture			

## PART -C

### STRENGTHS, WEAKNESS, OPPORTUNITIES, CHALLENGES (SWOC) OF WATER USERS ASSOCIATIONS

S. No.	Statements	Rank
<b>a) Strengths</b>		
1.	Improved the efficiency and performance of irrigation systems	
2.	Sufficient water is available during crop season	
3.	Equity in the distribution of irrigation water among head reach, middle and tail end areas	
4.	Increased crop yields	
5.	Freedom of cropping pattern within the limits of allocated water	
6.	Number of irrigations to the crop has been increased	
7.	Increased water use efficiency by implementation of warabandhi schedule	
8.	Good support from irrigation department official	
9.	Involvement of WUAs in water management	
10.	Increase in social relations among farmers	
11.	Reduced water disputes	
<b>b) Weakness</b>		
1.	Allocation of insufficient funds	
2.	Inadequate training facilities	
3.	Inadequate maintenance of drains	
4.	Poor quality of works	
5.	Lack of cooperation among water users associations	
6.	Inadequate infrastructure facilities	
7.	Non involvement of members of WUA in management of water users associations	
8.	Low educational qualifications of members of WUAs	
9.	Lack of trust between WUAs and Irrigation engineers	
10.	Short duration of tenure of elected members of WUAs	
<b>c) Opportunities</b>		
1.	Empowerment of farmers to manage irrigation system	
2.	Facilitates the effective implementation of warabandhi schedule	
3.	Enhancement of productivity of crops growing in Krishna delta region	
4.	Resolution of disputes among farmers	
5.	Improved decision making based on local knowledge	
6.	Active involvement of all classes of farmers	
7.	Development of good linkages between farmers and irrigation department officials	

<b>S. No.</b>	<b>Statements</b>	<b>Rank</b>
<b>d) Challenges</b>		
1.	Improving the drainage networks	
2.	Management of aquatic weeds	
3.	Development of friendly relationship among water users associations	
4.	Enhancement of knowledge about irrigation schemes and programmes to farmers	
5.	Eliminate the members engaged in corruption	
6.	Weak institutional setup	
7.	Increase in production of water intense crops	
8.	Reduce water logging and salinity	
9.	Involvement of women participation in decision making	
10.	Equal distribution of water among head middle and tail-end areas	
11.	Involvement of political leaders in day to day activities of WUAs	

## Appendix-B



### OPINION OF THE RESPONDENTS TOWARDS WATER USERS ASSOCIATIONS

**MR-** Most relevant **R-** Relevant **UD-** Undecided **LR-** Less relevant **LEA.R-** Least relevant

S. No.	Statement	MR	R	UD	LR	LEA. R
1	The Water Users Associations system gives freedom for the members to be effective and efficient					
2	The elected members are satisfied with their election tenure					
3	The election period of time should be expanded for the members, vice-president, president and management committee					
4	Adequate and equal distribution of water is possible to all sections of farmers through warabandi system					
5	Water Users Associations implement the warabandi schedule for each irrigation season					
6	Water Users Associations promote economy in the use of water allocated					
7	General Body Meetings, regular water budgeting and social audit are conducted as prescribed					
8	Water Users Associations encourage modernization of agriculture in its area of operation					
9	The books of accounts and other records are opened for information to the members of the Water Users Associations and also to any Govt. officials for inspection					
10	The Government should provide the incentives for the effective functioning of Water Users Associations					
11	Water Users Associations helps in restoring the confidence of the farmers in the irrigation system					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
12	The Water Users Associations officials are not exposed to trainings on the functioning and accounts maintenance					
13	The Water Users Associations and the Organization Committees are yet to develop as the agencies to redress the irrigation problems of the members					
14	The Water Users Associations are mostly toothless in preventing damage to the canal infrastructure and indiscipline among the members and evasion of water charges					
15	Individual Water Users Associations may never have resources to employ staff					
16	Execution of maintenance works requires experience and technical background					
17	Training camps are arranged by irrigation and agriculture departments, KVK's, NGO's etc. to the members for better management of irrigation water and agriculture					
18	A grace period of five years must be permitted for the new association to be functional and stable					
19	The Water Users Associations must be granted certain amount of autonomy to enforce their respective norms and conventions					
20	Water Users Associations receive sufficient amount of funds for maintenance and rehabilitation					
21	Awareness has been developed among farmers for efficient water use for crop production					
22	The duration of water allocation is not proportional to the size of the farmer's land holding					
23	The Water Users Associations are allowed to retain 50 per cent of the revenue from water charges					
24	The cost incurred through water charges for maintenance requirements of Water Users Associations are high					
25	The fallow land is bought under irrigated land due to reduced losses and equitable irrigation supply					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
26	There is equity in delivery of water to upstream, midstream and tail-end sections of farmers					
27	There is timely delivery of water in relation to crop requirements and farmers agricultural programmes					
28	All the farmers have an equal opportunity to receive a fair share of the water					
29	The water is supplied as per the warabandi system and when the farmers needed					
30	The water is not wasted unnecessarily					
31	The Water Users Associations ensures regular cleaning of watercourses and field drains in the area of operation					
32	The Water Users Associations executive has been found not effective in taking decisions on the rehabilitation works					
33	There is still lacking of decision in planning and managing the water distribution system					
34	Members and non members share their views on the practices and ideas being adopted by the association and its members					
35	The procedures for release of funds from Government are very tedious and time consuming					
36	Cleaning of drains and its maintenance requires technical capabilities					
37	The framing of water charges must be simplified for easy preparation of bills and collection by Water Users Associations					
38	The farming community is informed about supply and closing schedules of water supply					
39	The involvement of water users through Water Users Associations is economic and effective in tackling the problems of drainage and water logging in command areas					
40	Participatory Irrigation Management provides opportunity for changing of cropping pattern Rice-Pulses, Rice-Maize					
41	Participatory Irrigation Management contributed to reduction in social tension					
42	Water Users Associations have dramatically changed the socio-economic landscape of irrigated areas					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
43	Local political play a big role in the way of functioning of Water Users Associations					
44	Women participation in Water Users Associations is not necessary					
45	Farmer's empowerment has been increased through the Water Users Associations as they are more articulate now					
46	Involvement of MGNREGS workers in canal rehabilitation					
47	Head-reach farmers tend to appropriate more water than required.					
48	The tail-end farmers often fail to get their legitimate share of water					
49	The financial uncertainty is an issue affecting the effectiveness of Water Users Association					
50	Lack of technical input is one of the inhibiting factors affecting Water Users Associations					
51	Proper communication skills are required among the associations for its effective functioning					
52	The water users are satisfied with performance of Water Users Associations					
53	In proportion to the number of water users, upper castes and big farmers are dominating for both higher positions of President and Vice-President					
54	Government of India should lay special emphasis on involving women in the process of implementing Participatory Irrigation Management					
55	Frequency of conducting General Body Meetings is regular to all levels of Water Users Associations					
56	The participation rate of water users in General Body Meetings is low					
57	Conducting meetings either General Body Meetings or Management Committee Meetings is the major activity carried out by Water Users Associations					
58	The role of tenant farmers and women participants is very limited					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
59	There is no effort to enlist women farmers in the command area and facilitate them to take part in election as voters					
60	In order to ensure smooth and transparent functioning of Water Users Associations, provision of constituting sub-committees is required					
61	Farmers have a vast role on making decisions about water management and distribution					
62	Presence of sub-committees results in managing conflicts and misunderstanding on allocation of water for all water users					
63	It is essential to form separate sub-committees to look after work responsibilities related to record maintenance					
64	The members of record maintenance in sub-committee would also require training particularly on accounts and record keeping					
65	All important decisions on water regulating and allocation are being discussed in the presence of all Water Users Associations members and I&CAD officials					
66	Awareness on water regulation, allocation and management has improved significantly resulting in better water distribution among all water users					
67	Based on the crop grown irrigation scheduling needs to be done for the entire command					
68	The head end farmers have always been on the upper hand in availing water as compared to the tail end farmers					
69	Responsibility of Water Users Associations towards collection of water charges is not an important role of the Water Users Associations					
70	There is misuse and excessive use of water particularly at head reaches of irrigation system					
71	There is need of conducting technical training programmes particularly on efficient and effective water application practices and their impacts on environment					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
72	The support received from I&CAD in implementing warabandi schedule has strengthened the process of institutionalization of Water Users Associations					
73	All the committee members and farmers actively involved in rehabilitation works, removal of weeds, distribution structures, <i>etc.</i>					
74	The rehabilitation works not only improves water distribution efficiency but also inculcate a sense of ownership amongst committee members					
75	The women are attending the meetings regularly					
76	Two General Body Meetings are held regularly in a year i.e., one each before starting of the kharif and the rabi seasons					
77	There is a lack of initiation and motivation among the members to share the work and responsibilities of the Water Users Associations members					
78	The confidence level can increase only when the members or women receive sufficient knowledge of and are familiar with the subjects discussed in the meetings					
79	Lack of training of female members is a strong reason for the lack of ability and confidence among them					
80	There is a significant change in work responsibilities among the women with the initiation of PIM in the state					
81	Water Users Associations is one of the best associates for Participatory Irrigation Management					
82	Unless the women representation in management committee happens the other variables depend upon it (participation in decision-making, sharing of work, <i>etc.</i> ) will remain low					
83	Women can take up lead role in the functioning of the association					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
84	Water use efficiency can be better achieved with crops consuming less water and bringing down conveyance and field application losses					
85	Increased availability of water in terms of adequacy and timeliness along with improved agricultural practices leads to rise in crop yields					
86	The Water Users Associations helpful in the promotion of social equity					
87	Andhra Pradesh Water Sector Improvement Project facilitates empowerment of farmers through Farmers Training Centre by organizing training programmes					
88	There is a settlement of disputes related to water at the local level through formal and informal consultations and discussions among the members of Water Users Associations					
89	The role of agriculture department is limited in imparting training to the Water Users Associations members					
90	Two years is too short duration for achieving any meaningful/constructive actions within Water Users Associations					
91	The increase in tenant farmers has brought down the farmer's participation in Water Users Associations					
92	The performance of Water Users Associations, particularly organizing farmers, depends on leadership of the management committee members including president and vice-president					
93	The support of agriculture department in providing knowledge, technology and extension is critical in the context of efficient use of water					
94	There is a general improvement in engineer-farmer relationship as a result of agriculture department					
95	There is increase in crop yields due to economic use of irrigation					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
96	Construction of roads along the field canals facilitating transport of farm inputs and produce					
97	Avenue planting along the canals bringing about improvement in environment, etc.					
98	Cooperation from Irrigation department and agriculture department is very limited					
99	Participatory Irrigation Management provides opportunity for enhancement of production					
100	There should of minimum (10 <sup>th</sup> class) educational qualification for the members of Water User Associations					
101	Delegation of power transfer to Water User Associations in Irrigation department and distribution of management is only on paper					
102	The ayacut under the Water User Associations is too large to monitor					
103	Women are under representation for both higher positions and Management Committee members					
104	General Body Meetings facilitates for monitoring the functions of Water User Associations					
105	Irrigation charges should be initiated to overcome the misuse of irrigation water					
106	The allocated budget is not sufficient for the Operation and Maintenance expenses of Water User Associations					
107	The decision related to allocation of irrigation water in different Water User Associations is taken by General Body Meetings					
108	PIM facilitates to bring more area under irrigation with same quantity of water, increased availability of water due to saving of water and enabled more number of farmers to avail the benefits of water					
109	PIM helped in increasing farmers capability in managing irrigation system					
110	Though there is displacement of more people in the project area it is important to have Polavaram Project					

S. No.	Statement	MR	R	UD	LR	LEA. R
111	The water released from the Pattiseema project has brought huge dividends to water starved farmers of the Krishna Delta area					
112	The Pattiseema Lift Irrigation scheme is largely beneficial to the farmers in the Krishna Delta area					
113	Andhra Pradesh government has provided power for Water User Associations to supervise the various activities related to Andhra Pradesh Water Sector Improvement Project					
114	Incentives should be given to less water used rice production technology					
115	It is better to get water from Pattiseema project to Krishna river than from Srisailam and Nagarjuna Sagar project					
116	The Pattiseema project facilitates drinking water supplies to thousands of villages					
117	The Pulichintala Project provides timely water supply needed by <u>Prakasam Barrage</u>					
118	Water Users Association encourage conjunctive use ground water, canal water and drain water for water use efficiency					
119	The Pulichintala project is constructed exclusively for the purpose of stabilizing the Krishna delta					
120	Though the dam will not provide new irrigation to even a single acre, it will stabilize the irrigation needs of over 13 lakh acres of the Krishna delta spread over five districts					
121	Pulichintala was started over to stabilize the Krishna delta ayacut for raising paddy crop and prevent losses in possible cyclones around that season					
122	Irrigation management is the Governments responsibility but not the community					
123	Farmers Training Centre play an important role in capacity building of farmers under Andhra Pradesh Water Sector Improvement Project					
124	Water meter should be installed to measure the quantity of utilized by the farmer					

<b>S. No.</b>	<b>Statement</b>	<b>MR</b>	<b>R</b>	<b>UD</b>	<b>LR</b>	<b>LEA. R</b>
125	There should be 33 per cent reservation should be there for the women					
126	Involvement of farmers is necessary for the effective implementation of Participatory Irrigation Management					
127	Participatory Irrigation Management provides opportunity for enhancement of productivity					
128	The water from Pattiseema project stabilizes 12 lakh acres besides meeting the second crop requirements of Krishna Delta area					
129	Management Committee meetings are conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management					
130	Provision of assured water to members brought a change in social environment					
131	It is not necessary to link the Pattiseema with the Budameru river as it affect the parts of Krishna and Godavari districts at the time of flooding in Budameru river					
132	Funds provided by the world bank under Andhra Pradesh Water Sector Improvement Project facilitates the irrigation of modern infrastructure development in Krishna Delta System					
133	Pattiseema is a boon for stabilization of Krishna Delta System					

## Appendix-C



### t- Values of the statements that represent opinion of the respondents towards Water Users Associations

S. No.	Statement	t-value
1	There is increase in crop yields due to economic use of irrigation	8.59
2	There is timely delivery of water in relation to crop requirements and farmers agricultural programmes	7.86
3	There is equity in delivery of water to upstream, midstream and tail-end sections of farmers	6.10
4	Participatory Irrigation Management provides opportunity for changing of cropping pattern Rice-Pulses, Rice-Maize	4.77
5	Water Users Associations promote economy in the use of water allocated	4.71
6	The Pattiseema Lift Irrigation scheme is largely beneficial to the farmers in the Krishna Delta area	4.20
7	Water Users Associations implement the warabandi schedule for each irrigation season	4.18
8	Water Users Associations helps in restoring the confidence of the farmers in the irrigation system	4.09
9	The water from Pattiseema project stabilizes 12 lakh acres besides meeting the second crop requirements of Krishna Delta area	3.89
10*	Participatory Irrigation Management contributed to increase disputes among stakeholders	3.85
11	Cleaning of drains and its maintenance requires technical capabilities	3.79
12*	Proper communication skills are not required among the associations for its effective functioning	3.56
13	All important decisions on water regulating and allocation are being discussed in the presence of all Water Users Associations members and I&CAD officials	3.47
14	There is need of conducting technical training programmes particularly on efficient and effective water application practices and their impacts on environment	3.28
15	Incentives should be given to less water used rice production technology users	3.27
16	The Water Users Associations system gives freedom for the members to be effective and efficient	2.91

<b>S. No.</b>	<b>Statement</b>	<b>t-value</b>
17	Avenue planting along the canals bringing about improvement in environment, etc.	2.73
18*	Management Committee meetings are conducted regularly to sort out problems related to funds allocation, operation of Operation and Maintenance works and water management	2.68
19	Water Users Associations is one of the best associates for Participatory Irrigation Management	2.65
20	Though there is displacement of more people in the project area it is important to have Polavaram Project	2.59
21	Local politics play a big role in the way of functioning of Water Users Associations	2.16
22	Involvement of MGNREGS workers in canal rehabilitation	2.13

**\* Negative statement**









**Water channel for Munipeda Water Users Association**



**Peddakaluva Canal at Lakshmpuram Water Users Association**







**Agricultural land converted to aquaculture in tail-end area**



**Water channel without water at tail-end area**