International Journal of Future Generation Communication and Networking
Vol. 13, No. 4, (2020), pp. 396–418

Integrated Water Resources Management In The Province Of Northern Samar

LEO M. SAURO[1]

[1]Department of Civil Engineering, College of Engineering
University of Eastern Philippines, Catarman N. Samar, 6400, Philippines

INTRODUCTION

All forms of life depend on water and access to clean and potable water immensely contributes to human progress and development. Needless to say, the necessity of water to life, and its importance to socio-economic development explains man's perennial quest to improving water resources management and need for preservation of water resources (Allan, 2013). With this fundamental tenet, the last decade has seen an increasing recognition of the need to protect and sustainably manage the water resources.

Population growth, urbanization, intensive agricultural development, industrial growth and environmental requirements are all factors behind the increasing demand for water and land resources (Thou, 2008). The cheapest form of electricity, for example, comes from hydroelectric power plants that rely on water flowing through man made dams built in the country's various major river systems (Raymundo, 2015).

However, many negative consequences of unbalanced environment, such as, water quality degradation, flood and drought, groundwater depletion, land subsidence, erosion and sedimentation, as well as, seawater intrusions are more likely generated from manmade objects and human interventions. As a consequence, the negative impacts due to water pollution and its accompanied maladies are continuously jeopardizing the human health (Fulazzaky and Gany, 2009).

Undeniably, water scarcity already affects every continent. Around 1.2 billion people, or almost one-fifth of the world's population live in areas of physical scarcity, and 500 million people are approaching this situation. Another 1.6 billion people, or almost one quarter of the world's population, face economic water shortage. Water scarcity is among the main problems faced by many societies and the world in the 21st century. The population growth at the global level will put additional pressure on water availability. By 2030, 47% of the world's population is expected to be living under severe water stress. Securing freshwater will be in one of the top priorities for many countries. (WWC, 2012).

According to an ADB (2007) report, if some Asian countries will face a water crisis in the future, it will not be because of physical scarcity of water, but because of inadequate or inappropriate water governance including management practices, institutional arrangements, and socio-political conditions.

In the national setting, the Philippines, due to its geographical location, has abundant water resources coming from rainwater, surface water and groundwater resources. It has 421 principal river basins and 20 major river basin. The country's available freshwater is at 125,790 MCM/year based on 80 percent probability for surface water and groundwater recharge or extraction at 20,000 MCM/year (Abano, 2007)

However, despite of the abundance the country's water resources, it is becoming one of the critical resources. Rapid and uncontrolled urban development has reduced aquifer recharge and has eventually resulted in the decline of groundwater levels, as well as, saltwater intrusion (NWRB, 2012). A study by the Japan International Cooperation Agency (JICA) and National Water Resources Board (NWRB) estimated that all major cities in the Philippines, Metro Manila, Metro Cebu, Davao City and Zamboanga City will experience water shortages by 2025 (JICA-NWRB, 2008).

The Philippine freshwater ecosystem faces severe problem of pollution and rising costs of potable water supply. The water problem relates more to the lack of quality rather than quantity. The absence of waste management and sewage treatment facilities in most provinces and municipalities has resulted in the improper disposal of household, industrial, and agricultural wastes that has greatly compromised the

ISSN: 2233-7857 IJFGCN

quality and availability of ground and surface water in the country. Sixty six percent of the country's 611 classified inland bodies of water were deemed unsuitable for human consumption (SEPO, 2011). Fifty of the major rivers are now considered biologically dead including the main river systems in Metro Manila. The increase in population and economic activities has considerably increased the effluents being discharged to water bodies. Domestic sewage has contributed about 52 percent of the pollution load while industries account for the remaining 48 percent (Rola et.al.). As noted in the Philippine Development Plan (2017-2022), lack of urban planning, indiscriminate urban development, lack of investment in water, problems of water resource management, and the impact of climate change threaten water security and sustainability.

The threat of water scarcity is a complex problem that will involve multiple long-term solutions that cut across different sectors of the society. The successful management of the country's water resources will demand an integrated approach that takes into consideration the government's different policies and programs on agriculture, land use planning, energy development, industrial production and population control, among others. Moreover, studies have attributed the government's poor performance to weak regulatory institutions and the absence of a clear and organized framework for water resources governance (SEPO, 2011).

In a more local context, Northern Samar is located in the northernmost portion of Samar, the third largest island of the country. A second class province under Region VIII also known as, the Eastern Visayas region and Catarman is its capital. It has a total land area of 3,498 square kilometers with 24 municipalities and 569 barangays under its jurisdiction The province is endowed with natural resources including eight potential sources of water, namely, Catubig-Las Navas Watershed, Catarman-Lope de Vega Watershed, Mondragon-Bugko Watershed, Pambujan Watershed, Bobon Watershed, Mawo-Victoria Watershed, Palapag Watershed, Gamay Watershed.

Part of the efforts of the province for water resource management, the provincial government thru the PGENRO formulated draft of the Environment Code of Northern Samar, which includes water resources aimed to operationalize the powers and responsibilities of the Local Government Units, particularly on environment and natural resources management, to include the concept of an integrated management approach. Presently, the Department of Environment and Natural Resources are implementing programs like the Enhanced National Greening Program, Coastal and Marine Ecosystem Management Program (CMEMP), Forest Land Use Plan (FLUP), Northern Samar Provincial Foreshore Development and Management Plan. They are now conducting workshops on the formulation of Integrated Watershed Management Plan of Catubig Watershed attended by key people from NIA, Norsamelco, DPWH, DepEd, PO, LGUs. According to the CENRO and conducting an inventory of water refilling stations in the province as part of their implementation to secure permit with the department.

On water supply, only 6 out of 24 municipalities has established Water Districts yet, without water treatment facilities installed and one LGU managing its own water system. According to the PPDO Office, out of 569 barangays province-wide, only about 10 percent barangays has its water system (BAWASA) but they face problems on sustainability. There are UNICEF funded projects like I-Wash, Pro Water, Wash Hub, but they are implemented in only two pilot areas, Bobon and Mapanas. A project of the DILG "Salin Tubig" is also on-going in some municipalities.

Despite the presence of these resources, the proportion of households without access to safe water remains high, and far from the national rate. At a more micro scenario, according to the National Anti-Poverty Commission, five (5) barangays in the Catubig Poblacion, Northern Samar are among the 1,353 waterless villages in the country. The Catubig Sanitation Office found out that of the 47 barangays in the town of Catubig, only two have safe water. The water from the other 45 villages were tested positive for coliforms, particularly *E. coli*. Records show that out of more than 110,000 households in Northern Samar, only some 80,000 have access to safe drinking water. The province's access to water is also way below the MDG target of 86.5 percent by 2015, and actually only equals the Philippines' baseline rate for access to water in 1990 (GMA News, 2012).

With a poverty incidence of 47.9 percent, the province is among the 10 poorest provinces in the country (PSA, 2015).

ISSN: 2233-7857 IJFGCN

On a general perspective, the current state of water resources in the Philippines should be a cause for concern among national government officials, local government officials and the stakeholders. Water scarcity is serious enough in certain parts of the country, generally and of the province of Northern Samar, most specifically and the situation is not expected to improve unless efforts on its proper management are exerted.

As water resources management is becoming one of the main concerns of the country and the local government units, research along environmental concerns and water conservation is of primordial essence. Existing researches do not delve on these issues; thus, it has become imperative to conduct this academic undertaking. It is worthwhile then to look at the present water governance in the Province of Northern Samar, its governance and institutional frameworks and management instruments for sustainable water resource management, hence the researcher conceptualized this study.

MATERIALS AND METHODS

This study was conducted in the province of Northern Samar, particularly, in the 20 municipalities, namely Allen, Biri, Bobon, Capul, Catarman, Catubig, Las Navas, Laoang, Lavezares, Lope de Vega, Mondragon, Palapag, Pambujan, Rosario, San Antonio, San Isidro, San Jose, San Roque, Silvino Lobos, and Victoria. The study was undertaken during the School Year 2017-2018.

Respondents of the Study

Table 1 shows the respondents of the study who were identified as the national government officials, local government unit officials in the 20 municipalities of the province of Northern Samar, namely: Allen, Biri, Bobon, Capul, Catarman, Catubig, Las Navas, Laoang, Lavezares, Lope de Vega, Mondragon, Palapag, Pambujan, Rosario, San Antonio, San Isidro, San Jose, San Roque, Silvino Lobos, and Victoria. Table 1 presents the frequency and percentage distribution of the respondents of the study.

Table 1: Frequency and Percentage Distribution of the Respondents of the Study

Respondents	F	%
National Govt. Officials	45	7.71
Local Govt. Unit Officials	118	20.20
Stakeholders	421	72.09
TOTAL	**584**	**100.00**

As shown in the table, the frequency and percentage distribution of the respondents were: 45 (7.71%) national government officials, 118 (20.20%) local government unit officials and 421 (72.09%) of the 21 municipalities of Northern Samar Province. These respondents represented the 20 municipalities of the province of Northern Samar. Specifically, the government officials from taken from DENR, NIA, DPWH, and WDs and three (3) national agencies and 4 water districts for a total of 45 respondents.

Sampling Procedures

The respondents of the study were taken from the 20 municipalities of Northern Samar province namely Allen, Biri, Bobon, Capul, Catarman, Catubig, Las Navas, Laoang, Lavezares, Lope de Vega, Mondragon, Palapag, Pambujan, Rosario, San Antonio, San Isidro, San Jose, San Roque, Silvino Lobos, and Victoria. Total enumeration was used for the municipality-respondents whereby 20 out of 24 municipalities covering the province of Northern Samar were included in the study. Four municipalities were not included because proximity and recurring bad weather conditions in reaching these municipalities.

The respondents from the Local Government Units were also determined through purposive sampling. Purposive sampling was used for the government officials since the researcher included all of them as respondents of the study considering that they were just few and manageable and they were all deemed necessary to acquire reliable information relative to the problems posed in the study. This

ISSN: 2233-7857 IJFGCN

included elected officials, MENROs, MAOs, MPDCs, MEs, PSIs, MSIs and other officials whose functions were related to water resources management. There was a total of 118 LGU-respondents who were purposively chosen from the 20 municipalities of the province of Northern Samar.

The respondents from the National Government Units were also determined through purposive sampling. Total enumeration was used in these government offices which includes officials from DENR, DPWH, NIA, and Officers of Water Districts.

The respondents from the stakeholders were also determined through purposive sampling. The researcher purposively chose associations and organizations which are involved in water and watershed management, namely: Irrigators Associations, Farmers Organizations, Peoples Organizations, Water Users Organization, Water Concessionaires and BODs of WDs. List of these Organizations and water concessionaires were collected and sample size was computed making use of Slovin's Formula. The total of 421 respondents were purposely chosen from 5 water districts and from 36 associations/organizations.

Instrumentation

The researcher adapted a questionnaire as the main instrument in this study which was adapted from the United Nations Environment Programme (2012) of the The United Nations – Water Status Report on the Application of Integrated Approaches to Water Resources Management in assessing the level of implementation of the management of water resources.

The assessment was based on two surveys: A questionnaire-based survey was made in the level 1 survey among the national government officials, local government unit officials and stakeholders. The second level survey was an interview-based survey among the national government officials, local government unit officials and stakeholders.

The questionnaire for the level 1 survey was composed of two parts. The first part was on the perception of the respondents on the level of implementation of water resource management in terms of enabling environment as to policies, legislation and plans and investment and financing structures; governance and institutional framework with respect to institutional frameworks, stakeholders participation and capacity building; management instruments with respect to water resources development, water resources management programs, water uses and monitoring, information management and dissemination. In answering the items in this section, the respondents were asked to indicate the stages of formulation and approval of key enabling instruments for water resources management by encircling the number of their choice following the scale: 5 as fully implemented (FI); 4 as in place and partially implemented (IPPI); 3 as in place but not yet implemented (IPNI); 2 as under consideration (UC); 1 as not relevant (NR); and 0 as don't know (DK)

Part II were on the problems encountered in the implementation of water resources management in the province of Northern Samar which were categorized as to water uses; threats to the resource; levels of management; management between sectors; managing resource information; and specific types of management. The respondents will have to check the statement which they deemed as problem being experienced.

The interview-based survey which was conducted in the level 2 of the survey, was carried out to provide a more detailed in depth understanding of the situations. The interviews were conducted by the researcher himself. The level 2 survey was an extension of level 1 in the form of questions and issues discussed in focused group interviews. Four components from level 1 were included in these interviews: enabling environment; governance and institutional frameworks, management instruments, and problems encountered in the implementation of water resources management.

Validation of Instrument

Basically, the researcher adapted a questionnaire from United Nations Environment Programme (2012) of The United Nations – Water Status Report on the Application of Integrated Approaches to Water Resources Management in assessing the level of implementation of the management of water resources. However, in order to suit to the requirements and context of the study, some revisions were made to the adapted questionnaire which then required validation.

ISSN: 2233-7857 IJFGCN

As such, the first draft of the questionnaire was presented to the dissertation committee for their comments and suggestions. After the questionnaire was revised, finalized and approved by the committee, it was subjected for dry run in Calbayog City, Western Samar. During the dry run, the researcher coordinated with the Local Chief Executive of the city for courtesy call and sought approval for the conduct of dry run in the locality. The instrument was facilitated to 5 (16.13%) national government officials, 14 (45.16) local government unit officials and 12 (38.71%) stakeholders. Table 2 shows the result of the test of reliability of the instrument which was based on the three pillars of IWRM.

Table 2: Reliability Coefficients of the Questionnaire on the Level of Implementation of Water Resources Management Program in the Province of Northern Samar.

Indicators	Cronbach's Alpha	Number of Items	Description
Enabling Environment	0.998	16	Excellent Reliability
Governance and Institutional Frameworks	0.973	20	Excellent Reliability
Management Instruments	0.978	37	Excellent Reliability
Overall	0.998	73	Excellent Reliability

Legend:

0.90 and above	Excellent Reliability
0.80 – 0.89	Very Good Reliability
0.70 – 0.79	Good Reliability
0.60 – 0.69	Somewhat Low Reliability
0.50 – 0.59	Needs Revision

As shown in the table, the seventy-three items of the instrument garnered a reliability coefficient of 0.998 which was interpreted as with excellent reliability. As a result, the indicators enabling environment, governance and institutional frameworks and management instruments have obtained a result with excellent reliability. This means to say that the instrument has achieved its intent of measuring what it intended to measure and the respondents have perceived the same as appropriate in gathering the needed data to answer the problems posed in the study.

Data Gathering Procedure

Prior to data gathering, the researcher secured written permission from higher authorities of concerned government offices, organizations and stakeholders involved in the study to allow him to conduct the research in their respective institutions. Upon approval, the schedule to conduct the study was arranged on concerned personnel. The researcher personally administered the questionnaires to the respondents by explaining first the purpose and the importance of the study and the manner of answering the questionnaires.

In retrieving the questionnaires, some were collected during the actual fielding while some were sent to the researcher after two to three weeks. Upon retrieval and after understanding the level 1 survey, schedules were arranged for the second level which was the interview. The interview was carried out in 3 representatives from the national government officials, 3 from local government officials and 8 from stakeholders and was designed to provide a more detailed in depth understanding of local situations. The interviews were conducted by the researcher himself. The level 2 survey was an extension of the level 1 survey in the form of questions on issues. Four components from level 1 were included in these interviews: enabling environment, governance and institutional frameworks, management instruments and problems encountered in the implementation of water resources management in their locality. The level 2 survey further qualified the findings from level 1 through opinions and experiences which provided a narrative story of the situation from the national government, local government and stakeholders.

ISSN: 2233-7857 IJFGCN

After all data gathered and tallied, the researcher then proceeded in the analysis and interpretation in order to come up with the findings, conclusions. The findings and conclusions served as basis in the formulation of appropriate recommendations of the study.

Statistical Treatment

The following statistical tools were employed in the data gathered for the purpose of interpreting the data:

Weighted mean and standard deviation were utilized to determine the perception of the respondents on the level of implementation of water resource management. Analysis of Variance (ANOVA) was used to test the significant difference in the perceptions of the respondents on the level of implementation of water resource management program.

Post Hoc Test using Tukey HSD was used to test the significant difference on the perception of the respondents on the level of implementation of water resources management program and the priority challenges encountered in WRM implementation.

Furthermore, ranking was used to show the problems encountered by the respondents on the level of implementation of water resources management program.

RESULTS AND DISCUSSION

The level of implementation of water resource management program in the province of Northern Samar as perceived by the three groups of respondents was based on the three pillars / key elements of Integrated Water Resource Management. These pillars were: enabling environment with respect to policies, legislation, plans and investment and financing structures; governance and institutional frameworks with respect to institutional frameworks, stakeholders' participation and capacity building; and management instruments with respect to water resources development, water resources management, water uses and monitoring, information management and dissemination.

Table 3 presents the summary table of the means and standard deviations on the perceived level of implementation of water resources management program in the province of Northern Samar in terms of governance and institutional framework. In general, the level of implementation of water resources management program in terms of governance and institutional framework with respect to capacity building shows a mean of 2.65 described as "in place but not yet implemented" having a standard deviation of 1.103. Overall, governance and institutional framework shows that he National Government Officials has a mean of 2.96 described as "in place but not yet implemented" and a standard deviation of 0.748, On the other hand, the Local Government Unit Officials has a mean of 2.55 described as "in place but not yet implemented" and a 0.941 standard deviation, while from the stakeholders, result shows with a mean of 2.65 described as, "in place but not yet implemented" and a standard deviation of 1.027.

Table 3: Summary Table of the Means and Standard Deviations on the Perceived Level of Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Governance and Institutional Framework

Conditions	National Government Officials			Local Government Unit Officials			Stakeholders			Overall		
	Mean	Desc	SD	Mean	Desc	SD	Mean	Desc	SD	Mean	Desc	SD
Institutional Frameworks	2.96	INI	0.899	2.39	UC	1.005	2.40	UC	1.092	2.44	UC	1.069
Stakeholder Participation	2.89	INI	0.919	2.79	INI	1.073	2.89	INI	1.186	2.87	INI	1.145

ISSN: 2233-7857 IJFGCN

Capacity Building	3.04	INI	0.741	2.48	UC	1.043	2.65	INI	1.141	2.65	INI	1.103
OVERALL	2.96	INI	0.748	2.55	INI	0.941	2.65	INI	1.027	2.65	INI	0.995

Legends:

4.51 – 5.00	(F)	Fully implemented
3.51 – 4.50	(IPI)	In place and partially implemented
2.51 – 3.50	(INI)	In place but not yet implemented
1.51 – 2.50	(UC)	Under consideration
1.00 – 1.50	(NR)	Not relevant
0.00 – 0.99	(DK)	Don't know

In general, the level of implementation of water resources management program in the province of Northern Samar in terms of governance and institutional framework element of water resource management was described as, "in place but not yet implemented" having a mean of 2.65 and a standard deviation of 0.995.

Water governance in the Philippines has become too complex with so many institutions involved; all with different hierarchical coverage, varied mandates and representing the interests of diverse constituencies. The challenges in effectively managing the water resources of the country are the failure to adopt an integrated, holistic approach in addressing the inherently interrelated issues of development and management planning, implementation and operation, demand management, water pricing, pollution control and watershed and groundwater protection (Barba, 2005).

Table 4: Summary Table of the Means and Standard Deviations on the Perceived Level of Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Management Instruments

Conditions	National Government Officials			Local Government Unit Officials			Stakeholders			Overall		
	Mean	Desc	SD	Mean	Desc	SD	Mean	Desc	SD	Mean	Desc	SD
Water Resources Development	2.96	INI	0.649	2.38	UC	1.100	2.56	INI	1.166	2.56	INI	1.128
Water Resources Management Programs	3.23	INI	0.688	2.53	INI	1.044	2.60	INI	1.123	2.63	INI	1.092
Water Uses	3.13	INI	0.835	2.55	INI	1.104	2.30	UC	1.292	2.41	UC	1.246
Monitoring, Information Management and Dissemination	3.13	INI	0.868	2.30	UC	1.150	2.42	UC	1.179	2.45	UC	1.168
OVERALL	3.11	INI	0.625	2.44	UC	0.992	2.47	UC	1.054	2.51	INI	1.029

ISSN: 2233-7857 IJFGCN

Legends:

4.51 – 5.00	(F)	Fully implemented
3.51 – 4.50	(IPI)	In place and partially implemented
2.51 – 3.50	(INI)	In place but not yet implemented
1.51 – 2.50	(UC)	Under consideration
1.00 – 1.50	(NR)	Not relevant
0.00 – 0.99	(DK)	Don't know

Table 4 presents the summary table of the means and standard deviations on the perceived level of implementation of water resources management program in the province of Northern Samar in terms of management instruments.

As reflected in Table 4, of the five conditions or aspects under management instruments, two were rated by the respondents as "in place but not yet implemented" while the other two were rated as "under consideration". the aspects that were rated as "in place but not yet implemented" were on water resources development, water resources management programs having obtained mean ratings of 2.56 and 2.63, respectively while the other two with "under consideration" ratings were on water uses and monitoring, information management and dissemination having obtained mean ratings of 2.41 and 2.45, respectively.

With these ratings, it can be implied that generally speaking, the implementation of the water resource management program of the province of Northern Samar was not comprehensively made and therefore, more interventions should be made.

Table 5 reflected the ratings of the three group of respondents, the National Government Officials, the Local Government Unit Officials and the Stakeholders. It provided the mean and standard deviation on the perception of the respondents on the level of implementation of Water Resource Management in the province of Northern Samar. There were three elements of Integrated Water Resource Management as category in the table.

Table 5: Summary Table of the Means and Standard Deviations on the Perceived Level of Implementation of Water Resources Management Program in the Province of Northern Samar

Conditions	National Government Officials			Local Government Unit Officials			Stakeholders			Overall		
	Mean	Desc	SD	Mean	Desc	SD	Mean	Desc	SD	Mean	Desc	SD
Enabling Environment	3.14	INI	0.641	2.80	INI	0.948	2.71	INI	1.096	2.76	INI	1.044
Governance and Institutional Frameworks	2.96	INI	0.748	2.55	INI	0.941	2.65	INI	1.027	2.65	INI	0.995
Management Instruments	3.11	INI	0.625	2.44	UC	0.992	2.47	UC	1.054	2.51	INI	1.029
OVERALL	3.07	INI	0.576	2.60	INI	0.893	2.61	INI	0.993	2.64	INI	0.954

ISSN: 2233-7857 IJFGCN

Legends:

4.51 – 5.00	(F)	Fully implemented
3.51 – 4.50	(IPI)	In place and partially implemented
2.51 – 3.50	(INI)	In place but not yet implemented
1.51 – 2.50	(UC)	Under consideration
1.00 – 1.50	(NR)	Not relevant
0.00 – 0.99	(DK)	Don't know

Overall, the three elements of Integrated Water Resources Management were rated by the three group of respondents as "in place but not yet implemented". Specifically, the National Government Officials gave a mean of 3.07 and a standard deviation of 0.576, the Local Government Unit Officials with a mean of 2.60 and a standard deviation of 0.893 and the stakeholders gave a mean of 2.61 and a standard deviation of 0.993. In general, these three elements of Integrated Water Resource Management were rated by the respondents as "in place but not yet implemented" with a mean of 2.64 and a standard deviation of 0.954. Results imply that the three pillars of the Integrated Water Resource Management were not fully met and implemented by the province of Northern Samar.

Difference on the Perception of Respondents on the Level of implementation of Water Resource Management Program in the Province of Northern Samar

The One-way analysis of Variance (ANOVA) was utilized to determine whether significant differences existed between and among the means or the compared means from independent groups.

Table 16 shows the results between and within the means group of respondents. The result show that the perceptions of the respondents on the level of implementation of water resources management with regards to the three pillars / elements of IWRM namely: enabling Environment was significant at p-value < 0.05; governance and institutional frameworks was not significant at p-value > 0.05; and management instruments was highly significant at p-value < 0.01.

Table 6: One-Way Analysis of Variance on the Perception of the Respondents towards Level of Implementation of Water Resources Management Program in the Province of Northern Samar

Conditions	F	Df	p-value
Enabling Environment	3.541*	583	0.030
Governance and Institutional Frameworks	2.819ns	583	0.060
Management Instruments	8.447**	583	0.000
OVERALL	5.014**	583	0.007

Legend:
** – Difference is highly significant at 0.05 level (p-value < 0.01)
* – Difference is significant at 0.05 level (p-value < 0.05)
ns – Difference is not significant at 0.05 level (p-value > 0.05)

In general, there was a highly significant difference in the perceptions of the respondents in terms of Enabling Environment, and Management Instruments. With these results, the null hypothesis was rejected.

ISSN: 2233-7857 IJFGCN

This indicates that the three groups of respondents have varying perceptions on the level of implementation of water resource management program in the Province of Northern Samar. While most of the National Government Officials believed that the presence of the three pillars / elements of IWRM were already visible in the management of water resources in the province, but its presence have yet to be felt in its implementation, the Local Government Unit officials and the stakeholders have perceived otherwise since they perceived that the enabling environment and the governance and institutional frameworks were installed but the management instruments has yet to be considered and embraced towards its integration.

This is an indication that the National Government Officials, Local Government Unit Officials and Stakeholders each appreciated the tools and programs of WRM exclusively within its own field of responsibility with little or no regards to others concern. This implies traditional, sectoral and fragmented management of water resources, hence the need for an integrated and holistic approach.

Table 7 shows the result of the Post-hoc test using Tukey HSD on the perception of the respondents towards level of implementation of water resources management program in the province of Northern Samar.

Table 7: Post Hoc Test Using Tukey HSD on the Perception of the Respondents towards Level of Implementation of Water Resources Management Program in the Province of Northern Samar

Conditions	Paired Respondents	Mean Difference	Standard Error	p-value
Enabling Environment	National Government Officials and Local Government Unit Officials	0.348ns	0.182	0.14
	National Government Officials and Stakeholders	0.430*	0.163	0.02
	Local Government Unit Officials and Stakeholders	0.081ns	0.108	0.73
Management Instruments	National Government Officials and Local Government Unit Officials	0.670**	0.178	0.00
	National Government Officials and Stakeholders	0.639**	0.159	0.00
	Local Government Unit Officials and Stakeholders	0.031ns	0.106	0.96
Overall	National Government Officials and Local Government Unit Officials	0.477*	0.166	0.01
	National Government Officials and Stakeholders	0.462**	0.149	0.00
	Local Government Unit Officials and Stakeholders	0.015ns	0.099	0.99

Legends:
** – Difference is highly significant at 0.05 level (p-value < 0.01)
* – Difference is significant at 0.05 level (p-value < 0.05)
ns – Difference is not significant at 0.05 level (p-value > 0.05)

The analysis of the data revealed that the National Government officials and stakeholders showed significant differences in their perception on the level of implementation of water resources management in the province of Northern Samar in terms of enabling environment and management instruments. On the other hand, the National Government officials and the Local Government Unit officials' perceptions showed significant differences in terms of Management Instruments.

With respect to enabling environment, the main contributor to the difference in perceptions of NGO and stakeholders was the local integrated water resources management plan/s or equivalent strategic plan document/s, the water sector investment plan. It can be caused also by subsidies/microcredit programs for promoting water conservation technologies. This is an indication of a little or no stakeholders' participation in the formulation of said plans and programs.

With respect to management instruments, the main contributor to the difference in perceptions of National Government Officials and Local Government Unit officials was on water resources

ISSN: 2233-7857 IJFGCN

development, particularly on rainwater harvesting programs, programs and policies for recycling of water, wastewater treatment and reuse. On water resources management, the differences were attributed on the differences of perceptions on the programs and policies for watershed management, land/natural resources management programs, surface water management programs, program for re-use or recycling of water, programs to evaluate environmental impacts of projects. On water uses, particularly on programs and policies for managing other water uses and on monitoring, information management and dissemination, particularly on monitoring of surface water quantity, monitoring of ground water quantity, monitoring of aquatic ecosystem, standardized procedure for data compilation, processing and analysis and monitoring and reporting system to determine impact of IWRM reforms.

The variations in the perceptions was an indication of a traditional, sectoral and fragmented water development and management approach. Each agency undertakes programs and projects exclusively within its own field of responsibility with little or no regard to the needs of others (Dayrit, 2010).

Ranking on Problems Encountered by the Respondents on the Implementation of Water Resource Management Program in the Province of Northern Samar

The next succeeding tables present the ranking of problems identified on water resource management program in the province of Northern Samar, particularly in the areas of water uses, threats to the resource, levels of management, management between sectors, managing resource information; and specific types of management.

Water uses. Table 8 determines the problems encountered by the respondents of the study on the implementation of water resource management program in terms of water uses. Based on the results of the ranking, problem number 2.1b, stated as water for domestic use was ranked number 1.

Table 8: Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Water Uses

Problems Encountered	Frequency	Rank
Water for domestic use	320	1
Water for agriculture	280	2
Water for ecosystems/environment	149	3
Water for industry	114	4
Water for energy	99	5

The result manifests the situation in the province that out of 24 municipalities only six (6) has water districts and yet, these districts do not have water treatment facilities and one LGU managing its own water system. Although, in an interview with a resident in San Isidro, Northern Samar, the interviewee mentioned that there are some areas in San Isidro have no flowing water while some areas have; most of the residents get their water from groundwater wells. Based on secondary data obtained by the researcher, out of 569 barangays in the province, only about 50 barangays have their respective water system. But some were already non-functional according a PDO Officer IV.

The rank 2 problem was on water for agriculture. According to the Provincial Irrigation Management Office, some of the irrigation facilities in the province were non-operational because of the following reasons: undergoing construction, water insufficient, needs repair, on-going repair, suspended construction, need additional fund, pump non-functional. Hence, implementation of the project was restrained.

ISSN: 2233-7857 IJFGCN

The rank 3 problem encountered was water for ecosystem/environment while rank 4 problem was water for industry and the last rank problem encountered was water for energy. All these were identified to be existing in their respective areas which hindered the effective implementation of the water resource management.

Threats to the Resources. Table 9 determines the problems encountered by the respondents on the study on the implementation of water resource management in terms of threats to the resources. Based on the results of the ranking, problem floods were ranked as number one problem.

Table 9: Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Threats to the Resources

Problems Encountered	Frequency	Rank
Floods	441	1
Droughts	351	2
Water scarcity (surface water)	243	3
Water scarcity (ground water)	232	4
Water quality (ground water)	227	5
Water quality (surface water)	222	6

This is the result of denudation of forest and watershed which increases run-off causing flash floods in mountainous areas. In the interviews conducted with some UEP residents, water from water district distribution lines becomes turbid during heavy rains, typhoons and floods. According to the President of the Cablangan-Talolora Irrigators Association, their on-going construction of irrigation structures: mini dam and lined canal were damaged by erosion and siltation brought by typhoon Nona because of forest degradation. Rice fields and other agricultural products were also affected by this threat.

Rank 2 problem was attributed to droughts. In the interview with the officials of the Irrigators Association of Allen and Lagundi Irrigators Association, their source of water for irrigation are surface water which decline in quantity during droughts. Rank 3 problem encountered was water scarcity for water surface which is related or connected to problem number 2. Rank 4 problem was water scarcity for groundwater. According to Dayrit (2010) indiscriminate groundwater abstraction will result in salt-intrusion and eventually deplete groundwater resources. Rank 5 problem was water quality for groundwater. The last rank problem encountered was water quality for surface water. This shows that the management of water does not only cover the utilization side but more on the supply side, the watershed. Denuded watershed causes floods and erosion. Thus, it is about time of changing the behavior on perceiving water as a free commodity, instead thinking it has an economic value, hence, its conservation.

Levels of Management. Table 10 presents the problems encountered by the respondents of the study on the implementation of water resource management program in terms of levels of management.

Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Levels of Management

Problems Encountered	Frequency	Rank
Stakeholder participation	258	1
Coordination between levels and types of management	199	2
Institutional capacity at national level	162	3
Management through private enterprise	152	4
Institutional capacity at sub-national level	134	5

ISSN: 2233-7857 IJFGCN

Based on the results of the ranking, the problem which stated, "stakeholders' participation" was ranked number 1. This validates the significant difference of the perception of stakeholders and the national government officials on some areas on the enabling environment and management instruments in managing water resources which surfaced that stakeholders have experienced some inconveniences which may not have been felt by other concerned individuals or agencies like the LGU or the national government officials. As such, Consideration on the needs and demands of all stakeholders is essential to avoid conflicts and to ensure equitable decision-making over water resources (Taylor, 2001).

The rank 2 problem was on the coordination between levels and types of management. Water governance at the local level affects interfacing with higher levels of government. The role of the DENR, DA, NIA, other agencies and LGUs in watershed management should be clear to avoid management conflict. A memorandum of agreement could also be executed to stipulate each party's responsibility and delineate areas of responsibility on the watershed (Rola et.al. 2015). This was manifested by the different perceptions of the national government officials and the local government officials on management instruments as shown on tables 10, 11, 12, 13. Rank 3 problem encountered was institutional capacity at national level and rank 4 problem was on management through private enterprises. The last in rack, rank 5 was the institutional capacity at sub-national level.

Management between Sectors. Table 11 determines the problems encountered by the respondents of the study on the implementation of water resource management program in terms of management between sectors. Based on the results of the ranking, the problem on coordination between sectors at national level was ranked number 1 while rank 2 problem was on coordination between sectors at sub-national level.

Table 11: Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Management between Sectors

Problems Encountered	Frequency	Rank
Coordination between sectors at national level	231	1
Coordination between sectors at sub-national level	205	2

According to Rola et.al. (2015), the problem of multiple institutions with overlapping mandates came about because as one agency is established, the remaining agencies were not abolished. A high cost of coordination given this set up and the fact that some national agencies have no field presence in many localities. What is crucial is how their efforts could be orchestrated and how collaboration would be harnessed. Clear linkage among national agencies, among local units, and between national and local units, is vital to resolving conflicts, particularly where demand for water is concerned. This may call for a lead institution to serve as a catalyst. In this study, national agencies concerned should coordinate with each other to it clear as to what specific area of watershed and what specific functions were being devolve to LGU.

Other Governance Issues. Table 12 presents the problems encountered by the respondents of the study on the implementation of water resource management program in terms of other governance issues. Based on the result of the ranking, the problem on financing of water resources management was ranked as number 1.

ISSN: 2233-7857 IJFGCN

Table 12: Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Other Governance Issues

Problems Encountered	Frequency	Rank
Financing of water resources management	274	1
Infrastructure development	265	2
Financing of infrastructure	263	3
Legislation	174	4

This result was in conformity with the study of Tangaran, L. (2016) which claimed that one of the reason why Clean Water Act (RA 9275) has not been fully implemented in the seven cities of Region VIII was the lack of budget. In this study, financing the water resources management, to include the needed manpower, was one of the constraints in implementing water resource management in the province of Northern Samar. Governance without local capability such as, financial capacity will not bring about autonomy.

On the other hand, the rank 2 problem was on infrastructure development. This was further manifested by the current status of some irrigation structures which are, under construction, damaged and silted, undergoing repairs, insufficient capacity and others that restrained its implementation and use. Rank 3 problem encountered was on financing of infrastructure and the last ranked problem was on legislation.

Managing Resource Information. Table 13 presents the problems encountered by the respondents of the study on the implementation of water resource management in terms of managing resource information. Based on the results of the ranking, the problem on knowledge sharing was ranked number 1 followed by monitoring the resource.

Table 13: Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Managing Resource Information

Problems Encountered	Frequency	Rank
Knowledge sharing	267	1
Monitoring the resource	262	2

Water resources data were being collected and processed by various concerned agencies and kept in their independent database. The absence of reliable water resources information system diminishes the capacity of concerned authorities to make difficult and controversial water allocation decisions. Therefore, the improvement of data collection and establishment of an integrated nation-wide database on water resources is needed (Rola et.al., 2015). This was evidenced by the perception difference between the national government officials and stakeholders on management instruments.

Specific Types of Management. Table 14 presents the problems encountered by the respondents of the study on the implementation of water resource management program in terms of specific types of management. Based on the results of the ranking, the problem on disaster management was ranked number 1. Rank 2 problem was on climate change adaptation management followed by rank 3 water use efficiency management.

ISSN: 2233-7857 IJFGCN

Table 14: Ranking on the Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar in terms of Specific Types of Management

Problems Encountered	Frequency	Rank
Disaster management	314	1
Climate change adaptation management	297	2
Water use efficiency management	284	3

Most watershed in our country are in critical condition as manifested from recent and recurring calamities such as flashfloods. The greater frequency of El Niño reduces the water levels in dams, rivers, creeks and groundwater sources which affect the efficient use of water. This includes the adverse effects of man's activities in the watersheds such as, deforestation which has caused erosion and siltation problems in rivers, lakes and reservoirs. According to the Irrigators Association, the recurring calamities brought damaged to their irrigation structures which impede their implementation of managing water in their area of responsibility.

Table 15 presents the problems areas encountered by the respondents of the study on the implementation of water resource management program.

Table 15: Summary Table of Problems Encountered on the Implementation of Water Resources Management Program in the Province of Northern Samar

Problem Areas	Frequency	Rank
Specific Types of Management	298	1
Threats to the Resource	286	2
Managing Resource Information	265	3
Other Governance Issues	244	4
Management Between Sectors	218	5
Water Uses	192	6
Levels of Management	181	7

Based on the results of the ranking, the problem area which stated, "specific types of management" was ranked number 1. Rank 2 was the problem area on "Threats to the resource". This indicates that disaster and climate change adaptation management with increased probability of more frequent and more intense extreme events, is perceived by the respondents as apparently significant to impede water resource management programs. The group of respondents also consider threats from floods and droughts to be high management priority and that the significance of such threats has been perceived.

Conclusions

Based on the findings of the study, the following conclusions were drawn.

1. This implies that the enabling environment, governance and institutional frameworks, and the management instruments were already somehow formulated but there was a lack of political will to prioritize the development, management and use of water resources, budgetary constraints and lack of manpower.
2. The lack of political will restrained the effective implementation of the components or pillars of water resources management.
3. The stakeholders have limited participation in the formulation of the enabling environment and management instruments and there was inconsistency on the perceptions of the National Government officials and the Local Government Officials in management instruments.

ISSN: 2233-7857 IJFGCN

4. There was no clear delineation of specific areas of responsibility for LGU on watershed management. The inconsistency on the perceptions among respondents is an indication of a traditional, sectoral, fragmented water management that does not adequately meet the requirements for sustainability.
5. The uneven distribution of water and water pressure on one water district, state of turbidity for piped water during floods, increasing volume for non-revenue water for domestic water use, decrease in water quantity at sources because of droughts, erosion of watershed and siltation of dams and irrigation structures and canals due to floods restraint the implementation of water resources management program.
6. There was limited participation of stakeholders in the formulation of management instruments as manifested in the test for significant difference. In the same manner that there was lack of coordination between levels of management was manifested between DENR and the LGU as to what specific functions area of responsibility for water shed management each agency has to assume.
7. Budgetary constraints and lack of manpower restrained the implementation of water resource management program.
8. There was no sharing of information and data to monitor the resources.
9. Recurring typhoons and other calamities brought damage to water structures that impinę the implementation of water resources management program.

REFERENCES

1. Abano, Susan P. (2007) Integrated Water Resource Management. NWRB
    a. http://www.wepa-db.net/pdf/0710philippines/4_NWRB.pdf.

2. Abaygar, J. H. (2007). Extent of Implementation and the Level of Effectiveness of
    a. Solid Waste Management in the City of Iloilo (Unpublished Thesis, University of Iloilo, Iloilo City)

3. Allan, A. and Rieu-Clarke, A. (2010) Good governance and IWRM – a legal
    a. perspective. Irrigation Drainage Systems, 24: 239-248.

4. Allan, C. (2013). Climate change and water security: challenges for adaptive water
    a. management.https://www.sciencedirect.com/science/article/pii/S1877343513001309

5. Asian Development Bank (2007). Asian Water Development Outlook.
    a. Manila, Philippines, ADB 66p.

6. Asian Development Bank (ADB) (2013). *Integrated Citarum Water Resources*
    a. *Management Investment Program*; Project 1; Compliance Review Panel: Manila, Philippines, 2013.

7. Baldemoro, L. B. (2007). The Water Supply Service Management of Polangui Water
    a. System (Unpublished Thesis, Aquinas University of Legazpi, Professional Schools, Legazpi City)

8. Bigas, H. (2012). "The Global Water Crisis: Addressing an Urgent Security Issue",
    a. Papers for the InterAction Council, 2011-2012. Hamilton, Canada: UNU-INWEH.

9. Bielsa, J. I. Cazcarro (2014). Implementing Integrated Water Resources
    a. Management in the Ebro River Basin: From Theory to Facts *http://www.mdpi.com/2071-1050/7/1/441/htm*

ISSN: 2233-7857 IJFGCN

10. Biermann, F., Betsill, M.M., Vieira, S.C., Gupta, J., Kanie, N., Lebel, L., Liverman,D.,
    a. Schroeder, K., Siebenhüner, B., Yanda, P.Z. and Zondervan, R. (2010) Navigating the Anthropocene: the Earth System Governance Project Strategy Paper. Current Opinion in Environmental Sustainability, 2(3): 202-208.256

11. Biswas, A.K. (2008) Integrated Water Resources Management: Is It Working? Water
    a. Resources Development, 24(1): 5-22. Retrieved from https://www.researchgate.net/profile/Asit_Biswas/publication/228799275_Integrated_water_resources_management_Is_it_working/links/02e7e52291f2a90911000000.pdf

12. Butterworth, J., Warner, J., Moriarty, P., Smits, S. and Batchelor, C. (2010) Finding
    a. Practical Approaches to Integrated Water Resources Management. Water Alternatives, 3(1): 68-81.

13. CAP-NET - International Network For Capacity Building In Integrated Water
    a. Resources Management (2008): CONFLICT Resolution and Negotiation Skills for Integrated Water Resources Management. Available at: http://www.cap-net.org/sites/capnet.
    b. org/files/Conflict%20Manual%20Final%20I70908.pdf(15.07.2013)

14. CAP-NET UNDP (2009). IWRM as a Tool for Adaptation to Climate Change.
    a. Training manual and Facilitators Guide. Available at: http://www.cap-net.org/sites/cap-net.org/filesCap-Net_AR2011.pdf

15. CK-12 Foundation (2012). Water Uses. Earth Science.https://www.ck12.org/earth-
    a. science/Uses-of-Water/lesson/Uses-of-Water-HS-ES/

16. Cousins, J.B., & Whitmore E. (2008). Framing participatory evaluation in
    a. Understanding and practicing participatory evaluation. In E. Whitemore (Ed.), New directions for evaluation (Vol. 80, pp. 5-23). San Francisco: Jossey-Bass. Google Scholar

17. Dayrit, Hector, (2010). Executive Director, The National Water Resources Board of the Philippines, Manila, The Philippines: Formulation of a National Water Vision. Retrieved from www.fao.org/docrep/004/ab776e/ab776e03/htm.

18. FAO. (2012) Coping with water scarcity: An action framework for agriculture and
    a. food security. Rome: Food and Agriculture Organization of the United Nations.

19. Felipe, R., Tionco, M., Obrar, A. (2012). Achieving Sustainable Food Security in the
    a. Face of Climate Change: Adaptation Mechanisms and Policy Recommendations for Sound Economic Livelihood of Northern Samar.

20. Formilleza, S. P. (2007). Study of Conflict in Coastal Resources Management: The
    a. Anda Experience (Unpublished Dissertation, University of the Philippines, Diliman, Quezon City)

21. Franks, T. and Cleaver, F. (2007) Water governance and poverty: a framework for
    a. analysis. Progress in Development Studies, 7 (4): 291-306.

22. Fulazzaky, M.A.; Gany, A.H.A. (2009). Challenges of soil erosion and sludge

ISSN: 2233-7857 IJFGCN

a. Management for sustainable development in Indonesian. *J. Environ. Manag*.
b. 2009, *90*, 2387–2392.

23. Fulazzaky, M. (2014). Challenges of Integrated Water Resources Management in Indonesia. water ISSN 2073-4441 www.mdpi.com/journal/water.

24. GMA News (2012). Safe water is a human right, but costly in waterless town in
    a. Northern Samar. Published March 23, 2012 4:07pm. By JAKE SORIANO, GMA News Research

25. Godden, L., Ison, R.L. and Wallis, P.J. (2011) Water Governance in a Climate
    a. Change World: Appraising Systemic and Adaptive Effectiveness. Water Resources Management, 25: 3971-3976.

26. Government of Western Australia, Department of Water (2009). Water Quality
    a. Monitoring Program Design.
    b. http://www.water.wa.gov.au/_data/assets/pdf_file/0018/2934/87153.pdf

27. Grigg, N.S. (2011) Governance and Management for Sustainable Water Systems.
    a. London: IWA Publishing.

28. GWP - GLOBAL WATER PARTNERSHIP (2008): Integrated Water Resources
    a. Management. Available at :
    b. http://www.gwptoolbox.org/index.php?option=com_content&view=article&id=8&Itemid
       .

29. GWP - GLOBAL WATER PARTNERSHIP (2009): A handbook for Integrated Water
    a. Resources Management in Basins. Available at:
    b. http://www.gwptoolbox.org/images/stories/Docs/gwp_inbo%20handbook%20for%20iwrm%20in%20basins_eng.pdf ()

30. GWP - GLOBAL WATER PARTNERSHIP (2013): What is IWRM? Available at:
    a. http://www.gwp.org/The-Challenge/What-is-IWRM/ ()

31. GWP - GLOBAL WATER PARTNERSHIP (2013): Integrated Water Resources
    a. Management. Available at: http://www.gwp.org/The-Challenge/The-Urgency-of-Water-Security

32. GWP – GLOBAL WATER PARTNERSHIP (2017). Iwrm Toolbox.
    a. https://www.gwp.org/en/learn/iwrm-toolbox/About_IWRM_ToolBox/

33. Hassing, J., Ipsen, N., Calusen, T.J., Larsen, H., Lindgaard-Jorgensen, P. (2009)
    a. Integrated Water Resources Management in Action. DHI Water Policy and UNEP-DHI Center for Water and Environment. UNESCO. http://unesco.org/images/0018/001818/181891E.pdf

34. [JICA] JAPAN INTERNATIONAL COOPERATION AGENCY / [NWRB] NATIONAL
    a. WATER RESOURCES BOARD (2008). The study on integrated water resources management for poverty alleviation and economic development in the Pampanga river basin. Nippon Koei Co., Ltd.

ISSN: 2233-7857 IJFGCN

35. Komakeck, C. H. (2013). Emergence and Evolution of Endogenous Water
    a. Institutions in an African River Basin, Local Water Governance and State Intervention in the Pangani River Basin, Tanzania (Unpublished Dissertation)

36. Lenton, R., M. Muller (2009). Integrated Water Resources Management in Practice.
    a. *https://books.google.com › Nature › Environmental Conservation & Protection*

37. Lim, R.M. (2008). Water Quality Services and Consumers' Level of Satisfaction at
    a. the Local Government Units in Marinduque (Unpublished Thesis, Marinduque State College, Boac, Marinduque).

38. Lusuva, E.A. (2009): An Assessment of Gender Mainstreaming in Water Resource Management: A Case Study of Mkoji Sub Catchment in Usangu Plains,
    a. Tanzania. (Unpublished Dissertation) Available at: file:///C:/Users/Acer%20Aspire%20one%20Clou/Desktop/My%20Dissertation/Water%20Resources%20Management/Global/ELINA%20ADRIAN%20LUSUVA%20(2009)-An%20Assessment%20of%20Gender%20Mainstreaming%20in%20Water%20Resources%20Management.pdf

39. Mabiza, C.C. (2013). Integrated Water Resources Management, Institutions and Livelihoods Under Stress: Bottom-up Perspectives from Zimbabwe. (Published Dissertation, Delft University of Technology) CRC Press/Balkema PO Box 11320, 2301 EH Leiden, The Netherlands e-mail: Pub.NL@taylorandfrancis.com www.crcpress.com - www.taylorandfrancis.com

40. Maceda, M. O. (2007). Treatment of a Shopping Mall Wastewater using an Attached
    a. Growth Anoxic-Aerobic System (Unpublished Thesis, UP Diliman, Quezon City)

41. Mallari, A. L. (2008). Assessment of Municipal Coastal Database in the Formulation
    a. of Coastal Resource Management Plan oin Selected municipalities of Davao del Sur (Unpublished Thesis, University of Southeastern Philippines, Obrero, Davao City).

42. Meyer, C. (2013). Integrated Water Resources Management – The Orange-Senqu River Basin in South Africa. (Unpublished Master Thesis, University of Hamburg, Germany). Available at: (2013)file:///C:/Users/Acer%20Aspire%20one%20Clou/Desktop/My%20Dissertation/Water%20Resources%20Management/Global/IWRM%20The%20Orange%20-%20Sengu%20River%20Basin%20A%20Master's%20Thesis.pdf

43. Moses, T. M. (2012). Assessment of Water Resources Utilization and Management
    a. in Chahi Sub-Catchment, Kisoro District, Uganda (Unpublished Master Thesis Kenyatta University P.O Box 43844-00100 Nairobi, Kenya).

44. Mukhtarov, F.G. (2007): Integrated Water Resources Management from a Policy
    a. Transfer Perspective. In International Congress on River Basin Management: proceedings. Antalya: State Hydraulic Works of Turkey and World Water Council, pp. 610-625. Available
    b. at:http://waterwiki.net/images/1/1c/IWRM_from_a_policy_transfer_perspective.pdf ()

45. Mukwaya, C. (2010). Management of the Water Resources in the Rwizi Catchment,

ISSN: 2233-7857 IJFGCN

a. Southwestern Uganda. Ministry of Water and Environment Directorate of Water Resources Management.

46. Muller, M.,B. Schreiner, L. Smith, B. Van Koppen, H. Sally, M. Aliber, B. Cousins, B.
    a. Tapela, M. Van Der Merwe-Botha, E. Karar & K. Pietersen (2009) Water Security in South Africa. Development Planning Division. Working Paper Series No. 12 Development Bank of South Africa. Available at:http://www.dbsa.org/Research/DPD%20Working%20papers%20documents/DPD%20No12.pdf

47. Myers D.N. (2016). Why Monitor Water Quality?
48. http://water.usgs.gov/owq/Why MonitorWaterQuality.pdf

49. Northouse, P. (2009). *Introduction to leadership: Concepts and practice*. Thousand
    a. Oaks: Sage.

50. NWRB (2007). RESOLUTION NO. 006-0507 May 16, 2007 – 54th Board Meeting
    a. Approval And Endorsement Of The Philippine Integrated Water Resources Management (Iwrm) Plan Framework *www.nwrb.gov.ph/images/Board_Resolution/Res_06-0507.pdf*

51. NWRB. (2015). Philippines Country Paper. National Water Sector Apex Body.
    a. http://www.adb.org/Water/NWSAB/Philippines_Country_Paper.pdf

52. NATIONAL WATER RESOURCES BOARD. (2012). Investment Needs for
    a. Resource Assessment Capability in the Philippines to Improve the Planning and Management of Water Infrastructure. http://www.nwrb.gov.ph/images/Publications/Assessment_Capability_to_improve_Planning_and_Mngt_of_Water.pdf.

53. Pascual, C.M. (2009). Towards Sustainable Water Resources Management in the
    a. Philippines: Challenges and Issues to Secure Water for All. Science Council of Japan Symposium. http://www.scj.go.jp/ja/event/pdf/70-k-1-6.pdf.

54. Petate, M. B. (2008). The Role of Political Leaders, National Government and Non-
    a. Government Organization in the Governance and Development of Barangays in Catarman, Northern Samar (Unpublished Thesis, University of Eastern Philippines, Catarman, Northern Samar)

55. Philip, R.B. Anton, D. Cox, S.Smits, C.A. Sullivan, E. Chonguica, F. Monggae, L.
    a. Nyagwambo, R. Pule, & M. Berraondo Lopez (2008). Local Government and Integrated Water Resources Management (IWRM) Part II: Understanding the Context – The Role of Local Government in IWRM. Available at: http://logowater.iclei-europe.org/fileadmin/user_upload/logowater/wp5/Part2_en.pdf

56. Philippine Development Plan 2017 – 2022.

57. PHILIPPINE STATISTICS AUTHORITY (2015). The Philippines in Figures 2015
    a. Republic of the Philippines https://www.psa.gov.ph/sites/default/files/2015%20PIF%20Final_%20as%20of%20022916.pdf

ISSN: 2233-7857 IJFGCN

58. Quin, A. (2010). Monitoring and Evaluation of Rural Water Supply in Uganda.
    a. (Licentiate Thesis KTH-Environmental Management and Assessment Department of Land and Water Resources Engineering Royal Institute of Technology (KTH)). https://www.diva-portal.org/smash/get/diva2:371998/FULLTEXT01.pdf

59. Rahaman, M.M. & Varis, O., (2007). Towards Integrated Water Resources
    a. Management along the Ganges basin: An analysis of the Water Policies of the Riparian countries. Amsterdam Conference on the Human Dimension of the Global Environmental Change, 24-26 May, 2007, The Netherlands.

60. Rahaman, M. (2009). Integrated Water Resources Management: Constraints and Opportunities with a focus on the Ganges and the Brahmaputra River Basins. (Published Dissertation), Water & Development Publications, www.water.tkk.fi/global/publications - Helsinki University of Technology TKK-WD-05, Helsinki, Finland.

61. Raymundo, R.B. (2015). Challenges to water resource management: ensuring
    a. adequate supply and better water quality for the present and future generations DLSU Research Congress Vol. 3 2015 De La Salle University, Manila, Philippines

62. RA 9275 PHIL CLEAN WATER ACT OF 2004.
    a. http://www.lawphil.net/statutes/repacts/ra2004/ra_9275_2004.html

63. Rola, AC, Pulhin, JM, Tabios, JQ, Lizada, JC, Dayo, MHF (2015). Challenges of Water Governance in the Philippines. Philippine Journal of Science.

64. Sehring, J. (2009) The Politics of Water Institutional Reform in Neopatrimonial
    a. States: A Comparative Analysis of Kyrgyzstan and Tajikistan. Wiesbaden: VS, Verlag fuür Sozialwissenschaften.

65. Senate Economic Planning Office (2011). Turning the Tide: Improving Water Resource Management in the Philippines. Policy Brief. August 2011 PB-11- 03. https://www.senate.gov.ph/publications/PB%202011-08%20-
    a. %20Turning%20the%20Tide.pdf.

66. Sesay, P.A. (2007). Improving Institutional Coordination for Planning and Management of Floods in the Salug Valley Area (Municipalities of Molave, Mahayag and Tambulig), Zamboanga Del Sur Province, Philippines. (Unpublished Thesis, UP Diliman, Quezon City).

67. Severn Trent Water (2016). Water Resources Management Plan.
    a. https://www.severntrent.com/about-us/future-plans/water-resource-management/water-resource-managment-plan/

68. Solanes, M. & Gonzalez-Villareal, F. (2009). The Dublin Principles For Water As
    a. Reflected In A Comparative Assessment Of Institutional And Legal Arrangements For Integrated Water Resources Management 29, *available at* http://www.gwpforum.org/gwp/library/Tac3.pdf.

ISSN: 2233-7857 IJFGCN

69. Tangaran, L. (2016) . Philippine Clean Water Act of 2004 (RA 9275) Implementation in Region VIII. (Unpublished Dissertation. Northwest Samar State University,
    a. Samar)

70. Thou, A.D.M. (2008). Community and Social Responses to Land Use
    a. Transformations in the Nairobi Rural-Urban Fringe, Kenya. Available online:
    b. http://factsreports.revues.org/435.

71. Tokmak, H.S., Baturay, H.M., Fadde, P. (2013). Applying the context, input, process,
    a. product evaluation model for evaluation, research, and redesign of an online master's program. Review of Research in Open and …, - irrodl.org

72. Torio, P.C. (2016). Water Privatization in Metro Manila: Assessing the State of
    a. Equitable Water Provision. (Unpublished Dissertation, University of British Columbia).https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0300017

73. UFZ – Umweltforshungszentrum (2011). Integrated Water Resources
    a. Management. From Research to Implementation:
    b. http://www.dhydrog.de/wpcontent/uploads/2013/02/IWRM_Brochuere_english.pdf

74. UNDP. (2008) Effective Water Governance [online]. Available from:
    a. www.undp.org/water/about_us.html [Accessed: july 23, 2018].

75. UNDP - UNITED NATIONS DEVELOPMENT PROGRAMME (2011): The Millennium
    a. Development Goals. Available at:
    b. http://www.beta.undp.org/undp/en/home/mdgoverview.html

76. UNDP. (2013). What is Water Governance? UNDP Water Governance Facility at
    a. SIWI.Available at http://www.watergovernance.org/whatiswatergovernance

77. UNEP - UNITED NATIONS ENVIRONMENTAL PROGRAMME (2012): The UN-
    a. Water Status Report on the Application of Integrated Approaches to Water Resources Management. Available at:
    b. http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf ()

78. UNEP - UNITED NATIONS ENVIRONMENTAL PROGRAMME (2009): Water
    a. Conservation: A Guide to Promoting Public Awareness. Availabte at:
    b. http://www.unep.org/training/programmes/Instructor%20Version/Part_2/Activities/Interest_Groups/Public_Awareness/Supplemental/Water_Conservation_A_Guide_to_Promoting_Public_Awareness.pdf ()

79. UN ESCAP - UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR
    a. ASIA AND THE PACIFIC (2013): What is good governance? Available at:
    b. http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/gg/governance.asp

80. Vanham, D. (2009). Integrated Water Resources Management In Alpine Regions:
    a. Development And Application Of Methodologies For The Analysis Of Present And Future Conditions (Unpublished Dissertation, University Of Innsbruck, Austria)

81. Varis, O., M. Mizanur Rahaman & V. StuckI (2008): Integrated Water

ISSN: 2233-7857 IJFGCN

a. Resources Management Plans: The Key to Sustainability? Water & Development Publications - Helsinki University of Technology. Available at: http://water.tkk.fi/English/wr/research/global/myth/14_Varis&al_Mythsof-
b. Mekong.pdf ()

82. WOLRD BANK (2012): Investing In Water Infrastructure: Capital, Operations and Maintenance. Water Papers. Available at: http://water.worldbank.org/sites/water.worldbank.org/files/publication/water-investing-waterinfrastructure-capital-operations-maintenance.pdf

83. World Meteorological Organization, (2013). Planning of Water-Quality Monitoring
    a. Systems. http://www.wmo.int/pages/prog/hwrp/publications/Technica_report_series/TR-No3water_quality_monitoring_systems.pdf

84. World Water Council. (2012) Water crisis [online]. Available from:
    a. www.worldwatercouncil.org/index.php?id=25.

85. World Water Council (2012). Water and Green Growth, *Beyond the Theory for*
    a. *Sustainable Future*.
    b. *www.worldwatercouncil.org/sites/.../Water_and_Green_Growth_Report_Edition.pdf*

86. Xie et al. (2013). Addressing China's Water Scarcity, Recommendations for
    a. Selected Water Resource Management Issues. Table 2.1. World Bank. http://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-7645-4

ISSN: 2233-7857 IJFGCN