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Impact of Planning and Analysis of Water Resources System: A Benchmark consideration for Nigerian Water Implementation Sector

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ABSTRACT
Water Resources Planning is the orderly consideration of various aspects of water Resources data from the original statement of purpose to the final decision in a course of action. It considers various alternatives and evaluates them before taking the final decision. The planning aspect usually forms the basis for any proposed water Resources projects. It is the most important aspect of water Resources Engineering as a discipline for decades. It is the core background for this study with emphasis on the purpose, classification of water Resources projects, decision making; systems analysts, and characteristics required for water Resources projects planning.
Keywords: Planning, Analysis, Water Resources Systems, Benchmark, Nigerian water Implementation sector

INTRODUCTION

Water too much, too little, or contaminated. Throughout the world, these are the conditions that have always preceded water Resources planning and management to meet the demands for the desired quality and quantity of water at a particular location and Time. The Engineers with the help of Economists, political scientists, lawyers, planners, conversationalists, etc that have gained considerable experience in designing, constructing, and operating structures are together the ones to deliberate on improved management of natural water supplies.

The incentive to plan for increased control of any water body often follows a major disaster, such as a flood, a drought, a large fish kill, or water borne disease or epidemic. Following disease crises that often trigger water Resources planning, citizens, review committees, planning boards, advisory groups, and public hearing may all help to sustain the momentum needed to obtain governmental support and participation But just as rapidly as public

support develops for investments in Engineering structures controlling and managing water, environmental and preservation interest groups also emerge to critically question the wisdom of such potential investments, the concern of these group is not limited to the conservation and preservation of such areas and wild rivers, but often includes the broad regional impacts that could result from changes in air and water quality, noise levels, land use, transportation, and the alike . Water Resources planning, therefore involves not only multiple purposes, but also multiple objectives

Water Resources planning

Water Resources planning are orderly consideration of various aspects of water Resources data from the original statement of purpose to the final decision on a course of action. Various alternatives are usually evaluated before taking the final decision. The planning aspect usually forms the basis of proposed water resources project. It is the most important aspect of engineering for the project. Includes all the works associated with the design of a project except the detailed engineering of the structures required.

THE PURPOSE OF WATER RESOURCES PLANNING

Water Resources are planned to serve various purposes. These are:

Main (Multi) purposes with a concentration on the following:

(i) **Irrigation:** Dams, Reservoirs, wells, canals distributions systems, drainage facilities, grading, etc.

(ii) **Hydropower/Electricity:** Generators, transformers, transmission lines, turbines, etc.

(iii) **Flood Control:** Prevention or reduction of flood damages, river regulation, floodways, storage, reservoirs, flood walls, channel improvement, re-charging of water, etc

(iv) **Domestic and Industrial Water Supply:** Provision of safe and adequate water for domestic, industrial, commercial, municipal uses. Dams, reservoirs, wells, conduits, pumping plant, distribution system, etc

(v) **Navigation:** Inland navigation facilities for transportation of goods and passengers, dams, reservoirs, canals, locks, channel improvement, harbor improvement, etc

Secondary Purpose with a concentration of the following

(i) **Recreational use of Water:** Reservoirs, swimming pools, facilities for boating and water sports, preservation of sceneric beauty, etc

(ii) **Fish and Wild Life:** Wild life refuges, fish ladders, reservoirs, regulation of stream flows, pollution control, land management, etc.
(iii) **Drainage Control:** Ditches, tile drains levees, pumping stations, etc
(iv) Watershed Management: Sediment reduction, run-off retardation forest and grass land improvement, soil conservation practices, forest and range management practices, debris detention small reservoirs, farm ponds, etc
(vi) **Salinity Control:** Reservoirs for augmentation of low stream flows, barriers, and ground water re-charge coastal jetties, etc.
(vii) **Sediment Control: -**Soil conservation, afforestation, desisting works, revetment works, and bank stabilization, check dams, etc.
(viii) **Pollution Abasement:** Treatment facilities, legal measures to control pollution, insect control, recreational values, drainage extermination measures, cleaning of polluted rivers, etc
(ix) **Artificial Precipitation:** Cloud seeding equipment, meteordogical instrumentation, etc

Miscellaneous Purpose with a concentration on the following:

i. **Employment Opportunity:** the objective is to provide employment and other sources for increased income in backward areas having a lot of unemployment problems.
ii. **Acceleration of Public Works:** The objective is to accelerate the construction of various public works for the development of regions. Sometimes, water projects are planned so that they may be executed on cost-sharing basis among various agencies, such as central government, state government, local bodies and private organizations to accelerate the development.
iii. Development of New Water Resources policies, initiation of new policies for Development, composition, formation and execution of other water resources projects.

Comprehensive Water Resources Planning

Comprehensive Water Resources Planning is generally conducted in several separate but related phases, requiring input from a wide range of specialists, such as civil Engineers, architects, sociologists, Real estate agents, urban and regional planners, economist, financial planners, government agency personnel, citizens groups, hydrologists, environmental specialists, etc

These individuals are involved in one or more of several planning and management phases as:

- Establishment of project goals and objectives
- Collection of relevant data
- Identification of feasible best compromise alternative solution
- Preliminary impact assessment(s)
- Implementation(detailed structural design, construction, and/or policy implementation)
- Operation, management and sustainment.

Classification of Water Resources Engineering Projects

The water Resources Engineering projects are usually classified on the basis of the number of purposes such as:-

(i) Single purpose projects: These are usually designed and operated to serve only one basic purpose or function.

(ii) Multipurpose Projects: - These projects are designed and operated to serve two or more purposes. It may be noted that a projects which is designed for single purposes but which also serve other purposes is not a multipurpose projects.

WATER REQUIREMENTS FOR MULTIPURPOSE PROJECTS

Water requirements for multipurpose projects are designed to serve a number of purposes. The purposes usually served are irrigation, hydropower, flood control, water supply, navigation, recreation, fish and wild life sanitation. The water requirements for those functions are quite different. The successful use of stored water in multipurpose project can be made for various purposes after studying the various requirements. If these requirements are compatible, the stored water is then used more effectively because it would simultaneously serve more than one purpose. The water requirements for the above functions are discussed in detail below:-

(i) **Irrigation:-**Water requirement for irrigation is generally higher in a year of LOW rainfall. But the average demand does not vary greatly from year to year, if the irrigated area remains the same. Because irrigation is sort of insurance against drought, it is desirable to reserve as much storage as possible for irrigation use.

(ii) **Hydropower:-**water requirement for hydropower depend upon the type of the area served. The power demand generally has a marked seasonal variation. However, most of the hydropower plants are connected to a power grid and, therefore, there is considerable flexibility in their operation. The water requirements for hydropower can generally be coordinated with other uses of water. When

hydropower production is low, thermal and nuclear plants can be run to full capacity. In addition, hydropower production does not make consumptive use of water as the water released for hydropower can serve other purposes. Thus hydropower production is quite compatible with other uses. Water released for irrigation and water supply may be used to produce hydropower.

(iii) **Flood Control:** the basic requirements for flood control are that there should be a lot empty space in reservoir. Other uses which require that adequate water should be stored in reservoir however, the flood control requirement is seasonal as it is only during the rainy season.

(iv) **Water Supply:-** requirements for domestic water supply are more or less constant throughout the year, and this factor should be considered while planning a water supply project, adequate reserve should be maintained to avoid water shortage during the period drought.

(v) **Navigation: -** Requirements for inland navigation are that there should be adequate flow in the river to maintain the required water depth. Water is usually released from a storage reservoir to sustain downstream flow for navigation.

(vi) **Recreation:-** The basic requirements for recreation is that the reservoir should remain nearly full during the recreation season to permit boating, fishing, swimming and other water sports. In addition, there should not be sudden large draw downs which may create several problems. However, reservoirs are sometimes designed to serve recreation alone.

(vii) **Fish and Wild Life: -** for protection of fish, there should not be large and rapid fluctuation in water of the reservoir, particularly during the spawning? Period. In addition, the flaw of water downstream of dawn should not be completely stopped, as it would lead to destruction of fish and wild life.

(viii) **Sanitation:-**the requirements for proper sanitation requirements are compatible with other uses, as these can be easily combined with the release of water for other uses.

Water Resources Decision Making

Since large scale planning development and management of water Resources system usually take place in the government public sector, the individual or individual, responsible for taking decisions, or selecting from a

set of development alternatives are usually not the Engineers who perform the technical analysis related to give problem domain. The decision making topology is rather more like that presented below:

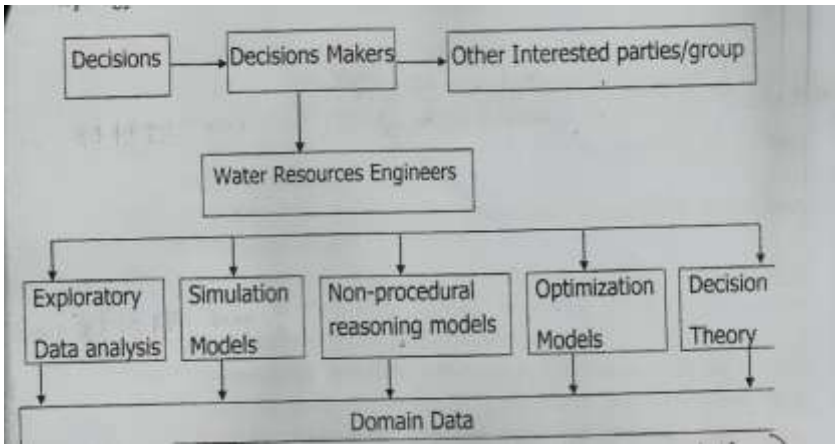

Figure (1)

Source: - African Scholar Journal of Engineering and Technology Research, vol3, No2, (2015)

At the top of topology are decision makers, who are usually, elected officials by the government. These individuals assume the responsibility of selecting a course of decision making, the decision makers then interacts with the interest parties, such as local, state and federal government agencies, independent organization or groups. At the bottom are all data that relate to the problems domain, including hydrological data, economic and other cost data, demographic and historic data, and information about relevant structural and management technologies. The water Resources Engineers then select from a wide range of modeling those that can best evaluate these data and provide the decision makers with information about the trade-offs that exist among multiples and conflicting management objectives

Water Resources System Analysts and Policy Makers

To actually engage in successful water Resources systems, a system analysts must possesses not only the requisite mathematical and systems methodology skills, but also an understanding of the environmental Engineering, economic and social aspect of water Resources planning problems. Necessary skills includes a sound working knowledge of hydraulics, hydrology and environmental quality Engineering. For example, to study the impact of any land development plan, the analyst must be able

to predict how the proposed plan would affect run-off and, in turn, the quality and quantity of surface and ground waters, and how the development would affect flow and conversely, how flood flow would affect the planned development. Chemical and physical processes that can influence or cause various nutrients, biodegradable wastes, chemicals, and other constituents that may be discharged into and transported by water bodies as a result of the planned development.

Characteristics of Systems Analysis and Applications

Some of the characteristics of successful applications of systems analysis as far as water Resources are concerned are the following:-

(i) A system that is focus on orientation: - attention is devoted to the interaction of all elements within the system as a whole, as well as to the elements themselves.

(ii) Tendency to use formal mathematical models:- the overwhelming preference of most systems analysts is to use symbolic models to assist in system description and evaluation.

SYSTEM ANALYSIS FOR WATER RESOURCES PROJECT PLANNING

A system analysis for water resources project planning becomes important for the following reasons:-

(i) Water projects typically and generally involved large scale, visible, more or less permanent physical changes in the space in which man lives. Large lakes are usually created, navigable water , water is also usually provided and flood plains are usually reclaimed or permanently inundated

(ii) The expertise of many disciplines is simultaneously considered. In many cases water law is highly developed. And the hydraulics of flood routing is also considered by the engineers.

(iii) The economics is needed in order to identify the economic benefits and costs, and to also help in specifying the viable compromises among complementary objectives, such as flood protection and preservation of natural streams and river channels.

(iv) Within the systems of planning framework, competent managers of waterworks will be needed in order to develop very good operating plans.

RECOMMENDATION

(i) Proper planning and analysis of water Resources systems can fully be effective for Nigeria, if the right caliber of people are allowed to carry out the task with this in view, a call is made to the federal Government to allow engineers in the country to take up the full responsibility with other professional bodies that will be capable.

(ii) A proper visit to ministry of water Resources with at federal and state levels will be of tremendous assistance in order to ascertain what has been done in the past for further improvement against the future.

(iii) Appointments of Engineers to hold rightful positions within the federal ministry of water Resources even at state levels will actually yield better results

(iv) Co-operation with other international organizations will lead to constant improvement in the water sector, since there will be constant monitoring and evaluation of progress under implementation agenda.

CONCLUSION

Planning and Analysis has always being major tool for achieving sustainable National development by any country. It's impact has been felt in many countries of the world, especially in the area of infrastructural development with emphasis on water Resources systems and implementation drive. A full understanding of various water Resources planning and implementation will be a vehicle towards a standard of measure with other developed countries of the world.

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