RAKSHAK FOUNDATION

Use of I.T. and preparation of a dashboard for the Uttar Pradesh Irrigation Department

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Submitted by:

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Preface

I am Sai Sreemukh. I am a 3rd year Computer Science student, pursuing my Bachelor of Technology degree from Indian Institute of Technology, Kharagpur.

This report is the result of my work as an intern in the summer internship program of Rakshak Foundation, 2013. The main goal of this project is to suggest models and recommendations which can address the hurdles and roadblocks faced by the Uttar Pradesh Irrigation Department in implementing its newly installed dashboard. This dashboard is a computer software, consisting of 26 modules, covering all the areas of interest like Project Construction, Flood Control and Management, Irrigation and Water Management etc.

The Irrigation Department, like any other government department, is plagued by general problems like inefficiency, disorganized storage of data, low motivation levels in employees and widespread corruption. There are also some department specific problems. In this project, I am only going to address the major problems that the department is facing in implementing the dashboard of the department headquarters, situated in Lucknow.

The scope of my project includes database management, project management tools and techniques, analysis of critical activities, human resource management and software planning.

It is rare enough to find an engineering student researching on policy related issues let alone a Computer Science student. But the internship program seemed so unique and rigorous that it made me think that I might be able to work on something big and relevant to the Indian society. Problems in all walks of life are aplenty in India, and the stakes high. The issues that arise in designing solutions for these problems are both challenging and often endemic to India, and its cultures. They would most

certainly demand deep and extensive knowledge about the situation. Thus one is presented with the opportunity to garner a good knowledge base about a very specific topic. One can most certainly learn a facet of India's social sphere – however insignificant it might seem in the big picture. This scope for challenging opportunities is what made me choose Rakshak foundation as the place for my summer internship. The diversity of the projects available for the interns is very extensive, encompassing a wide range of domains like medicine, I.T., education, law, tourism, and these are just to name a few. The foundation is playing a very active role in addressing the issues prevalent in the country at the level that matters – the policy level. Many new and innovative initiatives have been taken up by the foundation in a very short span of time. The structure and functioning of the internship program is very complete, logical and efficient. The association so far with the Rakshak Foundation has been a truly wonderful and a one-of-a-kind experience.

Acknowledgements

Firstly, I would like to thank Rakshak Foundation for giving me such a great opportunity to work on public policy issues, under the guidance of an eminent IAS officer.

I take this opportunity to express my heartfelt thanks to my mentor, Shri S.P. Goyal. It was very kind of him to accept to mentor me in spite of his many commitments, responsibilities and duties of paramount importance to the country and its citizens. His guidance so far has been priceless – regularly providing me with valuable information, contacts, and sources and above all, his insight and advice.

I would also like to thank Shri Mayur Maheshwari, Special Secretary, UPID, who in spite of his busy schedule, granted a personal meeting to discuss the possibilities of my project. I am also highly indebted to Shri Ambuj Dwivedi, Executive Engineer, UPID, who was instrumental in making our field visit a success. His generous and proactive help proved to be quite indispensable. My sincere thanks also go to Shri Rajesh Shukla, Assistant Engineer, PIM, UPID, who arranged and monitored a meeting with the Water Users Association, Rae Bareli.

I am grateful to Shri Arvind Kumar Gupta, Chief Engineer of Ganga Division, for accepting our request to interact with him and gain some valuable information pertaining to the irrigation department in the process. I also thank Shri Sanjay Mataray, Shri S.P. Verma and Shri Pradeep Kumar Pawar, who have been kind enough to escort me to Khatauli, where I watched the Upper Ganga Canal in action.

Not to forget my fellow interns and friends who have been very supportive and helpful. I would especially like to thank Arka Ghosh and Sameer Shaikh, who have provided me with some useful reading material pertaining to my project. Finally, I would like to thank my internship coordinators – Mr Pritesh Mittal, Mr Siddharth

Das, Ms Nikita Anand and Ms Ishika Gupta, who have been proactive and supportive throughout the internship program, providing the much needed 'friendly-guidance'.

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List of Abbreviations

AP	Access Point
BSNL	Bharat Sanchar Nigam Limited
BSS	Basic Service Set
CPM	Critical Path Method
DBMS	Database Management Systems
ER	Entity Relationship
ESS	Extended Service Set
GIS	Geographic Information System
HRMS	Human Resource Management System
IAS	Indian Administrative Service
IIT	Indian Institute of Technology
INCID	Indian National Commission on Irrigation and Drainage
INR	Indian National Rupee
IT	Information Technology
JOAAG	Journal Of Administration And Governance
LAN	Local Area Network
OCR	Optical Character Recognition
PERC	Political and Economic Risk Consultancy

PERT	Program Evaluation and Review Technique
PIM	Participatory Irrigation Management
RDM	Relational Database Model
SPCT	Shortest Possible Completion Time
UGC	Upper Ganga Canal
UPID	Uttar Pradesh Irrigation Department
WUA	Water Users Association

Executive Summary

This report deals with the problems being faced by the UPID in implementing a full-fledged dashboard, and suggests methods – in the form of financial models and I.T. systems to address these problems. It also gives an account of the origin and status of the dashboard, currently installed in the command centre of the UPID, in Lucknow. Scope for improving the dashboard, by integrating financial aspects with project sites, is also mentioned.

This report has been divided into several chapters, each consisting of sections and subsections for the readers' perusal. The first chapter is an introduction to the project particulars, furnishing the reader with some background information. The second chapter elucidates the research methodology employed – literature search, field visits and mentor meetings. The field visit that had been undertaken to Lucknow was especially useful and clarifying. The third chapter discourses about the government efforts in making the idea of a dashboard a reality. The modules that comprise the dashboard are conjointly construed in this chapter. The fourth chapter enumerates the results and findings from the research, and a gap analysis – gap existing between government efforts and actual needs of the stake holders, is ordained. The fifth chapter discusses the recommendations – scope, problems and strategy for implementation, put forth, in order to address the problems in hand. The sixth chapter concludes the report by providing the scope for future work on this project. The seventh chapter cites all the references and sources of data used, either explicitly or implicitly, in the report. The report ends with an appendix of tables and figures not used in the main body of the report.

Throughout the project, the focus is firmly affixed upon finding technological solutions, in the form of I.T. models and systems, to the problems that have arisen so far in the implementation of the dashboard of the UPID. The domain of my project

extends into the contours of database management, computer networks and project management algorithms, financial and physical progress parameters of the employees and fund flow mechanism prevalent in the department.

The recommendations evinced in this report include suggestions of models and systems designed for addressing diverse issues that the department is facing in implementing the dashboard. The recommendations are more like implementation schemes of some ideas. For ex. the idea is to have an organized system for implementing CPM in the department and the design issues of such a system have been considered in this report. Similarly, an idea like Online Fund Flow mechanism for the department has been conceived and the basic structure and design of such a system have been attended to in this report. Suggestions also include installation of wireless networking for the smooth functioning of the dashboard, as wired networks are proving to be quite cumbersome.

Some of the points which have been instrumental in – defining the goals of this project and identifying the needs of the department are listed below:

Key Findings:

- The UPID has a dedicated dashboard installed. The dashboard is a contrivance of 26 different and fully functional modules, each providing a unique functionality. The dashboard also has a team of technical personnel hired from a private firm, working on payroll basis. The whole infrastructure is in place – LCD display screens, computers, networking and connectivity and the software itself. One of the major aspects fettering the dashboard is lack of data.
- Take a look at this fact – approximately 20 gigabytes of data needs to be fed into the dashboard of which only 2 gigabytes has been met. This can be attributed to the reluctance of the employees in sharing their data.

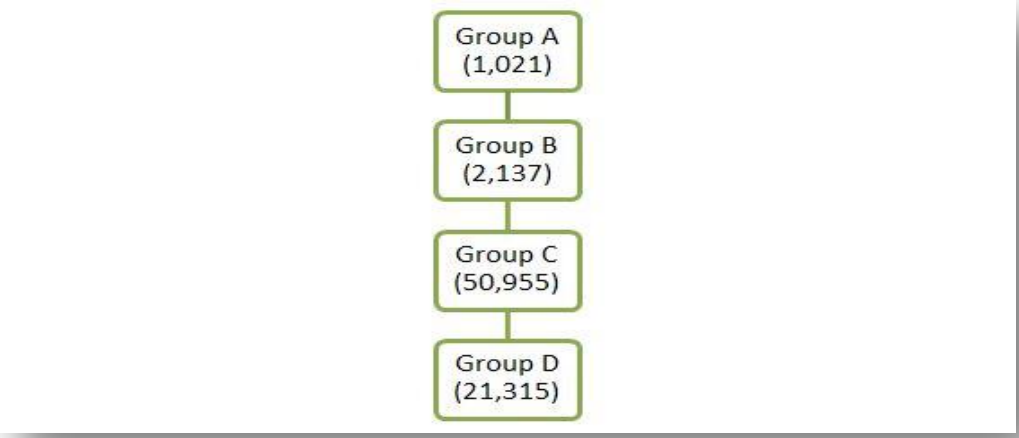
- The whole data and functionality of the dashboard has been articulated in 600 screen shots. This is posing a problem, as the monitoring and maintenance of such a large number of screen shots is difficult, thereby raising the need for fewer number of screen shots without compromising on the amount of data.

1. Introduction

1.1. Background Information

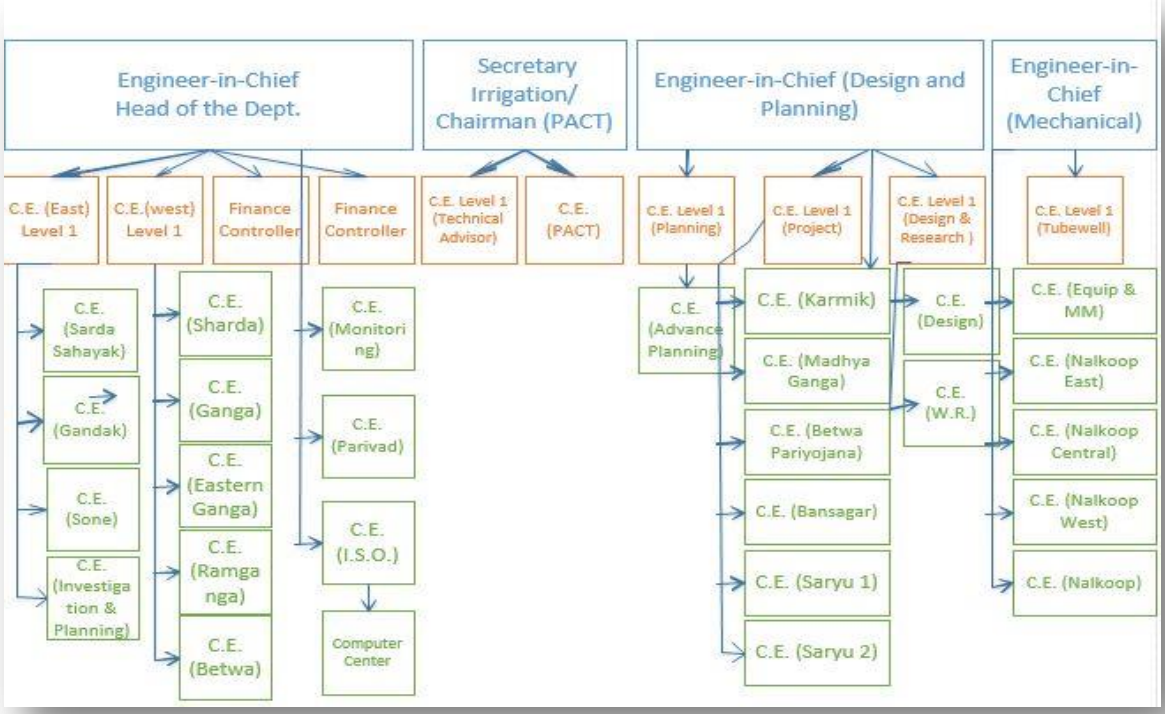
Uttar Pradesh Irrigation Department is one of the oldest departments in the state that has had a humble beginning in 1823, when the First Irrigation Office was instated in Saharanpur [9]. Construction of the Ganga Canal started in 1840 and completed in 1854 [3]. Soon the Central Public Works Department was established in the late 19th century [3]. Famine Commissions have been set up. Dams and Tube wells followed as the department continued to make big strides. Eventually the Directorate of Lift Irrigation was created in 1968 [3]. Since its inception, the Irrigation department has come a long way in managing the water resources of the state, delivering to the end user.

The department of Irrigation has a total strength of 75,428 employees. It is the second largest government employer after the Indian Railways. A hierarchy exists in the department, with the employees classified into four groups namely Group A, Group B, Group C and Group D.



Source: Prof. Singh. K. N, Prof. Singh. S and Dr. Kumar. S (IIM Lucknow), *Assessment of the Training Needs and Training Plan Development*, UPID, (2008)

Fig 1: Group based hierarchical organisation of UPID



Source: <http://irrigation.up.nic.in>

Fig 2: Top level hierarchical organization of UPID

The projects undertaken by the department are diverse and large in scale, considering the fact that Uttar Pradesh is the fifth largest state and has highest population in India. Types of projects include river valley projects, canal projects, hydroelectric dam projects, reservoir projects and tube well projects.

Coming into the realms of my project, UPID had commissioned the installation of dashboard software for expediting departmental monitoring activities in 2007. The job completed four years later, in 2011. Since then, the department has been grappling with the issues pertaining to the dashboard. Ironing these issues will go a long way in speeding things up a bit.

1.2. Main Problems – Scope and Impact

It is only natural to assume that such a large organization brings with it numerous organizational difficulties. Chaos and corruption is rampant. Inefficiency is impinging every activity taking place in the department. Activities in the department are generally complex, riddled with a ton of rules, regulations and procedures which are proving to be time consuming. The situation is only exacerbated with the reluctance of a majority of the employees to support the introduction of an I.T. initiative.

The above mentioned problems can only have only one outcome – delays in the implementation of projects. Incessant and prolonged delays are so very common that one gets surprised when a project gets completed hassle-free.

Moreover, the execution of roasters is very poor. Rarely do the farmers get water in their allotted slots. A lot of lobbying by influential people takes place in order to get the best water. Water sometimes recedes to alarming levels in the tail part of the canal. In short the system of roasters is not user friendly at any rate.

Problems are also aplenty in the internal functioning of the department. Data is still stored in files and paper in spite of technological advancements around the world. This can be attributed to the highly conservative nature of the some of the members of the department, who are very reluctant to welcome change. Change, they fear, will cover the loopholes in the system and bring an end to their corrupt practices.

The dashboard which hopes to abate the prevalence of the above mentioned problems itself is facing its own set of problems. Data collection from employees is practically non-existent. The wired network that is connecting the computers in the command centre with those in the Secretariat is disrupted recently, due to some construction activity. Even if all these problems are somehow eliminated, the problem of employer incompatibility with technology still persists. Most of the employees, one must remember, are not accustomed to using gadgets and

computers. The archaic system in place has been ingrained so deeply into the conscious of an employee that any slight modification – even the good ones is vehemently opposed and stamped out. In this scenario, trying to implement as big a system as the dashboard will surely have repercussions of all kinds. Change is necessary, but it should preferably be steady and progressive instead of an all-out bout of incompatible vicissitudes.

In summary the problems and their scope can be enunciated in two levels. Level 1 corresponds to problems in the department. These problems inevitably percolate to level 2 – grassroots level. Some of the problems experienced in the level 2 are:

- Inefficient working of the canal system due to the bureaucratic system of management.
- Big gap in the irrigation potential created (IPC) and irrigation potential utilized (IPU).
- Underutilization of high investment cost due to incessant delays caused by archaic procedures and bottlenecks.

Impact on the society can be of two types – materialistic and socio-cultural. Materialistic impact deals with the factors which have a say in the economic status of the primary stakeholders, i.e. farmers. Summary of the impact is as follows:

- Volatile and unpredictable management of water resources seriously hamper the agricultural productivity, thereby hampering the financial returns of the farmers in the state.
- Non-availability of water for irrigation forces farmers to depend on monsoons which are very sporadic and unpredictable in some places.
- All these factors limit the financial capability of the farmers by robbing them off a chance to grow.
- Low irrigation means low agricultural output means low growth rate of the Gross Domestic Product. Even though it is the service sector which is driving

the growth of the country, India is primarily an agricultural country, with the agricultural sector playing a crucial role in the growth of the Indian economy.

- Sense of frustration among the hardworking and honest members of the department, due to the poor implementation of various policies and projects.
- A general understanding among people that government offices notoriously inefficient and conservative.

The system is a chaotic mixture of elaborate processes and archaic procedures, which present many loopholes for the corrupt, to exploit. Widespread corruption is really hurting Indian government offices.

1.3. Goals and Objectives

The overall objective of this project is straightforward – suggestion of measures that can improve the operation of UPID in general, and the dashboard in particular. An exhaustive list of the objectives can be enumerated in the following way:

- Devising a system which employs the Critical Path Method in a formulated and lucid manner.
- Employee data standardization – data pertains to parameters like fund utilization, financial and physical progress.
- Scrutinizing the feasibility of replacing wired networks with wireless
- Designing an Online Fund Flow mechanism which can potentially check the problem of widespread corruption and fraudulence.
- Database management of irrigation projects.
- Suggesting ideas to facilitate the process of data collection from the employees, for the dashboard.
- Investigation of a complaint system for canals (A complaint system is already in place for tube wells).
- Ascertaining the pros and cons of the introduction of an 'Employee Performance Evaluation system'.

2. Methodology

The research methodology adopted in the completion of the project is uncomplicated – meetings with mentor made the scope of the project clear and gave the 'big picture' – field visits revealed the chinks and in the process made the list of objectives trivial – literature search served miscellaneous purposes like providing concepts, ideas and data.

2.1. Literature Search

It was a necessity to acclimatize to – computer science concepts like Computer Networks, DBMS – algorithms like the critical path method and – statistical tools like Program Evaluation and Review Technique, in order to work on the project. Plenty of literature was available, which could explain the above mentioned concepts and topics. Understanding the intricacies of these concepts is very important. A book spawning the entire history of the department proved to be quite useful – scale, functions and purpose of UPID was extensively covered. A report on the training requirements for UPID gave an idea on the – employee organisational hierarchy and – the challenges and roadblocks with regard to the performance of the employees. Computer Science textbooks teaching the concepts of computer networks were instrumental in elucidating the features and functioning mechanism of wireless networks. Some key concepts are explained below:

Dashboard: A dashboard can also be called a 'concise command centre'. It is a computer generated screenshot which displays vital information (in the form of graphs, tables etc.) pertaining to the organisation. The user should be able to grasp all the information at a single glance. There should minimum parsing requirements on the part of the user. The characteristics of a good dashboard can be summarized as follows:

- Single page
- Vital information should be displayed
- Minimal Parsing by a user
- Monitored at a glance

Database Management of Irrigation Projects: Database Management, as the name suggests, is a tool to organize data in an efficient manner. Any query relating to the information stored in the database can be quickly accessed, without having to resort to brute force methods. DBMS contains information about a particular enterprise. The enterprise in question is the irrigation department of Uttar Pradesh. The data to be stored is the whole set of irrigation projects – dams, canals, reservoirs, river valley projects etc. A DBMS provides the following general facilities – storage of interrelated data and – an environment that is both convenient and easy to use. Databases touch all the aspects of our life. They are in extensive use in almost all organizations and companies like banks, airlines, universities, sales, human resources etc.

The Critical Path Method: It is an algorithm that can estimate the shortest possible time of completion for a project. One of my objectives is to analyse the critical activities using the critical path method. This project management technique was developed in the 1950's by Americans Morgan R. Walker and James E. Kelly. An objective in my project requires me to understand and implement this algorithm.

2.2. Field Visits

The major role field visits played in my project was to reveal the problems plaguing UPID in general and the dashboard in particular. Once the problems were apparent, the objectives become trivial – namely solving these problems by various mechanisms and strategies. Field visits have been undertaken to Meerut, Khatauli, Lucknow and Rae Bareli. Interactions with officials belonging to various levels of the organisational hierarchy took place. Some discussions were fruitful – others not so

much. The field visit to Lucknow was capped off with a visit to the Parikal Bhavan, where the dashboard is installed and monitored from. A fruitful discussion with the technical personnel operating the dashboard ensued – problems became apparent and objectives clearer.

2.3. Meetings and Interviews

Apart from field visits and literature search, discussions with mentors regarding the challenges faced by the irrigation department and issues in induction of Information Technology initiative a.k.a. the dashboard to benefit the working of the department have also proved to be useful in compiling this report. The gains from mentor meetings are scope and a 'big picture'.

Apart from mentor meetings, discussions also took place with several people – a majority of them work in UPID. In depth knowledge of the problems and difficulties – being faced by UPID in general and the dashboard in particular – is the output of these meetings.

2.3.1. Mentor Meetings

A total of two personal meetings have taken place. One meeting took place in U.P. Sadan, Delhi, and the other one in the Uttar Pradesh Secretariat, Lucknow. Main points of discussion have been the possible scope of the project, problems plaguing the department and the general functioning of the department.

2.3.2. Field Visits

Table 1: Abridged Version of Field Visit Discussions

Date	Name	Designation	Institution	Topic of Discussion*
4th June' 13	Shri Arvind Kumar Gupta	Chief Engineer	UPID	Irrigation processes in general – Canal Irrigation in particular
4th June' 13	Shri Sanjay Mataray	Assistant Engineer	UPID	Roasters and water distribution mechanism
27th June' 13	Shri Ambuj Dwivedi	Executive Engineer	UPID	Problems in the implementation of dashboard and general employee mentality
27th June' 13	Shri Mayur Maheshwari	Special Secretary	UPID	Integration of financial aspects with project sites
28th June' 13	Shri Prateek Mai Khare	Technical team member, Dashboard		Technical details of the dashboard and difficulties being faced
28th June' 13	Shri Dev Singh	Technical team member, Dashboard		Technical details of the dashboard and difficulties being faced
28th June' 13	Shri Rajat	Technical team member, Dashboard		Technical details of the dashboard and difficulties being faced
28th June' 13	Shri Rajesh Shukla	Assistant Engineer	UPID	Participatory Irrigation Management

**Refer to Appendix A for further details*

3. Current Government Efforts

Technology is an absolute need we cannot escape from. Let's just say, it has a very big role in most aspects of our lives. In other words, it answers most of Mankind problems. The importance of technology is aiming for comfort of use in whichever form it is. It always directs for easiness in life [25]. Technology is undoubtedly one of the best force multipliers. It facilitates the irrigation department to monitor all activities under one roof. It enforces structure and discipline in the organization. Speed and efficiency are added benefits.

The government, in response to the growing need for a technology initiative, commissioned the installation of command center software – to monitor and manage all the aspects of the department. This project had been taken up by Tech Mahindra, in 2007. The work pertaining to this infrastructure management service had been completed in 2011 – and the dashboard software had been handed over to UPID.

3.1. Dashboard

The dashboard is an extensive piece of software, containing a total of 26 modules. The exhaustive list of the modules is as follows:

1. Question Management
2. Asset Management
3. Audit and Draft Para
4. Budget
5. Contract Management
6. Litigation Management
7. HRMS
8. Financial Accounting
9. Payroll Accounting
10. Procurement and Tender

11. Revenue
12. Store Accounting
13. Monitoring and Evaluation
14. Construction of Projects
15. Dam Safety Monitoring
16. Design of Works
17. Drainage Improvement and Maintenance
18. Flood Control and Management
19. Investigation and Planning
20. Irrigation and Water Management
21. Mechanical Works
22. Research Activities
23. Support (Diary and Dispatch, File Tracking, Document, Team)
24. General Administration
25. IT Management
26. Intranet

Most of the modules are fully equipped to start proceedings. A team of technical personnel has also been deployed in order to carry out the monitoring and maintenance activities of the dashboard. A budget of 200 million INR has been allotted for the functioning of the dashboard, this year. The technical personnel working are paid on a payroll basis.

3.2. Complaint System for Tube Wells

A complaint system is already in place in the department. Though only tube wells are covered in this system, it is definitely a positive move. On an average, six complaints are lodged via this system – every day. These complaints are pursued until the issues have been satisfactorily subdued. This system is quite good, with a dedicated team and infrastructure – computers, software and networking.

3.3. On site update system

There are also plans to integrate employees into system. According to this plan, field officers working on project sites will be required to take pictures of the on-going field work and send them to the dashboard – for evaluation and documentation. Tablet phones will be provided to these field officers in order to accomplish their tasks.

3.4. Integration of Financial aspects into the project map

The department is also planning to implement an application – the financial components of projects are put on the project map of UPID. Discrepancies in the utilization of funds for the respective projects are represented on the map by marking the project in red colour. The intensity of the colour depends on the scale of fraudulence or discrepancies in the utilization of funds. This enables the top level officials to take prompt decisions just by looking at the graphical map.

4. Results and Discussions

4.1. Findings from the literature

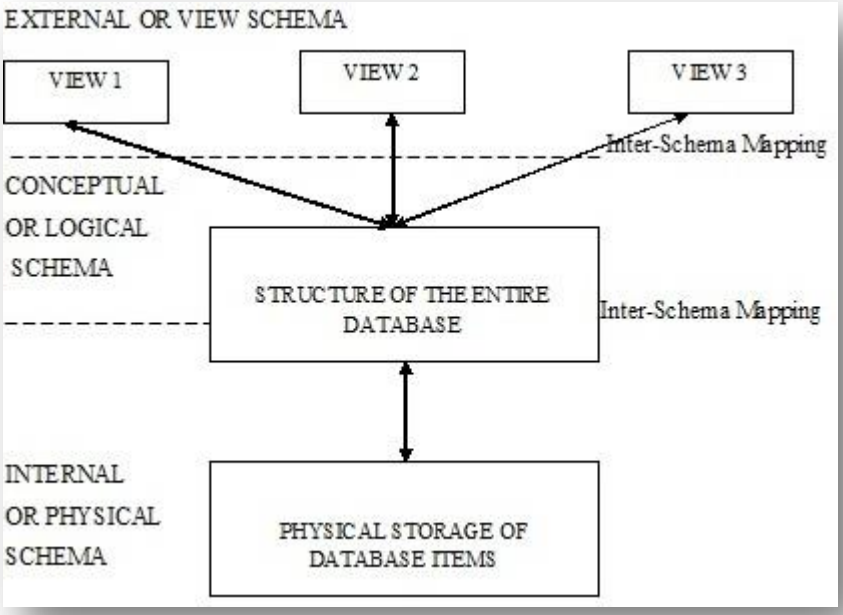
Literature search was chiefly effectuated to gain familiarity with concepts like Database Management, CPM, PERT and computer networking.

4.1.1. Database Management

DBMS contains information about a particular enterprise. The enterprise in question is the irrigation department of Uttar Pradesh. The data to be stored is the whole set of irrigation projects – dams, canals, reservoirs, river valley projects etc. A DBMS provides the following general facilities – storage of interrelated data and an environment that is both convenient and easy to use. Databases touch all the aspects of our life. They are in extensive use in almost all organizations and companies like banks, airlines, universities, sales, human resources etc. [26].

Levels of Abstraction offered by DBMS: 3 levels of abstraction are provided by a DBMS. They are – Physical level, Logical level and View level.

- Physical level describes how a record is stored.
- Logical level describes data stored in database and the relationships among the data
- View level describes how data specific details like file formats and information (ex: salaries of employees) are hidden in a database.



Source: <http://www.eazynotes.com/images/views-of-database.jpg>

Fig 3: Diagram depicting the 3 levels of abstraction in DBMS [27]

Logical Schema: Schema is the logical structure of the database. Database design at the logical level is called logical schema. Similarly physical schema is defined for the database design at the physical level. There should be physical level independence. Applications operating on the database should only depend on the logical level. This allows us to define interfaces between various levels freely without bothering about the repercussions that may arise if independence is not maintained between various levels [26].

Relational Database: It is based on the relational data model. Logical design of a database requires us to make two decisions. They are Business decision (what attributes) and Computer Science decision (what relational schemas & how attributes should be distributed) [26].

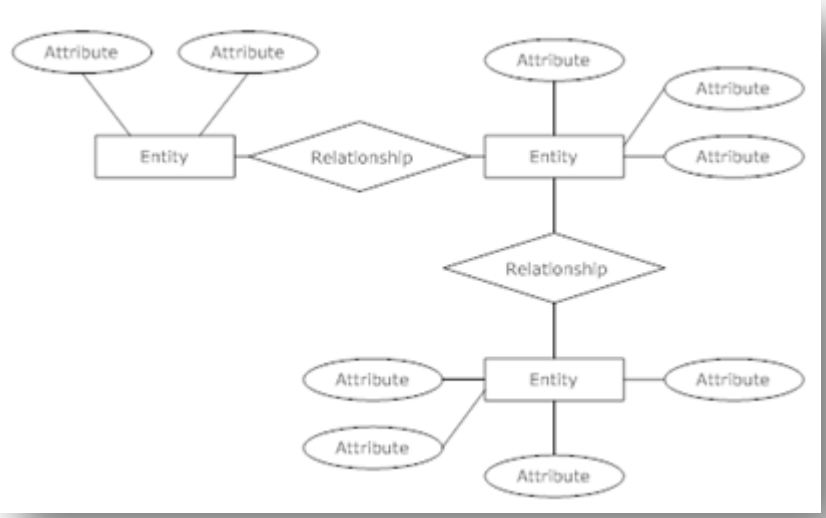
Entity-Relationship Model: Before developing the relational database, a preliminary schematic diagram illustrating the logical relationships between entities is drawn. This diagram is modified as the requirements and functioning of the database get clearer. The main terms used in drawing an ER diagram are:

Entity: An entity or an entity type is an object about which we wish to store information.

Attribute: As the name suggests – it is another object which describes something about the entity. It should be noted that an attribute cannot have attributes.

Relation: An object relating one entity to another.

An entity can be depicted pictorially in the form of a table – same as a relation – with the attributes being the columns of the table. A database is essentially a set of tables storing data, with links existing between tables. These links are database specific.



Source: <http://wc1.smartdraw.com/resources/tutorials/images/erdexample.gif>

Fig 4: Example of an ER Diagram [29]

A model like this can also be created for the logical storage of irrigation projects.

4.1.2. Critical Path Method

It is a useful mathematical tool to compute the critical path of any directed graph. A network is an example of a directed graph. In addition, any project can be diagrammatically represented by a network – a project can be thought of as a network of activities. In this way, we get the link between a project and CPM. A critical path can be computed based on any relevant parameter of a network – like time or distance – depending on the type of network. In this case it is time. So, the shortest possible completion time of a project can be computed using the CPM – as the computation of the SPCM is trivial after the determination of the critical path.

The process of employing the critical path method can be summarized in the following way:

- Construct the project network using precedence relationships between activities, individual activity durations and activity identities (title/name/any other identification mechanism).
- Calculate the critical path – the path which takes the longest completion time in the project network. It is trivial to note that the time taken by the critical path is equal to the shortest possible completion time of the project.
- The activities which lie on the critical path are termed as critical activities. These activities must be completed on schedule, else, project gets delayed. These activities do not have the slightest amount of slack.
- Any delays in the activities must be taken care of by re- constructing the project network and adjusting the critical path.

The critical path method is an easy and elegant to use mathematical tool – but it has its own set of problems. Some of them are:

- Project network needs to be constructed whenever there is a - change of plan in the project – delay.
- Projects which are big on scale might have complex network diagrams, thereby making the process of computation of the critical path a difficult and laborious affair. Delays and changes in plan will only exacerbate things in such a project. Software will be useful in handling such large and complex projects.
- There might be multiple critical paths in the project network.

UPID and CPM: The method is used by project related officials in the department. But the manner and form of the method that they use is suspect. This is evident from the incessant delays and roadblocks that plague irrigation projects. It is not uncommon to find projects which are delayed by decades. Proper employment of the method does not eliminate delays altogether – but will at least eliminate the delays caused by poor and disorganized planning of projects. A system which utilizes the CPM properly – in an organized fashion – can help the department to plan and execute projects in a much better way than that is in practice.

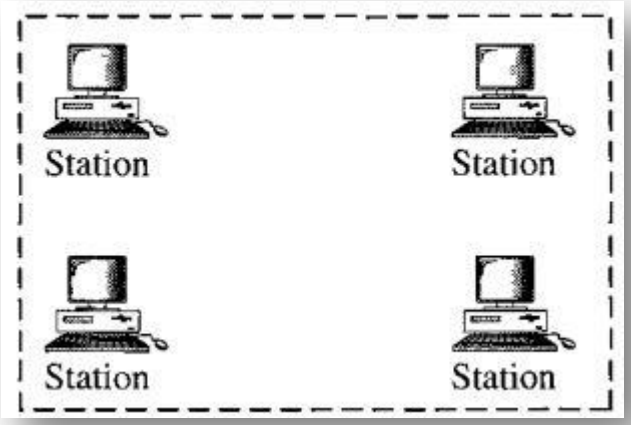
4.1.3. Wired or Wireless

Right now, the network requirements of the dashboard are being met by the BSNL. The network is spread over 20 sq. km and a total of 1000 machines are connected. The dashboard is facing difficulties due to disruptions in the network cables. This has prompted the department to look at other options like wireless.

Wireless communication – one of the fastest growing network technologies has transformed the countenance of the world. There are two propitious technologies employing wireless technology – IEEE 802.11 or wireless Ethernet – and Bluetooth. The terminology used in describing wireless Ethernet is:

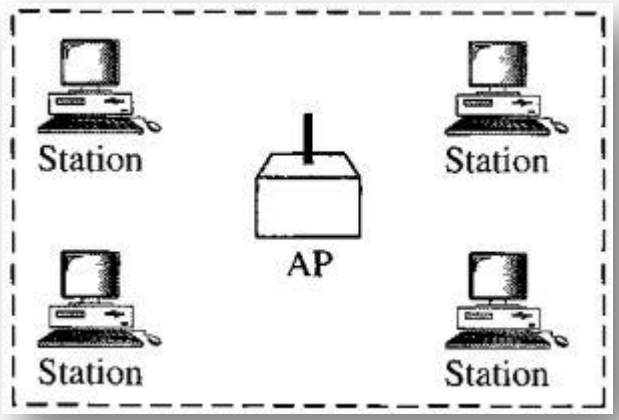
Basic Service Set: Building Blocks of wireless LAN. It is constituted by mobile or stationary stations and an optional central base station – termed as an Access Point.

BSS with an AP is called infrastructure network and the one without an AP is called an ad-hoc network.



Source: Behrouz A. Forouzan, *Data Communications and Networking*, Third Edition,Mac Graw Hill

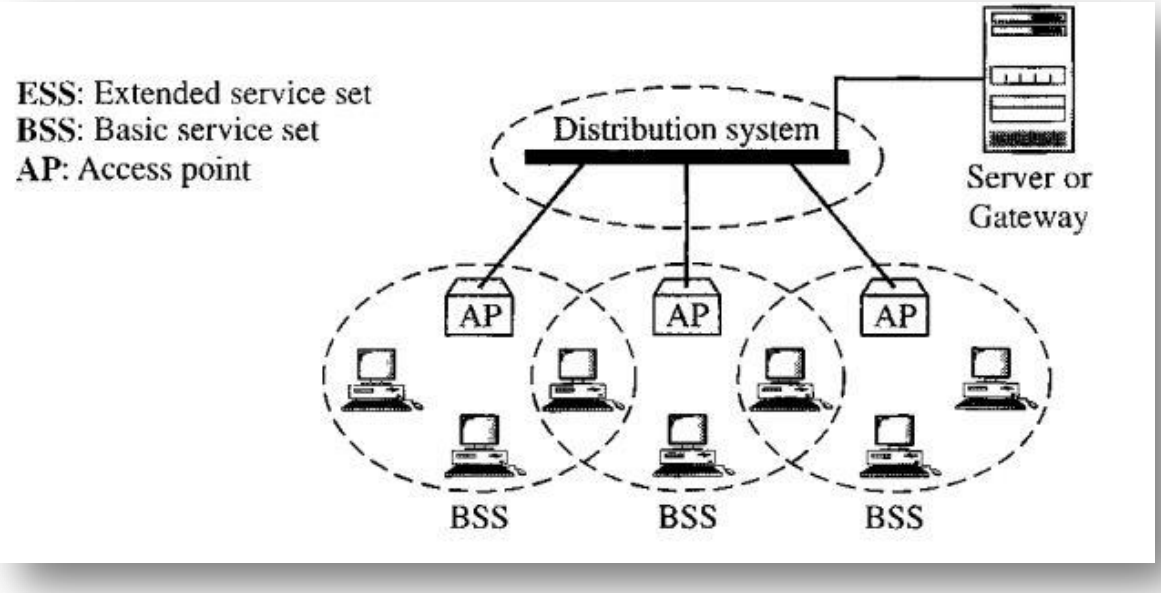
Fig 5: BSS without an AP - Ad-Hoc [24]



Source: Behrouz A. Forouzan, *Data Communications and Networking*, Third Edition,Mac Graw Hill

Fig 6: BSS with an AP – Infrastructure [24]

Extended Service Set: It is a made up of two or more BSSs with APs. The BSSs are connected by a distribution system. The distribution system is usually a wired LAN. APs in the BSSs are connected by the distribution system. No restrictions are placed on the distribution system by the IEEE 802.11 standards i.e. the DS can be any IEEE LAN like Ethernet. Communication in the ESS takes place in the following way: Two stations can communicate with each other without the use of an AP if they are in the same BSS – but two stations belonging to two different BSSs can only communicate with each other by an AP – very similar to a cellular system [24].



Source: Behrouz A. Forouzan, *Data Communications and Networking*, Third Edition,Mac Graw Hill

Fig 7: Extended Service Set [24]

So UPID can employ this system in order provide connectivity for their dashboard. The key difference between the system present now and the one explained above is that previously the stations were connected to the DS by wires –which is now wireless.

4.1.4. Underachieving Department

A Honk-Kong based corporate consultancy – Political and Economic Risk Consultancy (PERC) recently (2012) conducted a study and has made some very interesting claims. According to this study, Indian bureaucracy is the worst in Asia, far behind even China, Vietnam, Indonesia and Philippines [2]. It cited complaints such as "inadequate infrastructure" and "corruption" that tempted companies to make underhand payments to overcome bureaucratic inertia and gain official favours in India. While none of the above is surprising at any rate, to think that Indian bureaucracy is the worst in Asia is definitely very disconcerting news. The worst part of this situation is that it does not look like it is going to get any better.

Like it has been mentioned in the report before, UPID is the second largest government employer in the country, after Indian Railways. Large organisations have their own set of pros and cons – increased scale and capacity being the pros – and chaotic organization being one of the cons.

The present gap in the Irrigation Potential Created (IPC) and the Irrigation Potential Utilized (IPU) is 20.16% of IPC, and this value has only been increasing over the past few years [4]. This does not bode well for the future, as it signifies an inefficient system at play. It has been claimed by some department officials of the financial division that revenue constraints are the chief factors contributing to this gap.

The irrigational capability is dwarfed by the same of China. In China, on an average, one dam is completed every day. Incessant and long delays in the completion of a project can be blamed on the inefficient mechanism of the department, unavailability of funds, corrupt practices and vested interests. For instance, the Eastern Ganga Canal was first started in 1980 and was completed only in 2000. The Jarauli pump canal suffered a similar fate, with works starting in 1990 and completion only in 2002. The Karai Sinchai Pariyojana took 27 years for completion, and during the course has seen its total cost jump from 277.5 million INR to 34100

million INR, an increase by a factor of 122 [3]. Proper project management has the dual benefit of serving the people on time and saving a lot funds.

The government's policy is to award contracts to the lowest bidder. But this policy has many drawbacks. For instance, it does not take into account the quality of the finished product. Even time constraints are not considered often. This is not a progressive policy.

The inherent characteristics of some projects allow them to be scheduled in a way such that the construction process does not wait for the completion of the design process. Both these stages can be carried out in phases. This interaction between design and construction stages is called phased interaction. The time difference between a separate interaction and a phased interaction is significant. An even better option would be fast-tracking the project, where even the phased design and construction stages overlap, thereby reducing the project completion time to an even larger extent. But, according to the officials, policies like fast-tracking and phasing of projects had been adopted – and are very much in action, though the outcome does not reflect this fact.

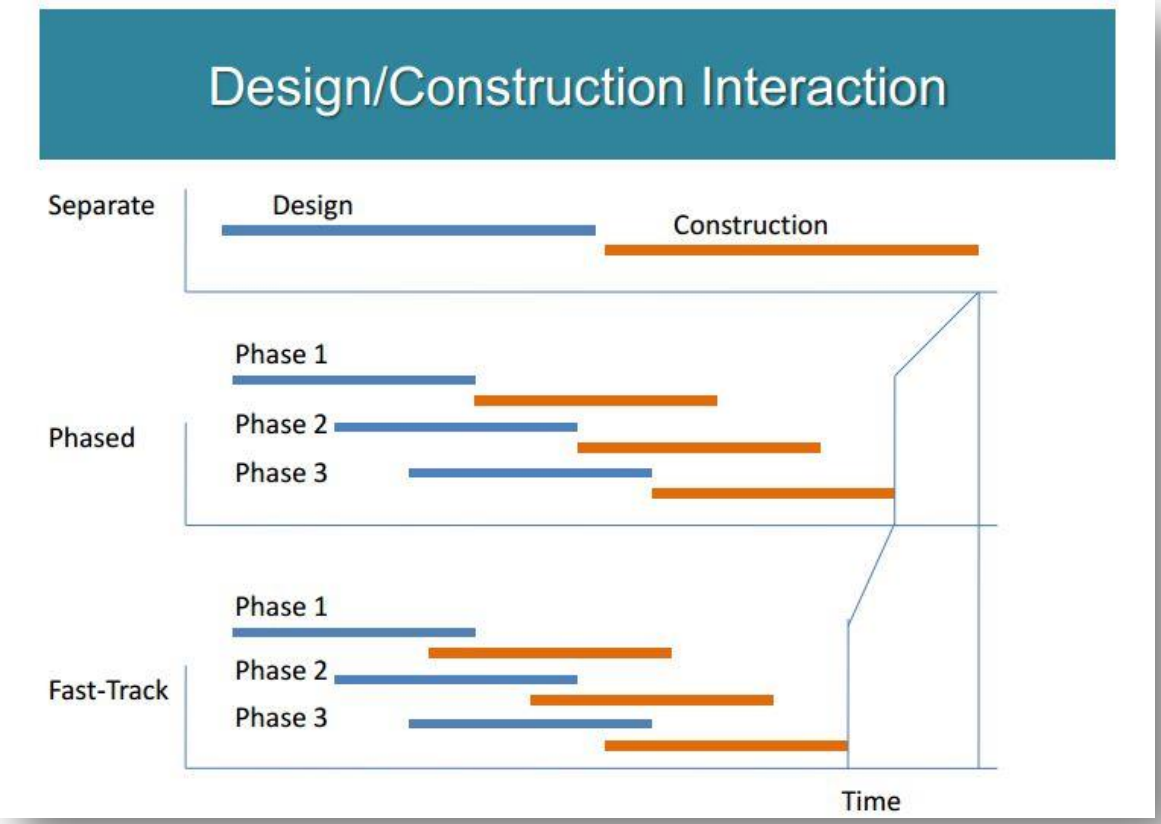


Fig 8: Various modes of interaction between Design and Construction phases

4.1.5. E – Bidding

Procedures, Rules and Regulations pertaining to the process of contract awarding to bidders have been studied. Contract Awarding forms a key part of the procurement stage of a project life-cycle. It would be very convenient for the advertiser (government) as well as the bidder if a major part of the contract awarding process is computerised. For that knowing the whole process of bidding and procurement is essential. The bidding method is as follows [6]:

- Advertisement: The owner (in this case, the government) advertises the existence of a contract and expects bids from companies.
- Pre-Bid Conference: Preliminary talk between the government and an interested party.
- Site Visit: Acclimatisation to the project site. Trying to gauge the scale of the project.
- Bid Submission: Companies which are interested to take up the project submit their respective bids to the government, including a full report on how they intend to complete the project.
- Bid Opening: Received bid envelopes are opened and examined by the advertiser (government in this case).
- Contract awarded: Bid awarded to whichever company that fits the advertiser's requirements the best. The irrigation department of Uttar Pradesh (along with all the departments of the Govt. of India) follows the policy of awarding the contract to the lowest bidder.

E – Bidding is a key part of the dashboard – covered under the Procurement and Tender module. It facilitates transparency and fairness in the whole process of tendering. Being fast, organized and efficient are added benefits.

4.2. Findings from field visits

The findings that have been compiled in this section played a key role in defining the objectives of the project – problems were acquainted with and strategies were formulated based on the need and scope.

4.2.1. Command Centre, UPID – Status and Problems

The origin of the dashboard has been already been mentioned in this report, in the 'Current Government Efforts' section – just as the modules list of UPID – 26 to be exact. Some crucial elements of the dashboard are:

- Digitization of Data in OCR format. Data is either technical details of the projects or drawings pertaining to these projects. The images are not of .jpg format.

- GIS mapping of water resources like rivers, canals, lakes, tube wells and reservoirs.
- SMS messages to farmers based on roasters – to inform them of their slot
- Flood and Forecast Warning System – prediction and aversion of natural calamities like floods.
- Financial and Project analysis integrated with individual projects – the department needs an application software that can meet this goal. Details of this software have already been mentioned.

Data collection however remains a problem. The data of the employees that needs to be fed into the dashboard for a full-fledged implementation is yet to be complied. Data aggregation is as low as 10% – 2 Giga Bytes in contrast to 20 Giga Bytes that is required. Moreover, the department is also facing the problem of employee data standardization. No fixed format is available for the data that needs to be collected. The parameters that govern this data are budget utilization, financial and physical progress of the employees.

BSNL is responsible for addressing the network requirements of the dashboard. Disruptions in the wired cables of the network are however proving to be hurdles in the functioning of the report.

4.2.2. Indifferent treatment of Water User Associations

Problems associated with the implementation of Participatory Irrigation Management in Uttar Pradesh are plenty – Roasters are scheduled but not implemented nearly accurate enough. On the basis of the roaster, farmers should collect their water from the canals, but water itself won't be present at times – causing a lot of frustration and helplessness in the farmers. The budget allocated for the functioning and maintenance of W.U.A. s are not being given. There is a severe lack of communication between the association and the concerned government

authority. Lack of training sessions and awareness among the farmers is quite evident. Though the project does not deal with the PIM, relevant recommendations aimed at improving the condition of the W.U.A. s have been included in the report.

4.2.3. Fund Flow in UPID

Fund flow in the department can be enumerated in the following way:

- Every financial year, the various divisions of the Uttar Pradesh Irrigation Department propose budgets for their respective divisions. These budgets are then passed on to the financial department of the UPID.
- The financial division evaluates and compiles all the individual budget proposals and sends them to the ministry for approval.
- The Irrigation ministry studies/evaluates this compiled budget proposal and sanctions funds. More often than not, the funds allocated are less than the amount of funds asked.
- These funds are then received by the UPID and distributed among its various divisions. Distribution takes place in the following manner: 35% in the first quarter, 15% in the second, 35% in the third and 15% again in the last quarter of the financial year.

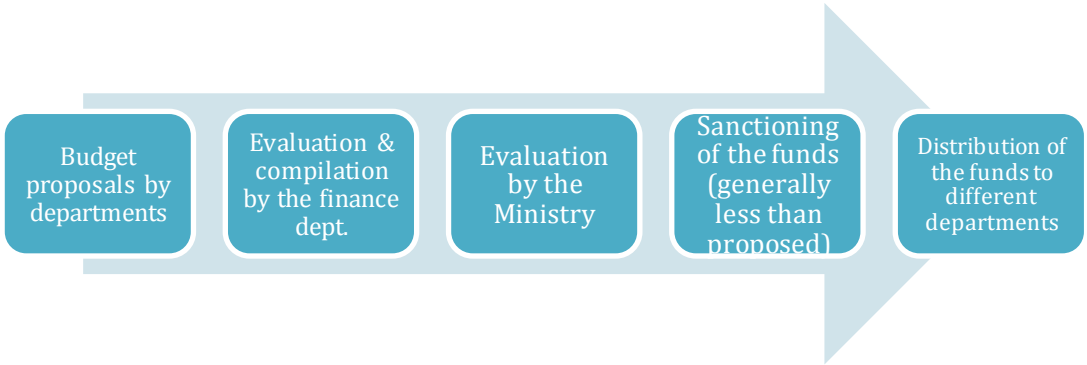


Fig 9: Fund Flow in UPID

4.2.4. Trade Off between Complexity and User-friendliness of systems

Implementation of roasters is incompetent. Seldom do farmers get water in the right slots and right amounts – if they get any water at all in the first place. This, according to an official working in the financial division of the department is due to the lack of user-friendly trait in the system in place. The reason for this is that for a system to be made user-friendly there should be a compromise in the simplicity of the system. More user-friendly implies less simple (more complex) and more resources. And the department generally avoids systems which are not simple enough.

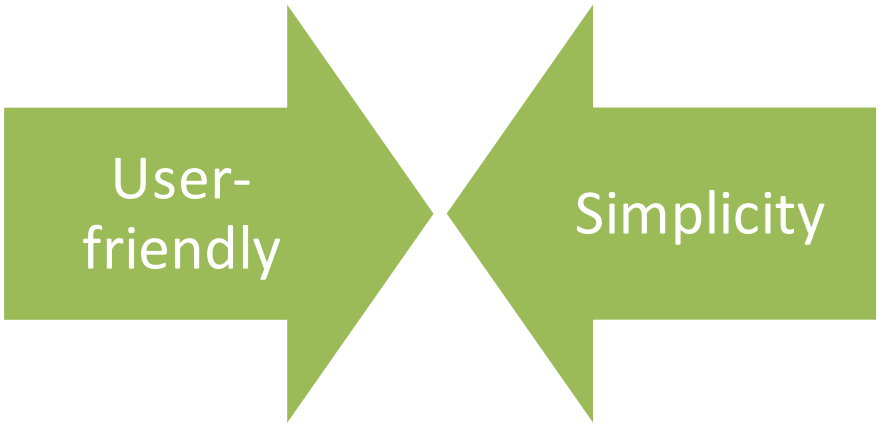


Fig 10: Diagram showing the trade-off between simplicity and user-friendliness of systems

5. Recommendations, Scope and Strategy for Implementation

Some of the problems that are plaguing the dashboard in particular and the department in general require not just ideas and suggestions – but also models and systems employing these ideas. With that perspective in mind, the following recommendations have been formulated.

5.1. Database Management of Irrigation Projects

Recommendation: Design and maintain a database exclusively storing data pertaining to irrigation projects.

Database Management of Irrigation Projects is recommended for better maintenance of records and data pertaining to all sorts of irrigation projects. A comprehensive and organized design of the database will expedite the process of cross-referencing details of irrigation projects.

Table 2: Finer points of recommendation 1

Reasons
Disorganized storage of data – Time consuming process to access small amount of data.
Scope
Storage of data pertaining to irrigation projects – Quick access to records.
Strategy
Design the database on the basis of the 3 levels of abstraction – Physical, Logical and View. Classify the irrigation projects into all possible cases and also define the parameters of each type of project. Construct the database using the 'Relational Database model'.

Following the above strategy, logical design of the database had been partially implemented. One possible ER diagram had been created. Given below are the ER diagrams – describing the database. The whole E-R diagram is supposed to be a single connected diagram, but due to space constraints the diagram has been split into 6 parts.

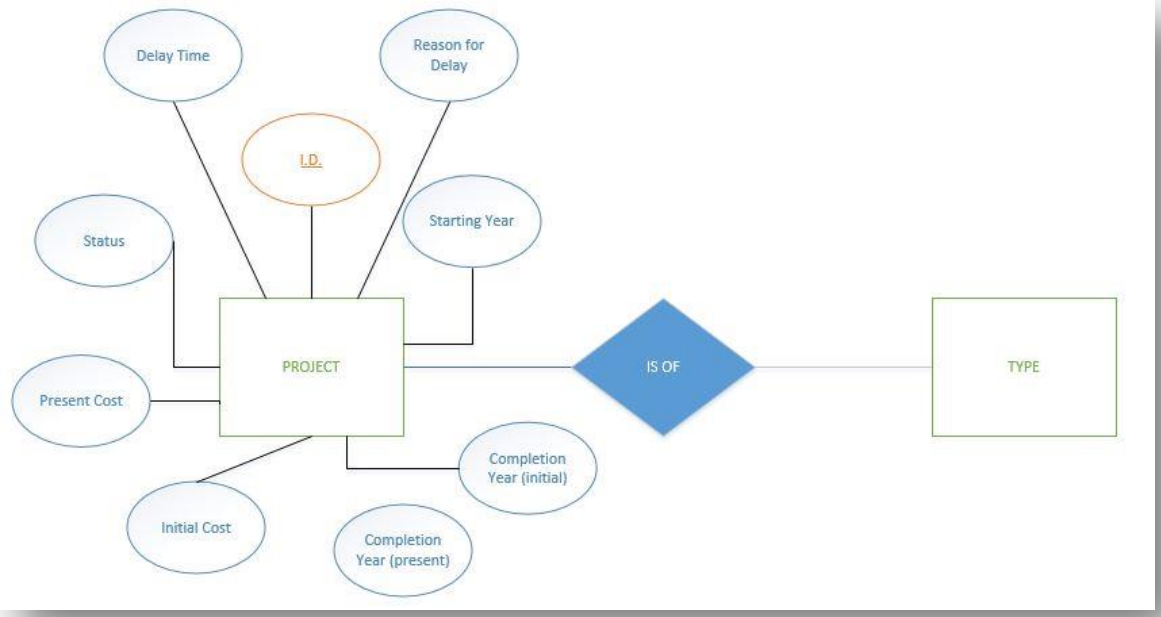


Fig 11: ER diagram describing 'Project' entity

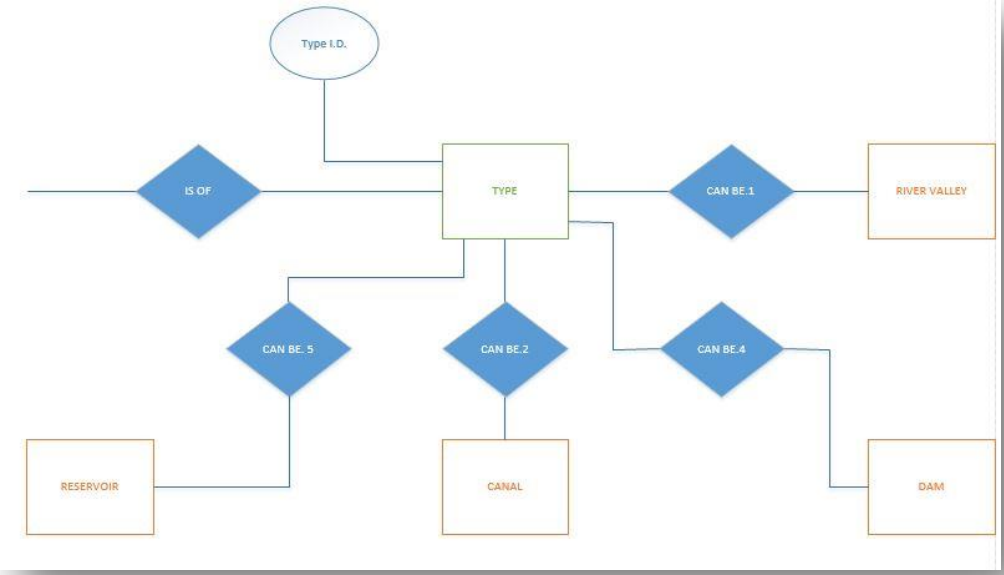


Fig 12: ER diagram describing the 'Type' entity

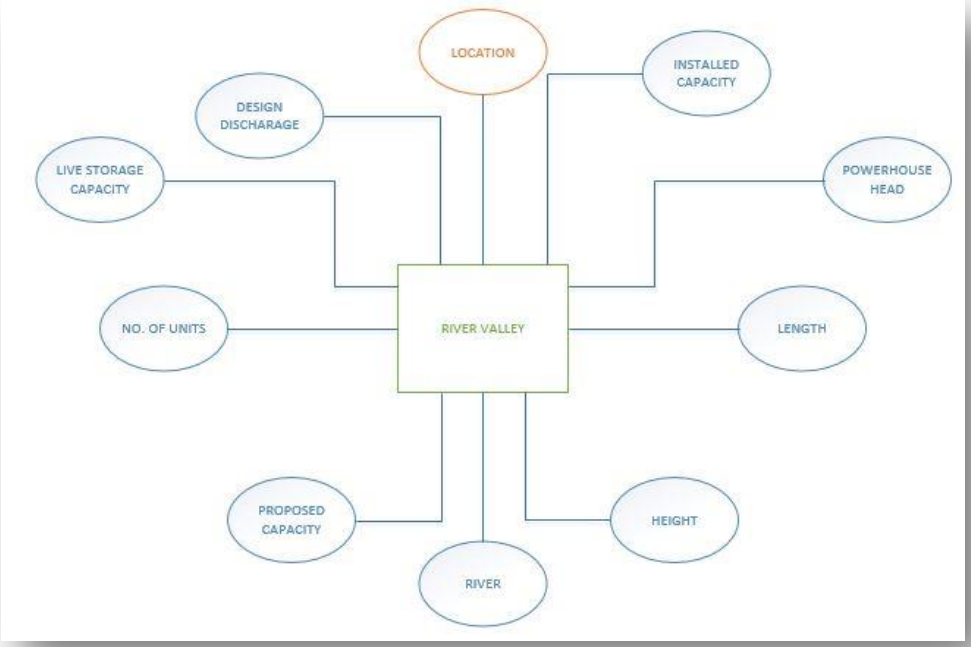


Fig 13: ER diagram describing 'River' entity

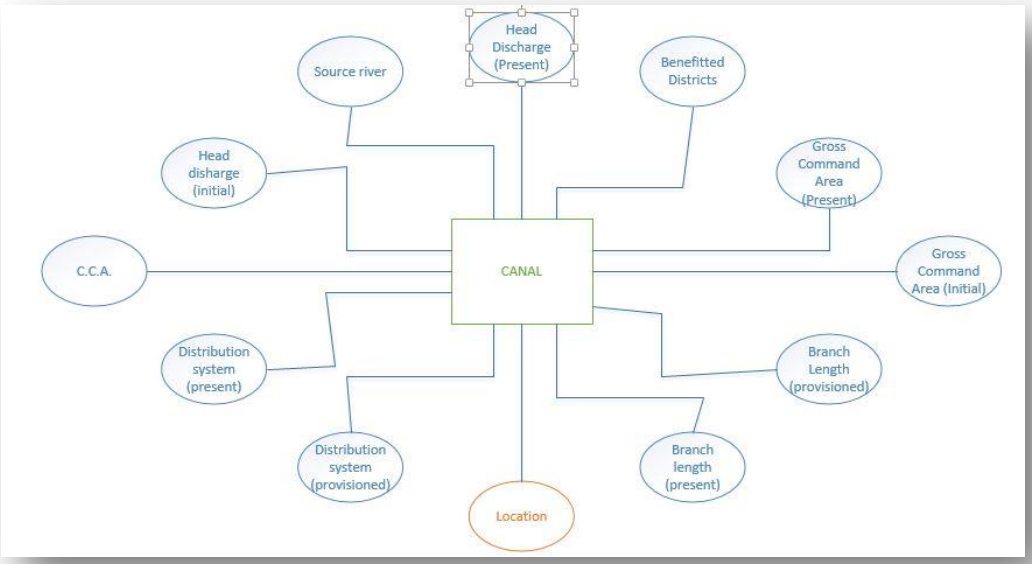


Fig 14: ER diagram describing 'Canal' entity

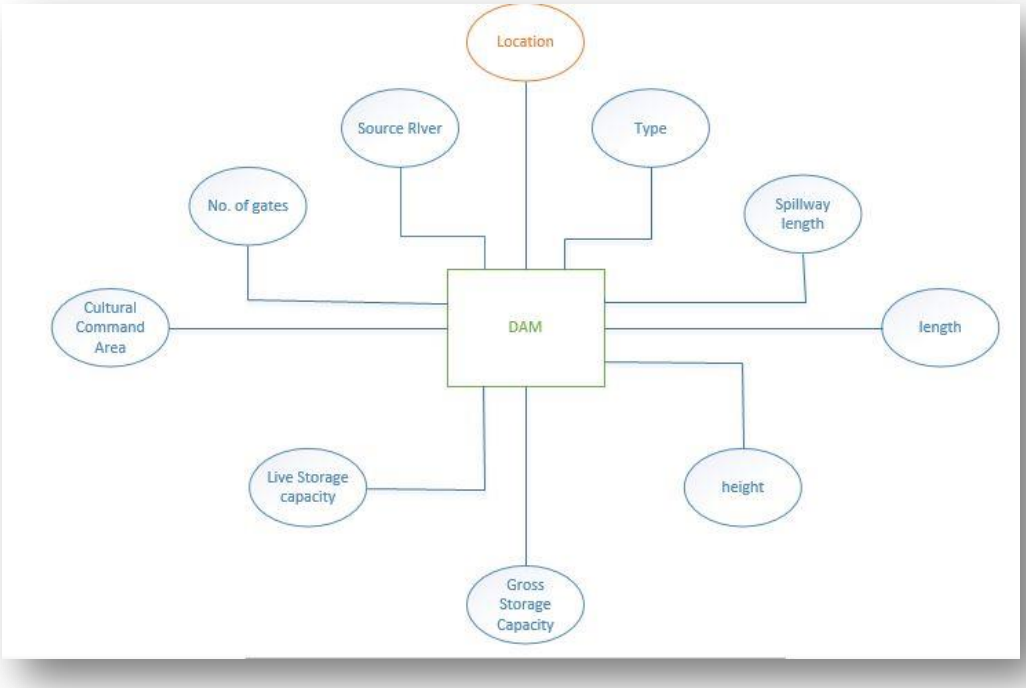


Fig 15: ER diagram describing 'Dam' entity

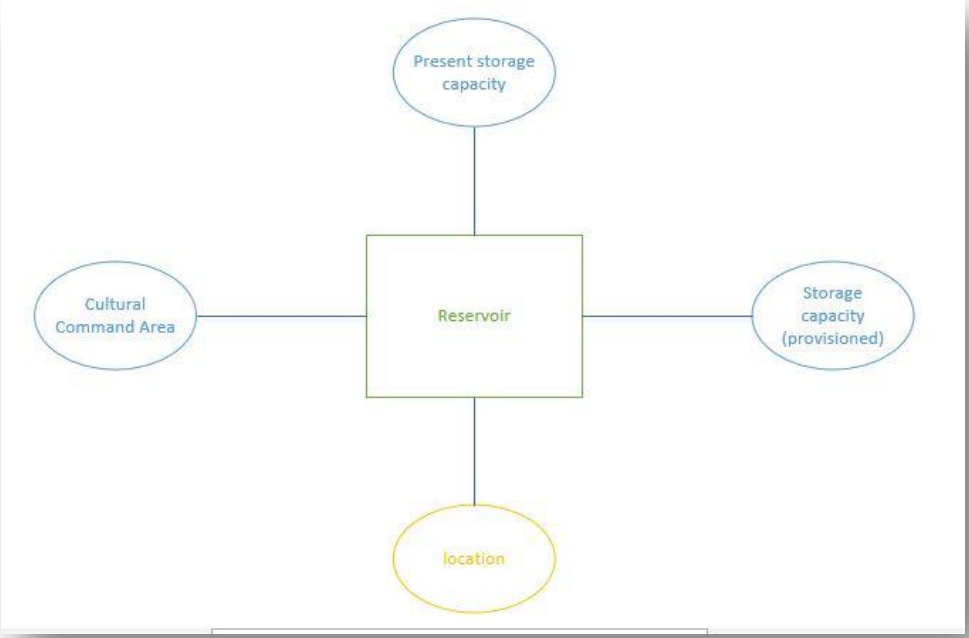


Fig 16: ER diagram describing 'Reservoir' entity

5.2. Project Scheduling System using CPM

Recommendation: Devise a system which employs the CPM in an organized and formulated manner

Proper employment of the method does not eliminate delays altogether, but will at least eliminate the delays caused by poor and disorganized planning of projects. A system which utilizes the CPM properly – in an organized fashion can definitely help the department to plan and execute projects in a much better way than that is in practice.

Table 3: Finer points of recommendation 2

Reasons
The method is used by project related officials in the department. But the manner and form of the method that they use is suspect. This is evident from the incessant delays and roadblocks that plague irrigation projects. It is not uncommon to find projects which are delayed by decades.
Scope
Reduction both in the number and durations of delays in the course of project completion that have been plaguing the department. Cost of projects will also not rise exponentially.
Strategy
Design the system – Propose this system to the engineers of the department – Find out their opinion on matters like relevance and feasibility – Fine tune the system after incorporating the changes.

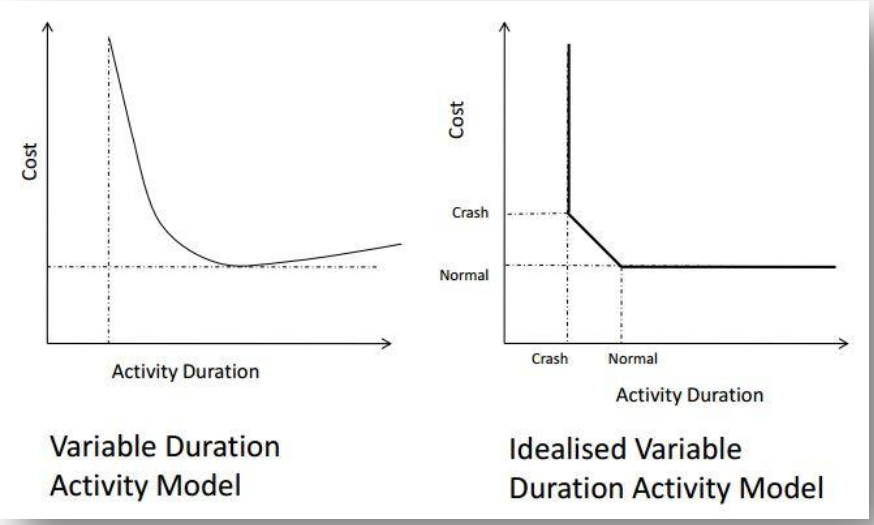
What follows is a description of the system. An example has also been devised in order to explain the intricacies of the system.

The System

Information that is required before constructing the project network is as follows:

- **Activity identities**: The variable which differentiates one activity from another. It can be – name, title, number, combination of letters and numbers or any other identification mechanism.
- **Durations of individual activities**: The approximate completion time of each activity is required. Completion time of an activity can be defined as the time taken by the activity to arrive at its end without any delay. Duration

estimation can be elegantly expressed by the following formula: D = Q/NP. D = Duration, Q = Quantity of work to be done, N = Number of resources and P = Productivity. As is evident from the above equation, the number of resources allocated, to a large extent, determines the duration of the project. The Resource-Duration Relationship can be plotted in the following way [30]:



Source: Laishram Boeing Singh, IIT Guwahati

Fig 17: Resource-Duration relationship

- **Precedence relationships between individual activities:** Rules which govern the chronological order of the activities that needs to be followed for the project to be possible. These rules are formed by a combination of logic, common sense, optimization, suitability and other miscellaneous factors. It should be noted that defining one precedence relationship automatically defines many other relationships. For ex.: if activity 1 should start after activity 2 finishes and activity 2 starts after activity 3 finishes, it is automatically fixed that activity 1 starts after activity 3 finishes. So there is

no need for a separate definition. Ideally, the set of precedence relationships should have the minimum possible cardinality, i.e. there should not be any redundant rules in the set.

Activity Resource Demand Models can be of three types [30]:

1. Ignore all resources except the key one of the activity
2. Combine all resources into a single resource
3. Accept multiple resource activities

Table 4: Features of various Resource Demand models

Option Number	Features
1	Dangerous option – Another resource may turn out to be the key resource – May not be apparent from the plan
2	If all the resources always work together – Good idea – Resources move from one gang to another/Working with several gangs throughout a day
3	Accept multiple resource activities – Consider the resources separately – Complicate the planning process to the point of making it impractical

The whole process is cyclic in nature. The abstract diagram depicting this continuous process is shown below.

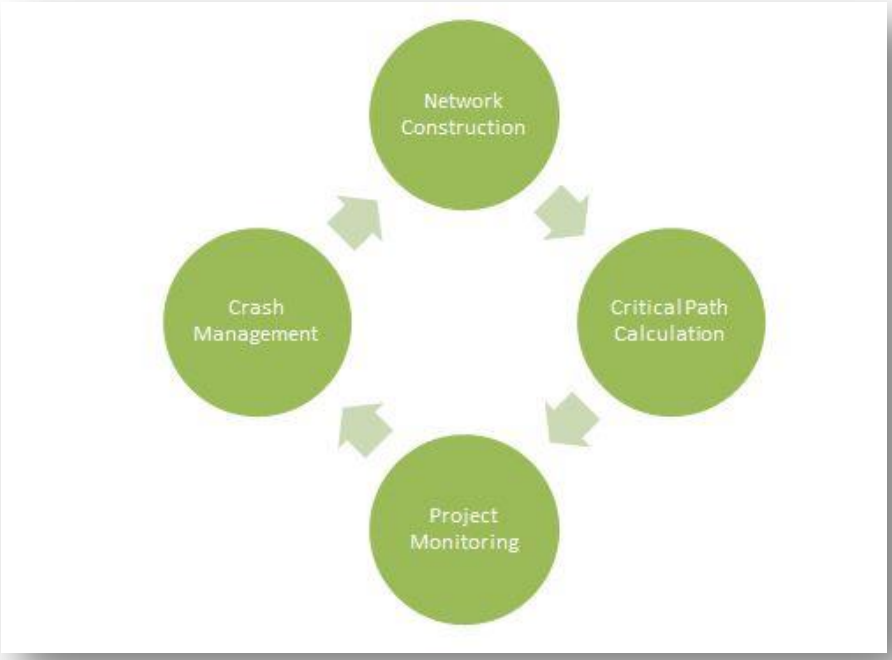


Fig 18: Basic process of the system

Network Construction

Using the prerequisites we can construct the network. First the information must be expressed in a suitable and convenient form. Two methods exist for network construction – AOA and AON. AON method has been used in this document.

Table 5: Activity list specifying the durations and activity identities

Project I.D. :			Project Title:	
Activity Number	Activity Title	Activity I.D.	Activity Shorthand	Duration
1			A	
2			B	
3			C	
4			D	
.			.	
.			.	
.			.	

Table 6: Table defining the precedence relationships

Activity that follows	Activity that is followed

Table 6 defines all the non-redundant precedence relationships between activities. The activity that shows up in the first column is related to the one in the second column in the way that the former succeeds the latter. This table can be filled by any

official who has sufficient knowledge about the project and expertise in employing the critical path method. For ex.: The project manager.

Project networks for simple projects can be constructed without using any formal algorithm. Proper application of logic will suffice. However large, complex projects pose a stiff challenge. Construction of networks for such projects requires an algorithm. For the sake of demonstrating the algorithm a sample project has been considered:

Table 7: Example Project - Prerequisites

Activity Number	Activity Shorthand	Duration (appropriate unit of time)
1	A	10
2	B	7
3	C	3
4	D	9
5	E	8
6	F	5
7	G	2

Table 8: Example Project - Precedence Relationships

Activity that follows	Activity that is followed
B	A
C	A
D	A
E	B
E	C
F	E

F	D
F	G
G	B

After using the above information and applying an algorithm for network construction, the following network is the result for the example project that has been considered:

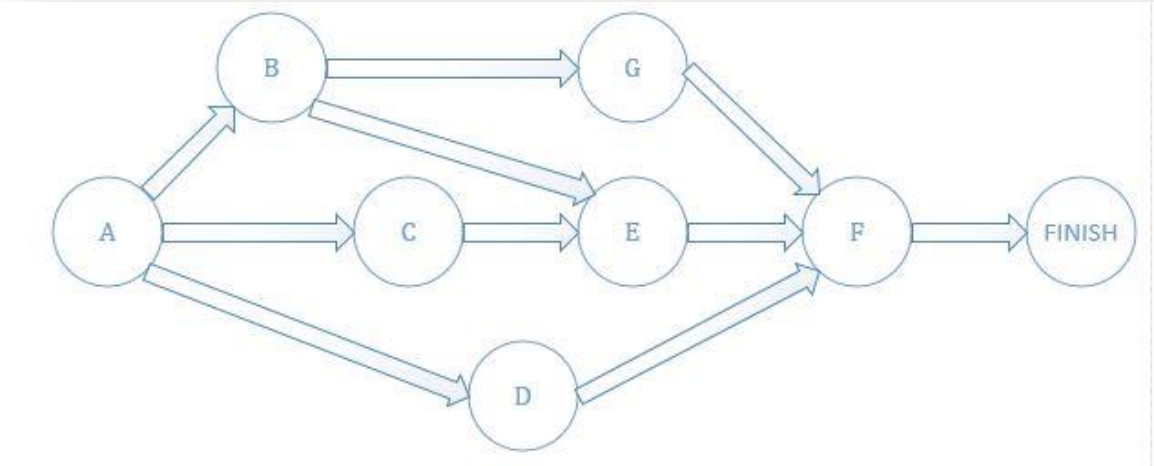


Fig 19: Project Network of the example project

After the network is constructed, using the durations of individual activities, some parameters for each activity are calculated. These parameters are a must for evaluating the critical path. The parameters are Earliest Start Time, Earliest Finish Time, Latest Start Time and Latest Finish Time. EST and EFT, for each activity, are calculated in the forward pass, whereas LST and LFT are calculated in the backward pass. The procedure for calculating these values is straightforward.

Table 9: Values of relevant parameters for the example project

Activity	EST	EFT	LST	LFT
A	0	10	0	10
B	10	17	10	17
C	10	13	14	17
D	10	19	16	25
E	17	25	17	25
F	25	30	25	30
G	17	19	23	25

Now calculating the differences between EST and LST for each activity, we get:

Table 10: Values of Floats for all the activities of the example project

Activity	Float/Slack = LST – EST
A	0
B	0
C	4
D	6
E	0
F	0
G	6

From the above table we get float = 0 for activities A, B, E and F. So the critical path is:

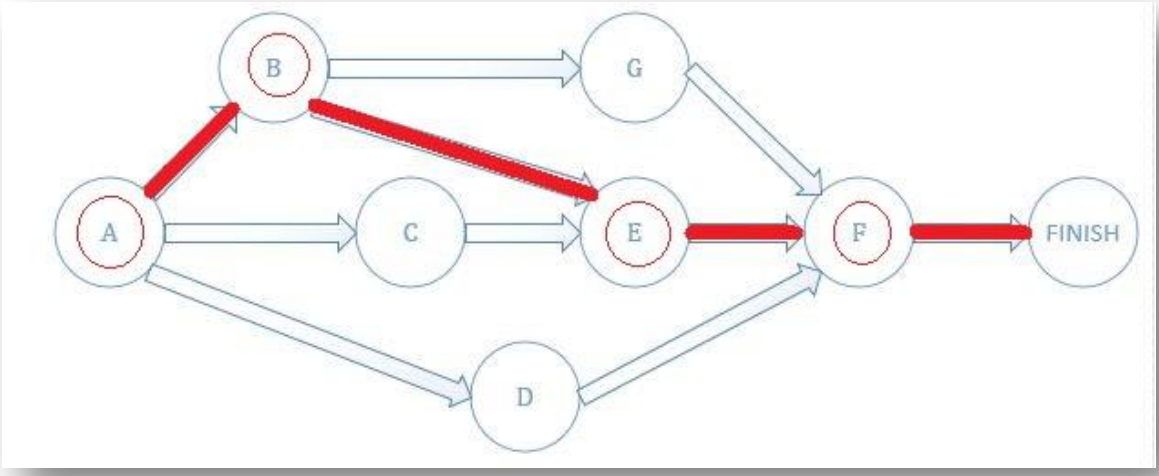


Fig 20: Project Network after evaluating the critical path

A -> B -> E -> F

Activity Analysis

An activity analysis form can be maintained for each activity. The properties and features of this form are:

- It informs the project manager of the estimated completion time of the activity.
- If the activity has been delayed due to some external factors, then the estimated amount of delay and revised completion time/date are also specified. Reasons for the delay also enumerated.
- It gives a clear and concise status of the activity.

This status form needs to be updated in regular intervals (by the project manager) in order to be of use. A design possibility of the status report is given below:

ACTIVITY STATUS REPORT

PROJECT TITLE: Date:

1. Previous Estimated Completion Time:
2. Present Estimated Completion Time:
3. Earliest Start Time:
4. Earliest Finish Time:
5. Latest Start Time:
6. Latest Finish Time:
7. Critical Activity (Yes or No):
8. Float: (Zero for critical activities):
9. On Schedule (Yes or No):
10. Delay:
11. Reason(s) for Delay:

Fig 21: Design possibility of an Activity Status report

Points 3 – 11 pertain to the present iteration of the activity. Only point 1 pertains to previous iteration.

This form must be updated:

- In fixed intervals of time, say a month.
- Whenever there is a delay in this activity
- Whenever there is a change in the project network, due to changes (or delays) in other activities.

5.3. Complaint System for canals

Recommendation: Expand the complaint system to canals.

UPID has a complaint portal in place for hearing grievances from farmers regarding the functioning and availability of water in the tube wells. Such a system can be expanded to encompass the domain of canals as well. The implementation though is quite a challenge as canals are more diverse, have more parameters and issues and are bigger in scale and stake. A possible mechanism to implement this system is explained below:

Table 11: Finer points of recommendation 3

Reasons
The system right now in place – catering to the grievances pertaining to tube wells – is functioning quite efficiently. Canal irrigation is not in a very healthy situation, with issues relating to water availability and inaccurate roaster implementation causing a lot of problems to the poor farmers.
Scope
Farmers get some much needed leverage. Problems which are now left unattended to will gain some attention. Some, if not all complaints, will be satisfactorily subdued. Improvement in the system of canal irrigation.
Strategy
Since the network of canals is a huge one, a fairly concrete and extensive strategy is required for implementing this system. For a start, one could consider including W.U.A. s into the scheme of things. Complaints will not be relayed directly to the government office, but instead, will be received by the complaint centre via the local W.U.A. Since the network of W.U.A. s is very extensive and widespread, there is no need for deploying additional personnel for gathering local complaints. This strategy however requires a lot of initial infrastructure development. W.U.A. s should be equipped with suitable technological gadgets like mobile phones or tablet phones (economical ones are available). They need to be taught how to use this technology. The positives of this strategy are that the W.U.A. members have a lot of insight and familiarity about the canal irrigation. They can easily stay in touch with farmers, understand their problems and relay them accurately. The W.U.A. exactly knows the kind of problems that the farmers experience and are hence preferable over department employees. Moreover the W.U.A. members understand the pulse of the common farmer and can easily relate to him, they themselves being farmers.

Additionally, complaints registered by different farmers might be sharing common source and solution. In such a case the W.U.A. members can identify this element of redundancy and act accordingly, since they have extensive knowledge about their jurisdiction. The added benefits of such a strategy are many. The condition of W.U.A. members is very pitiful in the state. This policy if implemented will provide considerable amount of leverage to them. Participatory Irrigation Management will also benefit from this scheme as W.U.A. members are the key players.

Fig 22: Forward pass of the complaint

The solving process of the complaints remains the same except for one change – actions taken by the government will now be made known to the appropriate W.U.A. and they will evaluate whether satisfactory work has been done or not.

5.4. Performance Evaluation System for the employees of UPID

Recommendation: Design a performance evaluation system for the employees of UPID in order to increase the efficiency of the department

Widespread corruption and inefficient working patterns of the employees are the chief factors responsible for the state of affairs UPID is in. There is no employee monitoring system prevalent in the department. The science of Organisational Psychology says that 'motivation' is vital for bringing out the best in the employees. If the actions of the employees are constantly scrutinized, the employees will feel the need to curb their present patterns and work in a better way. This in turn can improve the overall efficiency of the department and increase the output.

Table 12: Finer points of recommendation 4

Reasons
Inefficient working patterns of the employees hurting the functioning of the department. Lack of motivation among the employees a cause of concern.
Scope
Increased productivity – implying increased efficiency (resources remaining the same). Healthy working environment.
Strategy
Standardize the data of the employees that needs to be stored for evaluating performance. The parameters of this data are budget utilisation, financial and physical progress of the individual employees. Develop required software. Start the system on a small scale and - after monitoring and evaluation of the effectiveness of this system – fine tune the system and – finally implement on a large scale i.e. throughout the whole department.

Before this can be implemented similar systems employed in foreign countries must be studied. Mere replication of the systems prevalent in other countries won't help because of cultural and economic disparities.

5.5. Online Fund Flow System

That corruption is the single biggest complication badgering the department is unquestionable. Money controls everything and everyone. Money makes people do certain things and not do certain things as well. The fraudulences committed by some employees are lost or not cared about in the vast array of activities that take place every day in the department. This demands an online fund flow system in the department, where each and every rupee spent by the employees will be accounted for. Since, tampering with the data that will be put up on the machines will not be possible, there is a good chance that corruption can be reduced.

Table 13: Finer points of recommendation 5

Reasons
Corruption and Fraudulence rampant in the department.
Scope
Reduction in corruption – Efficient usage of funds.
Strategy
The data of the employees that will be collected for the dashboard will be integrated with this system. Software system must be developed to include certain functionalities. Every person is given an account and password. Employees must submit their fund usage in appropriately regular intervals. There should not be provisions for delayed submissions of these reports. The total sum of the funds utilized will be calculated and cross-referenced. Any discrepancies will be immediately apparent.

One could argue that such a system can be implemented without using machines. But such a system will again be at the mercy of the employees, who can easily tamper with the documents and produce false results. Everything looks alright on paper but the corrupt practices continue to go unnoticed and discretely.

However the implementation of such a system will face a lot of issues like employee reluctance and non-cooperation, absence of an enforcing authority – which can make sure that the defaulters are being put to the test and the possibly high infrastructure and maintenance costs.

6. Scope and Suggestions for future work

Various systems and models – each serving a different purpose, have been presented in this report. Models describing the usage of CPM – and database management of irrigation projects have been partially designed, whereas only ideas of systems like online fund flow, complaint system for canals and performance evaluation of employees have been presented. Concrete modelling of these systems is still not attended to. The design of each of these systems will require extensive and comprehensive study of the respective domains. Most important aspect of designing such systems and models is evaluation of their feasibility. Because, sometimes we might design seemingly robust models and end up finding that they are of no use in the practical arena. They are confined to the realms of a utopian society. So, yes, there is plenty of scope in this project.

7. Conclusion

After accumulating the key findings from various sources – literature and field visits, recommendations have been formulated pertaining to domains like project management, employee performance, complaint system, database management and fund flow mechanism. The key findings are – UPID is facing difficulties in collecting employee data for the dashboard – absence of a transparent fund flow system – no complaint system covering canals – lack of an employee performance evaluation system – and inefficacious use of the CPM. Recommendations include deployment of a system using CPM in an adequate and methodized comportment – introduction of an online fund flow system tracking each and every penny spent – complaint system for canals in addition to tube wells which is already in place – an employee performance evaluation system for providing the much vaunted 'motivation' – and finally a possible logical view design of a database for the irrigation projects.

If one were to ask any other person to describe a classic Indian government office, the reply would be something along these lines – files and papers stacked everywhere, no sign of computers, inefficient and lethargic employees, and a general air of chaos. It is very easy to term government officials corrupt, lazy and inefficient. And it holds true for a majority of the employees – just a majority, not all. There are quite a few sincere, efficient and hardworking employees and officers in UPID, making their own, often silent, efforts. The time really is ripe to revamp the whole system. Technology is one such force multiplier. The trick lies in the judicious and concerted usage of technology. But before trying to change the departmental scenario, taking into consideration the following – often neglected aspects.

We are ready for change, but are they?

It is so easy to get mesmerised and carried away by the tempting possibilities of technology. But, one must remember that the employees working in Indian governmental offices do not belong to this generation. They fumble when using even

the simplest of technological equipment. So, small and progressive steps are the needs of the hour.

Change in attitude required

Indian governmental organizations and departments are known to be very conservative and rigid in their approach. They have a blind belief in the existing system of extensive procedures, rules and regulations. The system has been hardwired into their minds, and they are not going to be brainwashed any time soon. Some people use the loop holes and bureaucratic red-tape to their advantage – ruthlessly cashing on. One can only hope – on this front – that the current crop of mostly derelict officials and employees are replaced by better people.

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Appendix A

Meetings and Interviews

Name: Shri S.P. Goyal

Designation: Secretary, UPID

Date: May 27, 2013

Time: 10:30 AM

Venue: U.P. Sadan, Chanakyapuri, New Delhi

Duration of Discussion: 90 minutes

Discussion details:

Mentor explained to me the hierarchical organization structure of the UP irrigation department. He also asked me to focus on the system prevalent in the department, and suggest recommendations that can improve the situation. He described the inefficiency associated with government offices and its various bottlenecks, by citing an example. He told us about people working in the department – people who oppose the idea of introduction of I.T. initiative in the department. Discussion also took place about how young minds, who are bereft of negative motives, can work, together, to bring about some change in the department. He later suggested me to meet Shri Arvind Kumar Gupta, Chief-Engineer – Ganga, Meerut. I was also suggested to read a book titled 'History of Irrigation in Uttar Pradesh'.

Name: Shri Arvind Kumar Gupta

Designation: Chief-Engineer – Ganga, UPID, Meerut

Date: June 4, 2013

Time: 10:30 AM

Venue: Ganga Bhavan, Meerut

Duration of Discussion: 90 minutes

Goals of the meeting:

- To understand the organizational hierarchy more deeply
- To understand the technical aspects of canal irrigation
- To know exactly how tenders are awarded, and who, in the government is responsible for the smooth completion of individual projects

Outcome of the visit:

- Got to see canal irrigation in action
- I have seen the Upper Ganga Canal in Khathauli. I have also seen a distributary and two minors.
- I also came to know about the structure of the carrier system of the Upper Ganga Canal. I can use this information in order to form a database management model for canal irrigation.
- I was able to procure a document specifying the irrigation schedule for the Upper Ganga canal.

Discussion details:

Shri Arvind Kumar Gupta spent a major part of our interaction in explaining the 'carrier system' of the Upper Ganga canal. He, with the help of a couple of maps, gave a detailed picture of the irrigation functions carried out with the help of the Upper Ganga Canal. He also listed the problems plaguing the irrigation activities, laying special emphasis on water theft. Due to this, people in dire need of water are being

deprived of their share of water. He also gave reasons why the government is slow to adopt technology. A short questionnaire from my side ensued. I enquired about the prevalence of technology in the department and also about the process of contract/tender awarding to interested and worthy bidders.

Name: Shri Ambuj Dwivedi

Designation: Executive Engineer, UPID

Date: June 27, 2013

Time: 2:00 PM

Venue: UPID, Lucknow

Duration of Discussion: 90 minutes

Goals of the meeting:

- To study the prevalence of I.T. in the UPID.
- To know about the problems plaguing the department – both internal and external.
- To know the reasons behind the delay, in the full-fledged implementation of the command center, installed in the department.

Outcome of the visit:

- Knowledge about the dashboard – origin, purpose, modules and technical difficulties, gained. Work towards ironing out the problems and find ways to achieve 100% data collection for the dashboard.
- I came to know that the Critical Path method is employed in planning and managing projects – though the efficiency of the system employing this method is suspect.

- Was able to interact with the members of the Water User Association, Rae Bareli and know the problems they are facing in maintaining their association. Participatory Irrigation Management is out of the scope of my project. So no action planned for this outcome.
- I came in contact with the technical personnel associated with real-time maintenance of the dashboard. Found out their views and ideas regarding the dashboard.
- I also came to know about the problems prevalent in roster enforcement and monitoring.
- I became aware of the complaint and feedback mechanism in the department. This system though is limited to tube wells.

Discussion details:

Sir briefed me about the problems in the implementation of the dashboard. These problems range from the technical ones like network connectivity to the more rudimentary ones like data collection from the employees of the department. 20GB is the expected size of the information on the dashboard, but only 2GB has been managed so far, thanks to non-cooperative and reluctant employees. I first met two officials in the financial division of the department. They disagreed with my notions that the department is inefficient. They kept reiterating that everything is fine in the department and that there is no need for any change. Ambuj Sir later asked me what I made out of my interactions with the finance officers. I told him that they were very reluctant, conservative and that they opposed change. Ambuj Sir agreed with my thoughts. This reinforced my belief that a majority of the employees in the department are mired in corrupt practices and happy with the current system. Sir explained about the various modules in place in the dashboard. Some of the features of the dashboard are: Digitization of data (OCR format), GIS mapping of water resources, flood forecast and warning system, sending SMS messages to farmers based on the roaster, gate operations of canals etc. I also learnt that 'Tech Mahindra'

was instrumental in creating the dashboard. The network requirements were met by BSNL. The network though is now disrupted due to the uprooting of some network cables. The department is now looking for wireless options. As a part of the functioning of the dashboard, field officers are given tablets, with which pictures of the project site can be taken and sent to the command centre in Lucknow. But this system has some inherent difficulties. The most important one is that the field officers might not be adept at using this technology.

Name: Shri Mayur Maheshwari

Designation: Special Secretary, UPID

Date: June 27, 2013

Time: 5:00 PM

Venue: UP Secretariat, Lucknow

Duration of Discussion: 20 minutes

Discussion details:

Sir asked me to write a program which can integrate financial aspects of the projects in the project map. Project sites where discrepancies in the handling of funds are large will be more visually intense on the map. This enables the department to quickly take an action just by looking at the map.

Name: Shri Rajesh Shukla

Designation: Assistant engineer, PIM, UPID

Date: June 28, 2013

Time: 1:00 PM

Venue: UP Secretariat, Lucknow

Duration of Discussion: 180 minutes

Discussion details:

He explained in great detail the concept of Participatory Irrigation Management – Scope, Purpose, Structure, Problems in implementation. He also arranged a meeting with the members of the Water User Association, Rae Bareli. He stressed on the need for a financially autonomous 3rd party overseeing the proceedings of P.I.M. by coordinating the WUA's as well as the department. He also suggested me to devise an Online Fund Flow system in order to address the problem of corruption in the department. The difference between an online system and paperwork is that paperwork can be tampered or manipulated, whereas no such thing can occur with an online system in place.

Appendix B

Table 3.1: Sanctioned strength of various levels of staff in UPID
(Source: ISR Report, SMEC India, May 2006)

Sr. No.		Classification/ Categorization of Post	Total No of Approved Posts
1		2	3
Group A	1	Engineer in Chief & Head of Department	1
	2	Engineer in Chief (Design& Planning)	1
	3	Engineer in Chief (Mechanical)	1
	4	Chief Engineer Level-I (Civil)	8
	5	Chief Engineer Level-1 (Mechanical)	1
	6	Chief Engineer Level-2 (Civil)	26
	7	Chief Engineer Level-2 (Mechanical)	6
	8	Superintending Engineer (Civil)	137
	9	Superintending Engineer (Mechanical)	42
		Total	223
	10	Executive Engineer (Civil)	591
	11	Executive Engineer (Mechanical)	207
		Total Group A	1021
Group B	12	Assistant Engineer (Civil)	1588
	13	Assistant Engineer (Mechanical)	549
		Total Group B	2137
Group C	14	Junior Engineer (Civil)	4685
	15	Junior Engineer (Mechanical)	1926
		Revenue cadre	
	16	Deputy Revenue Officer	137
	17	Ziledar	600
	18	Seench Paryavekshak	2389
	19	Seench Pal	6361
	20	Head Munshi	103
	21	Munshi	695
		Drawing cadre	
	22	Head Architect cum Draftsman	164
	23	Head Architect	6
	24	Architect & Draftsman	14
	25	Draftsman	933
		E-in-C cadre	
	26	Senior Administrative Officer	1
	27	Personal Asst.	5
	28	Administrative Officer	41
	29	Senior Assistant	157
	30	Head Clerk	144
	31	Lower Division Clerk	171
	32	Personal Assistant Level-1	9
	33	Personal Assistant Level-2	27

Source: Prof. Singh. K. N, Prof. Singh. S and Dr. Kumar. S (IIM Lucknow), *Assessment of the Training Needs and Training Plan Development*, UPID, (2008)

Fig 23: [9]

	34	Legal Assistant	2
		Circle cadre	
	35	Office Superintend	119
	36	Senior Assistant	333
	37	Head Clerk	410
	38	Lower Division Clerk	677
	39	Steno	128
		Division cadre	
	40	Head Clerk	393
	41	Senior Assistant	899
	42	Head Clerk	3868
	43	Lower Division Clerk	2592
	44	Stenographer	500
		Other Posts	
	45	Tubewell Mistry	1890
	46	Tubewell Operator	18811
	47	Other Technical Posts	1655
		Total Group 'C'	50955
Group D	48	**Group 'D' (Peon, Driver, Beldar, Sweeper, Helper, etc.)**	21315
All Groups		**Total no. of employees**	75428

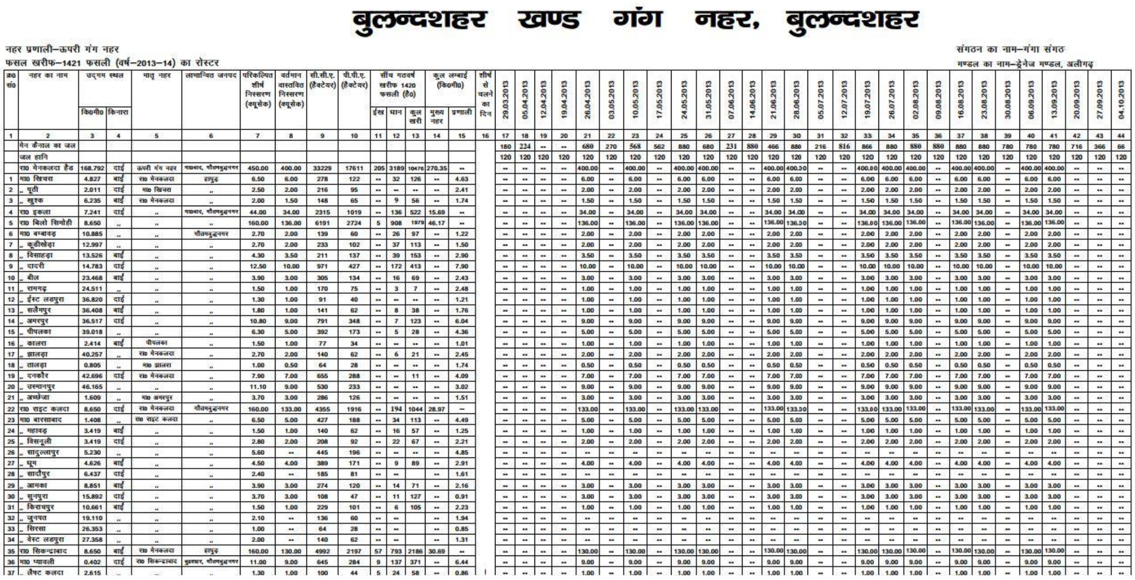
Classifl caton/ Categorization of Post	Total No of Approved Posts	Percentage of the Total Approved Posts
Group 'A'	1021	1.35
Group 'B'	2137	2.83
Group 'C'	50955	67.55
Group 'D'	21315	28.26
Total	75428	100.00

Source: Prof. Singh. K. N, Prof. Singh. S and Dr. Kumar. S (IIM Lucknow), *Assessment ofthe Training Needs and Training Plan Development*, UPID, (2008)

Fig 24: [9]

Fig 25: Escape at Khatauli; Self-generated image

Fig 26: Main Canal view at Khatauli: Self-generated image



बुलन्दशहर खण्ड गंग नहर, बुलन्दशहर

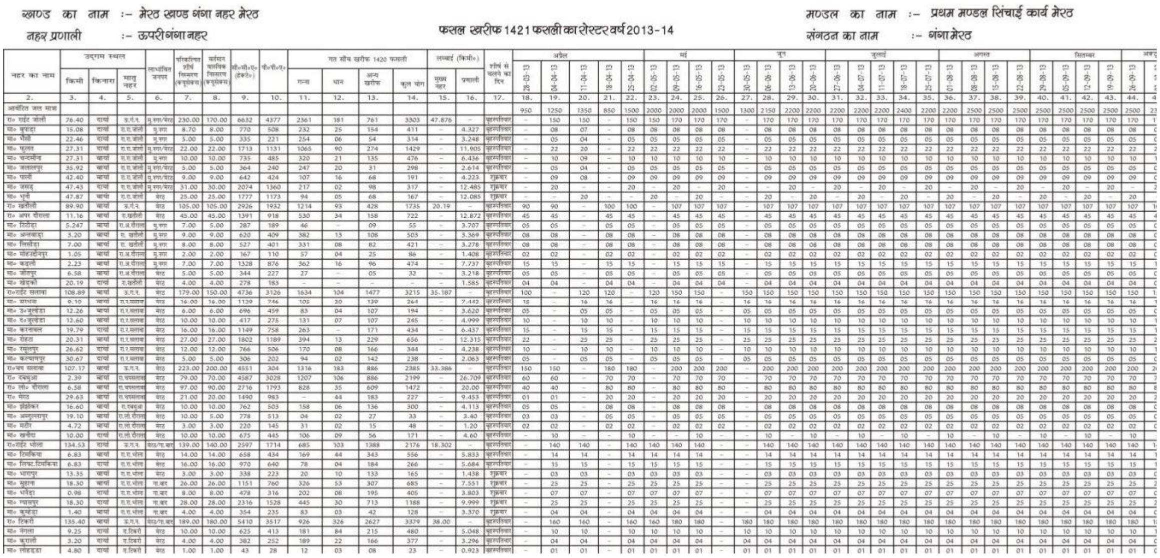
नहर प्रणाली–ऊपरी गंग नहर
फसल खरीफ–1421 फसली (वर्ष–2013–14) का रौस्टर

संगठन का नाम–गंगा संगठ
मण्डल का नाम–ड्रेनेज मण्डल, अलीगढ़

क्र0 सं0	नहर का नाम	उद्गम स्थल		मातृ नहर	लाभान्वित जनपद	परिकल्पित शीर्ष निस्सरण (क्यूसेक)	वर्तमान वास्तविक निस्सरण (क्यूसेक)	सी.सी.ए. (हैक्टेयर)	पी.पी.ए. (हैक्टेयर)	सींच गतवर्ष खरीफ 1420 फसली (है0)			कुल लम्बाई (कि0मी0)		शीर्ष से चलने का दिन	29.03.2013	05.04.2013	12.04.2013	19.04.2013	26.04.2013	03.05.2013	10.05.2013	17.05.2013	24.05.2013	31.05.2013	07.06.2013	14.06.2013	21.06.2013	28.06.2013	05.07.2013	12.07.2013	19.07.2013	26.07.2013	02.08.2013	09.08.2013	16.08.2013	23.08.2013	30.08.2013	06.09.2013	13.09.2013	20.09.2013	27.09.2013	04.10.2013
		कि0मी0	किनारा							ईख	धान	कुल खरी	मुख्य नहर	प्रणाली																													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
	मेन कैनाल का जल															180	224	--	--	680	270	568	562	880	680	231	880	466	880	216	816	866	880	880	880	880	880	780	780	780	716	366	66
	जल हानि															120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
	रा0 मेनकलदा हैड	168.792	दाईं	ऊपरी गंग नहर	गाजियाबाद, गौतमबुद्धनगर	450.00	400.00	33229	17611	205	3189	10476	270.35	--		--	--	--	--	400.00	--	400.00	--	400.00	400.00	--	--	400.00	400.00	--	--	400.00	400.00	400.00	--	400.00	400.00	--	400.00	400.00	--	--	--
1	मा0 खिचरा	4.827	बाईं	रा0 मेनकलदा	हापुड़	6.50	6.00	278	122	--	32	126	--	4.63		--	--	--	--	6.00	--	6.00	--	6.00	6.00	--	--	6.00	6.00	--	--	6.00	6.00	6.00	--	6.00	6.00	--	6.00	6.00	--	--	--
2	,, पूठी	2.011	दाईं	मा0 खिचरा	,,	2.50	2.00	216	95	--	--	--	--	2.41		--	--	--	--	2.00	--	2.00	--	2.00	2.00	--	--	2.00	2.00	--	--	2.00	2.00	2.00	--	2.00	2.00	--	2.00	2.00	--	--	--
3	,, खुश्क	6.235	बाईं	रा0 मेनकलदा	,,	2.00	1.50	148	65	--	9	56	--	1.74		--	--	--	--	1.50	--	1.50	--	1.50	1.50	--	--	1.50	1.50	--	--	1.50	1.50	1.50	--	1.50	1.50	--	1.50	1.50	--	--	--
4	रा0 इकला	7.241	दाईं	,,	गाजियाबाद, गौतमबुद्धनगर	44.00	34.00	2315	1019	--	136	522	15.69	--		--	--	--	--	34.00	--	34.00	--	34.00	34.00	--	--	34.00	34.00	--	--	34.00	34.00	34.00	--	34.00	34.00	--	34.00	34.00	--	--	--
5	रा0 बिलो सिमोही	8.650	,,	,,	,,	160.00	136.00	6191	2724	5	908	1979	46.17	--		--	--	--	--	136.00	--	136.00	--	136.00	136.00	--	--	136.00	136.00	--	--	136.00	136.00	136.00	--	136.00	136.00	--	136.00	136.00	--	--	--
6	मा0 बम्बावड़	10.885	,,	,,	गौतमबुद्धनगर	2.70	2.00	139	60	--	26	97	--	1.22		--	--	--	--	2.00	--	2.00	--	2.00	2.00	--	--	2.00	2.00	--	--	2.00	2.00	2.00	--	2.00	2.00	--	2.00	2.00	--	--	--
7	,, कूडीखेड़ा	12.997	,,	,,	,,	2.70	2.00	233	102	--	37	113	--	1.50		--	--	--	--	2.00	--	2.00	--	2.00	2.00	--	--	2.00	2.00	--	--	2.00	2.00	2.00	--	2.00	2.00	--	2.00	2.00	--	--	--
8	,, बिसाहड़ा	13.526	बाईं	,,	,,	4.30	3.50	211	137	--	39	153	--	2.90		--	--	--	--	3.50	--	3.50	--	3.50	3.50	--	--	3.50	3.50	--	--	3.50	3.50	3.50	--	3.50	3.50	--	3.50	3.50	--	--	--
9	,, दादरी	14.783	दाईं	,,	,,	12.50	10.00	971	427	--	172	413	--	7.90		--	--	--	--	10.00	--	10.00	--	10.00	10.00	--	--	10.00	10.00	--	--	10.00	10.00	10.00	--	10.00	10.00	--	10.00	10.00	--	--	--
10	,, बील	23.468	बाईं	,,	,,	3.90	3.00	305	134	--	16	69	--	2.43		--	--	--	--	3.00	--	3.00	--	3.00	3.00	--	--	3.00	3.00	--	--	3.00	3.00	3.00	--	3.00	3.00	--	3.00	3.00	--	--	--
11	,, रामगढ़	24.511	,,	,,	,,	1.50	1.00	170	75	--	3	7	--	2.48		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--
12	,, ईस्ट लड़पुरा	36.820	दाईं	,,	,,	1.30	1.00	91	40	--	--	--	--	1.21		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--
13	,, सलैमपुर	36.408	बाईं	,,	,,	1.80	1.00	141	62	--	8	38	--	1.76		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--
14	,, अमरपुर	36.517	दाईं	,,	,,	10.80	9.00	791	348	--	7	123	--	6.04		--	--	--	--	9.00	--	9.00	--	9.00	9.00	--	--	9.00	9.00	--	--	9.00	9.00	9.00	--	9.00	9.00	--	9.00	9.00	--	--	--
15	,, पीपलका	39.018	,,	,,	,,	6.30	5.00	392	173	--	5	28	--	4.36		--	--	--	--	5.00	--	5.00	--	5.00	5.00	--	--	5.00	5.00	--	--	5.00	5.00	5.00	--	5.00	5.00	--	5.00	5.00	--	--	--
16	,, कालरा	2.414	बाईं	पीपलका	,,	1.50	1.00	77	34	--	--	--	--	1.01		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--
17	,, झालड़ा	40.257	,,	रा0 मेनकलदा	,,	2.70	2.00	140	62	--	6	21	--	2.45		--	--	--	--	2.00	--	2.00	--	2.00	2.00	--	--	2.00	2.00	--	--	2.00	2.00	2.00	--	2.00	2.00	--	2.00	2.00	--	--	--
18	,, तालड़ा	0.805	,,	मा0 झालरा	,,	1.00	0.50	64	28	--	--	--	--	1.74		--	--	--	--	0.50	--	0.50	--	0.50	0.50	--	--	0.50	0.50	--	--	0.50	0.50	0.50	--	0.50	0.50	--	0.50	0.50	--	--	--
19	,, दनकौर	42.696	दाईं	रा0 मेनकलदा	,,	7.90	7.00	655	288	--	--	11	--	4.09		--	--	--	--	7.00	--	7.00	--	7.00	7.00	--	--	7.00	7.00	--	--	7.00	7.00	7.00	--	7.00	7.00	--	7.00	7.00	--	--	--
20	,, उस्मानपुर	46.165	,,	,,	,,	11.10	9.00	530	233	--	--	--	--	3.02		--	--	--	--	9.00	--	9.00	--	9.00	9.00	--	--	9.00	9.00	--	--	9.00	9.00	9.00	--	9.00	9.00	--	9.00	9.00	--	--	--
21	,, अच्छेजा	1.609	,,	मा0 अमरपुर	,,	3.70	3.00	286	126	--	--	--	--	1.51		--	--	--	--	3.00	--	3.00	--	3.00	3.00	--	--	3.00	3.00	--	--	3.00	3.00	3.00	--	3.00	3.00	--	3.00	3.00	--	--	--
22	रा0 राइट कलदा	8.650	दाईं	रा0 मेनकलदा	गौतमबुद्धनगर	160.00	133.00	4355	1916	--	194	1044	28.97	–		--	--	--	--	133.00	--	133.00	--	133.00	133.00	--	--	133.00	133.00	--	--	133.00	133.00	133.00	--	133.00	133.00	--	133.00	133.00	--	--	--
23	मा0 बारसाबाद	1.408	,,	रा0 राइट कलदा	,,	6.50	5.00	427	188	--	34	113	--	4.49		--	--	--	--	5.00	--	5.00	--	5.00	5.00	--	--	5.00	5.00	--	--	5.00	5.00	5.00	--	5.00	5.00	--	5.00	5.00	--	--	--
24	,, महावड़	3.419	बाईं	,,	,,	1.50	1.00	140	62	--	16	57	--	1.25		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--
25	,, बिसनूली	3.419	दाईं	,,	,,	2.80	2.00	208	92	--	22	67	--	2.21		--	--	--	--	2.00	--	2.00	--	2.00	2.00	--	--	2.00	2.00	--	--	2.00	2.00	2.00	--	2.00	2.00	--	2.00	2.00	--	--	--
26	,, सादुल्लापुर	5.230	,,	,,	,,	5.60	--	445	196	--	--	--	--	4.85		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
27	,, घूम	4.626	बाईं	,,	,,	4.50	4.00	389	171	--	9	89	--	2.91		--	--	--	--	4.00	--	4.00	--	4.00	4.00	--	--	4.00	4.00	--	--	4.00	4.00	4.00	--	4.00	4.00	--	4.00	4.00	--	--	--
28	,, सादोपुर	6.437	दाईं	,,	,,	2.40	--	185	81	--	--		--	1.61		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	,, आमका	8.851	बाईं	,,	,,	3.90	3.00	274	120	--	14	71	--	2.16		--	--	--	--	3.00	--	3.00	--	3.00	3.00	--	--	3.00	3.00	--	--	3.00	3.00	3.00	--	3.00	3.00	--	3.00	3.00	--	--	--
30	,, सुनपुरा	15.892	दाईं	,,	,,	3.70	3.00	108	47	--	11	127	--	0.91		--	--	--	--	3.00	--	3.00	--	3.00	3.00	--	--	3.00	3.00	--	--	3.00	3.00	3.00	--	3.00	3.00	--	3.00	3.00	--	--	--
31	,, किरावपुर	10.661	बाईं	,,	,,	1.50	1.00	229	101	--	6	105	--	2.23		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--
32	,, जुनपत	19.110	,,	,,	,,	2.10	--	136	60	--	--		--	1.94		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
33	,, सिरसा	26.353	,,	,,	,,	1.00	--	64	28	--	--		--	0.85		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
34	,, वेस्ट लड़पुरा	27.358	,,	,,	,,	2.00	--	140	62	--	--		--	1.31		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
35	रा0 सिकन्द्राबाद	8.650	बाईं	रा0 मेनकलदा	हापुड़	160.00	130.00	4992	2197	57	793	2186	30.69	--		--	--	--	--	130.00	--	130.00	--	130.00	130.00	--	--	130.00	130.00	--	--	130.00	130.00	130.00	--	130.00	130.00	--	130.00	130.00	--	--	--
36	मा0 प्यावली	0.402	दाईं	रा0 सिकन्द्राबाद	बुलन्दशहर, गौतमबुद्धनगर	11.00	9.00	645	284	9	137	371	--	6.44		--	--	--	--	9.00	--	9.00	--	9.00	9.00	--	--	9.00	9.00	--	--	9.00	9.00	9.00	--	9.00	9.00	--	9.00	9.00	--	--	--
37	,, लैफ्ट कलदा	2.615	,,	,,	,,	1.30	1.00	100	44	5	24	58	--	0.86		--	--	--	--	1.00	--	1.00	--	1.00	1.00	--	--	1.00	1.00	--	--	1.00	1.00	1.00	--	1.00	1.00	--	1.00	1.00	--	--	--

Source: <http://irrigation.up.nic.in>

Fig 27: Bulandshahar division roaster [3]



खण्ड का नाम :- मेरठ खण्ड गंगा नहर मेरठ
नहर प्रणाली :- ऊपरीगंगा नहर

फसल खरीफ 1421 फसली का रोस्टर वर्ष 2013-14

मण्डल का नाम :- प्रथम मण्डल सिंचाई कार्य मेरठ
संगठन का नाम :- गंगा मेरठ

Source: <http://irrigation.up.nic.in>

Fig 28: Meerut division roaster [3]

"The highest measure of democracy is neither the 'extent of freedom' nor the 'extent of equality' but rather the highest measure of participation."
- A.D. Benoist

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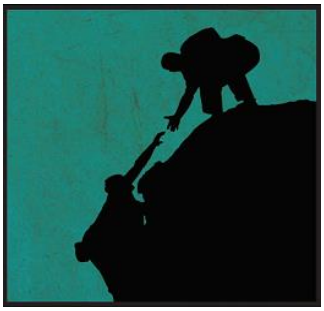

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