HIRAKUD IRRIGATION SYSTEM MANAGEMENT USING PERFORMANCE INDICATORS

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Abstract

Climate changes may also causes, unpredictable heavy precipitation sometimes or not, change in temperature of the any region, cropping pattern, seasonal variations and droughts will affect on over all development of the region/state/country. It may also change the water quality of Irrigation system. Even Rapid increase in population in developing and under developed several countries in the world will lead to face water problems, environmental, financial problems. It has also been observed that the most of the irrigation systems are not operating properly, i.e. as it was designed to perform. Due to increase in salinity certain extent of land becomes unproductive every year due to not getting adequate quantity of water. The performances of the irrigation systems must achieve the progress of livelihood, basic requirement of human beings and its growth.

The performance, indicators would be helpful to manage irrigation system hence Hirakud irrigation of Odisha State of India is taken for study, performance of the existing irrigation system to know the extent of the benefits derived, to understand the deficiencies and the overall condition. The study also aims to develop model using fourteen minimum set of performance indicators are identified from literature which are related to agricultural production, water supply, finance, and use of fertilizers are applied, that will help the researchers /scientists to choose the performance indicators and to understand which of the performance indicators are most influencing.

Keywords: *Irrigation System, Hirakud, Indicators*

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1. INTRODUCTION

Climate change may leads to skepticism in hydraulic structures and its challenges. Its effects may vary from region to region, which leads to variation in temperature and evaporation, higher winter precipitation as rain, not as snow; there may be summer drought, decay in water quality, acute water shortages, These may results in economic losses, may be more common in many regions due to its impacts. Over all it affects on agricultural field, even there may be frequent drought; finally there will be increase on cost effects on local communities.

The Management of irrigation system must satisfy primary need as food production for growing population. Developing country like India, irrigation projects were constructed investing huge amount of money and these projects in general, taken extreme long periods. There is very much essential to know the performance of the existing irrigation systems. There are many performance indicators are available, but problem faced by the researchers is that which of the performance indicators should be included / excluded in evaluating the irrigation system. In this aspect management of Hirakud Irrigation system of Odisha State of India has taken into consideration for evaluating performance and suggesting requirement of performance model for management.

2. OBJECTIVE

For the present study, Hirakud Irrigation System of Odisha lying in east coast of India (annual rainfall of 1000-2500mm) has been taken up, with data of 20 years periods from the year 1980 to 1999. The following are the objectives:

- To identify the Performance indicators from the literature for irrigation management.
- To develop performance model using the Performance indicators by statistical approaches and test the performance of the models developed.
- To suggest a suitable general model for evaluating the performance of Hirakud system

Paddy is the main crops grown in this area, which are grown both in *Kharif* and *Rabi* seasons. It occupies almost 95 to 98% of the irrigated area, rest of the area are covered with Sugarcane, Til, Castor, Mustard, Groundnut, Sunflower, Maize, Condiments, Wheat, Gram, Mung, Biri, Kulthi, Pulses, Vegetables Potato, Sweet potato, Chilies, etc.,

3. STUDY AREA

Hirakud irrigation system of Odisha is a multipurpose reservoir project, built across the river Mahanadi, the biggest river flowing through the state of Odisha. It is located at a latitude 21^0 32' N, longitude 83^0 52'E, and 15 Km upstream of Sambalpur town. The total command area is 1, 59,093 hectares, the command area being spread over

14 administrative blocks, in Sambalpur (5), Bargarh (6), Subarnapur (2) and Bolangir (1) districts. The distribution system consists of three head regulators i.e. Bargarh main canal with discharge of 107.6m^3/s, irrigating 1,33,50 ha, Sason main canal discharge of 17.8m^3/s, irrigating 25,556ha and Sambalpur distributor of 3.4 6m^3/s, irrigating 135 ha.

4. METHODOLOGY

The following is the methodology adopted for management of Hirakud of irrigation system using performance indicators

- Evaluate all the fourteen selected performance indicators like, four agricultural performance indicators (Standard Gross Value of Production(SGVP) per unit cropped or unit cultivated area(S_{GPCU}) in Rs/ha, Standard Gross Value of Production per unit command area (S_{GPCA}) in Rs/ha, Standard Gross Value of Production per unit irrigation supply(S_{GPWD}) in Rs/m^3, Standard Gross Value of Production per unit water consumed(S_{GPWC})in Rs/$m^{3)}$, **Five** Water supply indictors (**Relative water supply** (R_{WS})**,** Relative irrigation supply(R_{IS})**,** Water delivery capacity (W_{DC}), Annual irrigation water supply per unit command area (A_{NWCA})in m^3 /ha, Annual irrigation water supply per unit irrigation area (A_{NIWCU}) in m^3/ha), **Four Financial indicators (**Gross return on investment (G_R) in % , Financial self-sufficiency (F_S) in %, Total Management operation Maintenance (MOM) cost per cultivated area, Average revenue (A_{VRU}) per 1000 cubic meter of irrigation water supplied in Rs/m^3,one fertilizer indicator (Fertilizer applied per unit cultivated area (F_R)).
- The selected indicators are used for development of performance model for the Hirakud irrigation system using Statistical approach using SPSS Software and test the performance of the models developed. Steps involved in the analysis are shown in flow chart in Figure 1

5. RESULTS

- The following are the results obtained after evaluating fourteen performance indicators using the secondary data collected from the different departments of Hirakud Irrigation System. The maximum, minimum and average values of the fourteen Indicators are given in Table 1.

Table: 1 The Maximum, Minimum and Average Values of the Performance Indicators

Sl No	Indicators	Hirakud Irrigation System		
		Minimum	Maximum	Average
1	Standard Gross Value of Production per unit command area (Rs/ ha)	90496.43	94845.44	92451.50
2	Standard Gross Value of Production per unit cultivated area (Rs/ ha)	103088.29	118077.60	108785.68
3	Standard Gross Value of Production per unit irrigation water delivered **(**Rs/ m^3 **)**	10.41	15.41	11.94
4	Standard Gross Value of Production Per unit Water Consumed (Rs/m^3)	16.30	23.50	19.60
5	Relative water supply(ratio)	3.08	4.69	3.57
6	Relative irrigation supply(ratio)	2.69	4.37	3.28
7	Water delivery capacity(ratio)	0.37	1.10	0.84
8	Annual irrigation water supply per unit command area (m^3/ha)	5878.17	8961.86	7814.20
9	Annual irrigation water supply per unit irrigated area(m^3/ha)	6792.50	10800.82	9149.92
10	Financial self-sufficiency (%)	13.86	49.51	78.76
11	Gross return on investment (%)	102.99	121.04	112.20
12	Total Management operation Maintenance cost per unit cultivated area (Rs/ha)	87.65	154.95	100.13
13	Average revenue per 1000 cubic meter of irrigation water supplied (Rs/ m^3)	191.69	726.60	322.35
14	Fertiliser applied per unit-cultivated area. (kg/ha**)**	8.73	37.00	20.68

- After analysing the data using SPSS Software, performance model has been developed, taking standard Gross Value of Production per cultivated area **(S_{GPCU})** as dependent variable and remaining 13 Performance indicators as independent variable. It has been found that **Stepwise method** was most suitable, since it was having high values of correlation coefficient and coefficient of determination. This Model satisfied F statistic significance test, and the error between the observed and computed values was also very less. Hence the suggested model for Hirkud Irrigation system given by

$$S_{GPCU} = 5954.834 + 778.815 \times G_R + 3241.435 \times R_{IS} + 324.513 \times F_R + 2400.809 \times R_{WS} - 1.118 \times A_{NIWCU}$$

6. CONCLUSION

Hirakud irrigation system management using performance indicators through development of a model is most important to the researcher's community which helps researchers to choose the indicators and to know about the irrigation systems.

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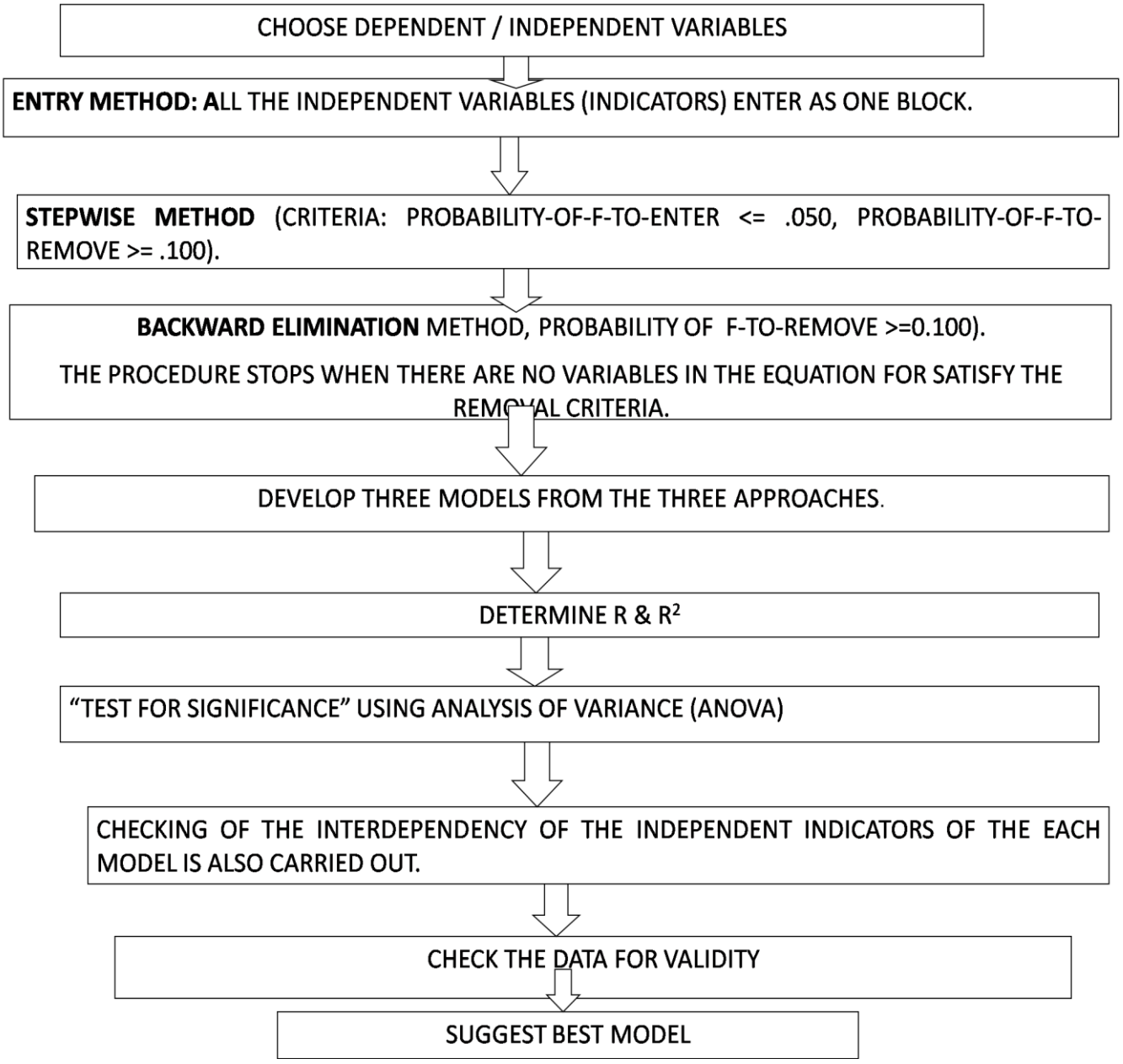

Steps involved in the analysis are shown in flow chart in Figure 1

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