



Research Article

IMPROVING PUBLIC INVESTMENT OUTLAYS IN IRRIGATION SECTOR IN TAMIL NADU: A CASE FOR OPTIMIZATION IN THE CONTEXT OF FISCAL RESPONSIBILITY MANAGEMENT LAWS

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Abstract: The Public investment in irrigation infrastructure is essential in the context of national goal of doubling farm incomes by 2023. The prudential constraints imposed by Fiscal Management laws and competing demands from various sectors have dampened irrigation sector investment outlays in Tamil Nadu. The study, using linear programming technique, has suggested a model for optimization of on budget and off budget borrowings by Government of Tamil Nadu from financial institutions like National Bank for Agriculture and Rural Development and state development loans to meet the desired investment level in irrigation sector within the policy constraints. The indicative model could be fortified further into a full-fledged decision support system to aid policy makers.

Keywords: Public investment, Fiscal Management, NABARD

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Introduction

The public investment in irrigation infrastructure is sine qua non for improving farmers income in semi-urban areas in the context of national goal of doubling farm incomes by 2023. The burgeoning fiscal deficit and the prudential constraints imposed by the fiscal management laws have dampened the public investment spending in the state of Tamil Nadu. This study reviews the dynamic context and has suggested a preliminary optimization solution using linear programming model which could be further developed into a decision support system.

Material and methods

The secondary data on public investment by Govt. of Tamil Nadu for the year 1990-91 to 2016- 17 is presented in [Table-1].

Trends in public investment by Government of Tamil Nadu and State Income

In order to validate the relationship between public investment of Government of Tamil Nadu and Gross state domestic product, a regression line was fitted using the function: $Y = a + bx$

Where,

Y = gross state domestic product,

x = public investment,

a = constant and

b = co-efficient.

$Y = 27.135x + 44745$

The R^2 value of 0.903 reveals a strong relationship between Public Investment and GSDP of Tamil Nadu which underlines the need for more public investment in the state for economic growth.

Several impact evaluations studies have past cited in the literature and another research study done by the primary author has evidenced positive impact of public investment in irrigation infrastructure through Rural Infrastructure Development Fund (RIDF) funded by NABARD on farmers income to the extent of 35 percent of higher farm income. Thus, there is a strong case for improving the public investment outlays in general and in particular on irrigation infrastructure.

Public investment needs and constraints of FRBM

As per Vision Document 2023 of Government of Tamil Nadu and the PWD- WRD, there is a requirement of investment of the order of Rs. 5000 crores annually of investments in irrigation. Compared to the investment requirements, the actual capital expenditure by government of Tamil Nadu in the irrigation sector is of the order of Rs. 1800 cr annually on an average which is just one third of the requirement. A segment analysis of the budget resources after Government of Tamil Nadu reveals that the capital expenditure on irrigation infrastructure comprises of State's own revenue from taxes, central government grant, borrowings from NABARD and bilateral, multilateral funding institutions such as Asian Development Bank, World Bank etc. The resources raised from State Development Loans (SDL) which are open market borrowings are not project tied. As per Fiscal Responsibility Management Act stipulations, the state government can borrow up to 3% gross state domestic product (GSDP). The debt servicing ratio has to be within 25 percent of GSDP. Further, the increasing trends in revenue expenditure and decreasing trend in devolution of central share by Government of India are the major difficulties faced by Finance Department, Government of Tamil Nadu. Since the state government's annual borrowing limit (currently about Rs.55000 Crores for the year 2019-20.) cannot be exceeded, the state government has been encouraging off budget borrowings through its corporations to meet investment needs. While market borrowings are increasingly required for meeting revenue expenditure and other fiscal management activities, borrowings from multilateral agencies are constrained by clearance by Department of Economic Affairs, Government of India, long gestation time and foreign exchange hedging costs. NABARD funding especially RIDF is one of the most percent sought-after funds by state governments since it has the lowest interest rate- currently 2.75 percent p.a. However, of late, NABARD has introduced many new lines of credit for investment in irrigation/ water management as in [Table-2].

Linear optimization for irrigation investments

Keeping in view of the above aspects in view, in order maximizing investment with optimal interest cost for the state government with a judicious combination of

Table-1 Trends in Public Investment and GSDP in Tamil Nadu (Rs Cr.)

Year	Public investment	GSDP	Year	Public investment	GSDP
1990-91	980	31339	2004-05	12630	202374
1991-92	920	36957	2005-06	6740	257833
1992-93	1210	43010	2006-07	12880	310525
1993-94	1300	57549	2007-08	12770	350525
1994-95	1800	68666	2008-09	14130	401336
1995-96	1620	78205	2019-10	13350	479733
1996-97	2340	89237	2010-11	17970	584896
1997-98	2380	103550	2011-12	25630	667202
1998-99	2180	118209	2012-13	24330	744860
1999-00	1900	134185	2013-14	24370	854238
2000-01	2690	146796	2014-15	28580	976703
2001-02	3260	148861	2015-16	27900	1176500
2002-03	4470	158155	2016-17	54920	1270490
2003-04	8490	175370			

Source: Report on State Finances, 2018-19 RBI, Budget documents of Gov. Tamil Nadu

market and NABARD borrowings, the following linear optimization function has been employed:

$$\text{Max } Z = 15X_1 + 36X_2 + 17X_3 + 25X_4 + 13X_5$$

where,

Z = investment level cost

X₁ = State Development Loans (open market borrowings facilitated by RBI) X₂ = RIDF loan from NABARD

X₃ = LTIF loan from NABARD X₄ = MIF loan from NABARD X₅ = NIDA loan from NABARD

(Constant terms are inverse of interest rate used as a proxy for contribution) Subject to

X₁ (SDL) ≤ 800 (Budget constraint)

X₂ (RIDF) ≤ 500 (Normative allocation constraint) X₃ (LTIF) ≤ 1000 (Fund constraint)

X₄ (MIF) ≤ 400 (Statewise allocation constraint)

X₅ (NIDA) ≤ 4000 (Statewise allocation constraint)

X₁+X₂+X₃+X₄ ≤ 3500 {on budget borrowing limitation for the State under article 293}

X₁+X₂+X₃+X₄+X₅=5000 (desirable investment level) and X₁,X₂,X₃,X₄,X₅ ≥ 0 (Non – Negativity Constraints)

Optimization of objective function was arrived at using Excel Solver, and the results are presented in [Table-3].

Table-2 Various NABARD loan products to State Govt./Corporation

Loan product	Tenure	Current interest rate (% p.a.) *
1.RIDF	7 years	2.75%
2. Long Term Irrigation Fund (LTIF)	15 years	6%
3.Micro Irrigation Fund (MIF)	7 years	3.90%
4.NABARD Infrastructure Development Assistance (NIDA)	15 years	7.80%

*The inverse of interest rate has been taken as a proxy for contribution in the linear programming objective function

Results using simplex LP method

The results revealed that the desired investment level of public investment in irrigation estimated at Rs.5, 000 crores annually (maximum of Rs. 6,700 crores considering the slack of Rs. 1700 crores under NIDA) could be funded through a judicious combination of open market borrowings and borrowings from NABARD at a weighted average interest rate of 6.47% currently which is less than 6.8 percent to 7.5 percent paid by the Govt. of Tamil Nadu from State Development Loans through open market borrowings. Further, the Long-Term Irrigation Fund so far not availed by the state, may be pursued vigorously under PMKSY. Moreover, considering the limitations of overall borrowing limits allotted by Department of Economic Affairs, Govt. of India, annually around Rs. 50,000 – 55,000 crores and considering the constraints of fiscal responsibility management act, the State Govt. of Tamil Nadu may consider encouraging Tamil Nadu Water Resources Management and River Restoration Corporation to borrow from NABARD and other bilateral/multilateral financial institutions which is off-budgetary in nature. It

may be added that this linear optimization model is only indicative and could be fortified further for decision making by the Government.

Table-3 Linear Programming for optimizing funding options for public investment Objective Cell (Max)

Name	Original Value	Final Value
Total contribution	41350	86900

Variable Cells

Loan Product	Amount (in crores)*	Optimal Value	Integer
X1(SDL) Open Market Loan	1000	800	Contin
X2(RIDF) NABARD	400	500	Contin
X3(LTIF) NABARD	0	1000	Contin
X4(MIF) NABARD	400	400	Contin
X5(NIDA) NABARD	150	2300	Contin

Constraints

Loan Product	Optimal Loan Amount (Cr)	Constraints	Status	Slack
Total Requirement	5000	≤5000	Binding	0
X1(SDL) Open Market Loan	800	≤800	Binding	0
X2(RIDF) Funds NABARD	500	≤500	Binding	0
X3(LTIF) NABARD	1000	≤1000	Binding	0
X4(MIF) NABARD	400	≤400	Binding	0
X5(NIDA) NABARD	2300	≤4000	Not Binding	1700

*Values indicate the current level of availability used for irrigation investment

Conclusion

The public investment in irrigation infrastructure needs augmentation, within the constraints imposed by Fiscal Responsibility Management Laws of the state, for doubling farmers income. Optimization model for borrowings from financial institutions like NABARD using linear programming technique could be employed gainfully. The results of the linear programming model in the case of Tamil Nadu reveals that desired level of investment in irrigation infrastructure could be mobilized through a fine combination of on-budget, off-budget borrowings from financial institutions and state development loans through open market borrowings.

Application of research: This model is only indicative and needs to be fortified further through dynamic linear programming application techniques as well as information technology into a full pledged decision support system to aid policy makers.

Research Category: Agricultural Economics

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Study area / Sample Collection: Irrigation Sector in Tamil Nadu

Cultivar / Variety / Breed name: Nil

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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