



A STUDY OF IRRIGATION DEVELOPMENT IN INDIA

Dr.T.Sudarsana Reddy

Associate Professor, Department of Economics, Yogi Vemana University, Kadapa, Andhra Pradesh

-----ABSTRACT-----

India's increasing water shortage threatens the sustainability of human development and irrigated agriculture. In India, regrettably, 70 years of planned development and huge public and private expenditures could irrigate about half of the cultivated land. Ground water (64%) and Canals (23%) are the two main sources that irrigate around 87% of irrigated agriculture. Though there is a huge public spending in the construction of large-scale surface irrigation projects, large number of farmers still drills wells and tube wells with the massive private investment through their own savings and loans. Regarding surface water, the government-built major and medium canal irrigation system but the main problem is the widening gap between the irrigation potential created(IPC) and the irrigation potential utilized (IPU) in India. Hence, the present paper analyses the trends in progress of irrigation during the last seven decades in India.

KEY WORDS: *India, Irrigation, Development, Gross Irrigated Area, Net Irrigated Area-----*

1. INTRODUCTION

Irrigation is a significant driving force for agricultural development in India. It is essential to increase yield and productivity, minimize large fluctuations in crop yield or loss, and alleviate crop production. Areas with scarce and uncertain rainfall are in absolute need of artificial irrigation because it is so difficult to cultivate otherwise. Some areas might experience heavy rainfall but only for some months and the rest of the year remains dry. Provision of irrigation facilities in areas as such will help farmers plant crops more than once a year. Therefore, irrigation is an important input to increase both productivity and production in agriculture so as to provide food security for the India's increasing population.

Irrigation is vital to increase the use of inputs that can increase yield, increase crop intensity and crop productivity (Dhawan, 1988; Narayanamoorthy, 1996). Although the demand for irrigation water may increase with the needs of agriculture and intensification, resource constraints and the increasing demand for water in the non-irrigation sector, limit irrigation water. The effective use of available water will become an important means to expand the benefits of irrigation (Dhawan, 1997).

As a cultural and social tool, irrigation can help society develop along an ideal trajectory. This is an ancient exercise, actually the first time the elders practiced. Therefore, hydrological facilities are one of the earliest scientific and technological achievements of mankind. In the era of the Green Revolution, irrigation was the cornerstone of agricultural growth and investment. The impact of irrigation development was generally considered to be beneficial to the creation of a modern society, as subsistence farmers turn to higher-value crops and were more firmly attracted to the market economy. Irrigation largely determined the pace and progress of agricultural development (Agarwal 1999).

2. OBJECTIVES

1. To study the growth of irrigation in terms of Irrigation Potential Created (IPC) and Irrigation Potential Utilised (IPU) under Five Year Plan Periods in India .
2. To analyse Irrigation Potential Created and Irrigation Potential Utilised under Major, Medium and Minor Sources in India.
3. To examine the trends in growth of Gross and Net Irrigated Area in India.
4. To study the status of irrigation across the states in India.



3. METHODOLOGY

This paper is based on secondary data only. Secondary data is collected from Central Water Commission, Government of India, Agricultural Statistics at a Glance, CAG Reports, Statistical Abstracts, etc. The present study covers during a time period between 1950-51 and 2016-17.

4. REVIEW OF LITERATURE

According to A. Narayanamoorthy (2021), Tamil Nadu was India's premier irrigated state in the 1960s and 1970s. Tamil Nadu had a share of 11% of India's gross irrigated area between 1960 and 1963. However, because of the lack of attention paid to irrigation development, the state's contribution fell to 3.40 percent in 2014-17. Tamil Nadu was the only state to Surprisingly, Tamil Nadu is the only state to have experienced a decrease in gross irrigated area (GIA) from 1960 to 2016.

Prasuna. V et al (2018) pointed out that AP has one of the largest irrigation areas. The gross irrigation area is 6.28 m. Ha. The state holds around 7.3% of the country's total irrigation volume. The irrigation patterns in Andhra Pradesh are going through a huge transition from large-scale surface irrigation to ground water irrigation. 49% of net irrigated area is under ground water irrigation in AP.

Y.K. Alagh (2018) opined that the lower difference between IPC and IPU during the pre-reforms period, can be explained in terms of the government's focused programme for finishing ongoing irrigation projects, which began in 1975-76 as an instrument to assist the government's strategy for food self-reliance and was repeated in 1987-88 to give a boost to the stalling agricultural sector.

Krishna Reddy, C and Praveen Kumar, B (2012) found that the gross sown area in Andhra Pradesh increased from 131.93 lakh hectares to 138.3 lakh hectares during the period between 1990 and 2008. The gross irrigated area also increased from 40 percent to 49 percent during the same period. He further stated that in Andhra Pradesh, irrigation through water tanks has been significantly reduced. However, a dramatic increase in well irrigation undermined the decline in tank irrigation. In 1996, the proportion of canal irrigation was 38% which fell to 32% in 2002.

Ashok K. Mitra (1998) found that the irrigated area in Maharashtra has increased significantly in the past 40 years. By the end of the Seventh FYP, the national irrigation potential reached 44 lakh hectares, including 20 lakh hectares underneath major and medium irrigation and 24 lakh hectares for minor irrigation. Nevertheless, it has performed poorly in taking advantage of the irrigation potential created by the major and medium sectors. The results show that the utilization rate of the major and middle sectors is 49%. The overall utilization rate is also low, mainly due to the low utilization rate reported in the major and medium-term plans. By 1995-96, the total irrigation potential target for all sources was set at 48,32,000 hectares, including 22 lakh hectares of medium-sized and major plans. The actual data reported in 1993-94 were 21 lakh hectares and 25 lakh hectares for major, medium and minor projects. In addition, he confirmed that the 1993-94 estimate showed that only 51% of the irrigation potential created was used, that is, half of the irrigation potential created under the major-medium plan remained unused. Considering the investment per hectare (capital cost) used to create potential, this is a serious problem.

5. IRRIGATION POTENTIAL CREATED AND UTILIZED IN INDIA

According to the Ministry of Water Resources, irrigation potential created (IPC) is the total gross area projected to be irrigated under different crops throughout a year under a scheme. The gross area actually watered during the reference year out of the gross intended area to be irrigated by the scheme during the year is referred to as Irrigation Potential Utilised (IPU).

The analysis of irrigation potential over Plan periods in India is presented in the Table 1. It is observed from the table that the total IPC from major, medium, and minor irrigation schemes has increased from 226 million hectares in the pre-plan period to 1135 million hectares by the end of XII Five Year Plan.

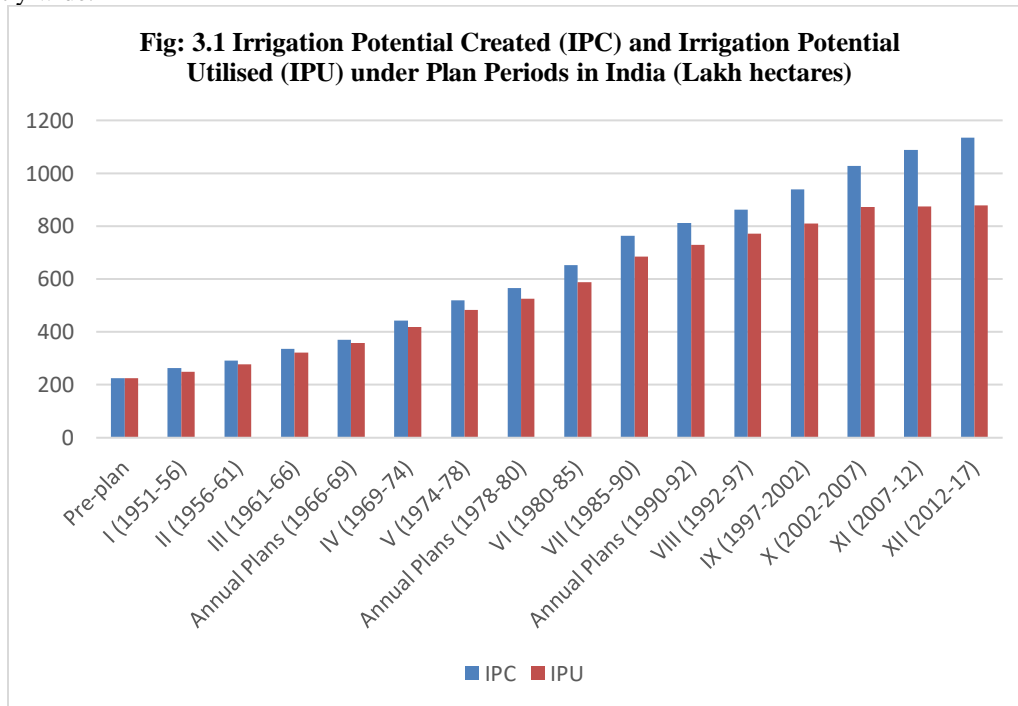


Table: 1 Irrigation Potential Created (IPC) and Irrigation Potential Utilised (IPU) under Plan Periods in India (Lakh Ha)

Plan (Period)	IPC	IPU	Gap between IPC and IPU
Pre-plan	226	226	0
I (1951-56)	263	250	13
II (1956-61)	291	278	13
III (1961-66)	336	322	14
Annual Plans (1966-69)	371	358	13
IV (1969-74)	442	419	23
V (1974-78)	520	484	36
Annual Plans (1978-80)	566	526	40
VI (1980-85)	652	588	64
VII (1985-90)	764	685	79
Annual Plans (1990-92)	811	729	82
VIII (1992-97)	863	772	91
IX (1997-2002)	940	809	131
X (2002-2007)	1027	872	155
XI (2007-12)	1089	874	215
XII (2012-17)	1135	878	257

Source: Government of India (2011), ‘Report of the Working Group on Major & Medium Irrigation and Command Area Development for The XII Five Year Plan (2012-2017)’, ‘Ministry of Water Resources, Government of India, New Delhi, 2011.

The IPC increased to 1395 lakh hectares by 2020-21. In terms of irrigation potential used, it is noted that during the pre-plan era, the total potential created was 226 Lha, which rose to 878Lha by the end of the XII plan. It was also observed that in both the pre-plan and the initial plan, the IPC was equal to the IPU. However, there is a difference between IPC (1135 Lha) and IPU (878 Lha) in XII plan. The gap, during pre-plan period, was 0 but it started increasing ever since. By the end of V plan (1974-78) it rose to 3.6 Mha and further increased to 25.7Mha by the XII plan (2012-17). It can be said that in the late 1960s, the gap between irrigation potential created and irrigation potential utilized started increasing, which became wider in the late 1980s and early 1990s. However, recently, the gap has become significantly wide.



Source: Table 1



The difference between IPC and IPU is costing the government more money than it should have if the gap had been filled on time. It's also costing farmers money because they have to rely on pricey ground water extraction to meet agricultural water needs. Finally, this method causes environmental harm in irrigation commands due to water logging and salinization, carbon emissions from the usage of power/fuel, and over-extraction of ground water in non-command areas. As a result, it is evident that governments, both national and state, spend a significant amount of money on public irrigation systems each year.

5.1 Irrigation Potential Created and Utilized under Major, Medium and Minor Irrigation

During the pre-plan period, India's irrigation potential created was 226 lha, of which major and medium irrigation accounted for 42.9 percent and minor irrigation accounted for the rest 57.1 percent. The governments both at central and state levels took various initiatives to increase the IPC and IPU during the plan periods. As a result, by the end of XII five-year plan, the IPC has increased to 1135 lha (Table 2). The proportion of major and medium irrigation and minor irrigation did not change much. The major and medium accounted for 41 percent while the minor irrigation accounted for 59 percent. The IPU during the pre-plan period was equal to the IPC. But by the end of XII plan, the IPU was 878 lha. The major and medium irrigation accounted for 37.4 percent whereas the minor irrigation accounted for 62.6 percent. All of the Five-Year Plans have prioritised the development of greater irrigation potential.

It is apparent that, in the case of IPC, MI has had a larger proportion than MMI since the pre-plan period. Similar is the case with IPU. Over the pre-plan period, IPC and IPU were precisely the same, but during the first three plans, MMI's portion of both IPC and IPU rose, although having a lower share than MI. During the fifth plan period, the proportion of major and medium projects in IPC is around 47.5 percent, with small projects accounting for the rest. Similarly, during the fifth plan, major and medium projects account for 43.6 percent, while minor projects account for 56.4 percent.

It can be said that not all of the irrigation potential that has been created is utilized. Almost 73 percent of the potential developed in India is being used for MMI. Again, there are significant differences at the state level. Tamil Nadu and Punjab use 98.7 percent and 93.5 percent of the potential created, respectively, whereas some states use less than half of the potential created (Himachal Pradesh, Assam, Jharkhand, and Madhya Pradesh). In India, there is a lack of appropriate processes, organisations, and a last-mile service delivery system for canal water. This, combined with the fact that canal water's head users use the infrastructure to grow water-intensive crops, resulting in inequity in water distribution between head and tail-end users, creates a situation in which there is a gap between irrigation potential created and irrigation potential utilised. The use of created potential for MI irrigation, on the other hand, is superior to that of MMI. Whereas in certain states, the used area is less than half of the potential created in the case of MMI, all of the major states utilise more than 60% of the potential provided here. This is most likely due to the much-discussed rationale of having greater flexibility in determining the timing and quantity of application of ground water compared to surface water, as well as cheaper and private expenses for installing small irrigation, which also contribute to better usage.

Table: 2 IPC and IPU between Major, Medium and Minor Sources (Percent)

Plan (Period)	IPC			IPU		
	Major & Medium	Minor	Total	Major & Medium	Minor	Total
Pre-plan	42.9	57.1	100 (226)	42.9	57.1	100 (226)
I (1951-56)	46.4	53.6	100 (263)	43.9	56.1	100 (250)
II (1956-61)	49.2	50.8	100 (291)	46.9	53.1	100 (278)
III (1961-66)	49.3	50.7	100 (336)	47.1	52.9	100 (322)
Annual Plans (1966-69)	48.8	51.2	100 (371)	46.8	53.2	100 (358)
IV (1969-74)	46.8	53.2	100 (442)	43.9	56.1	100 (419)
V (1974-78)	47.5	52.5	100 (520)	43.6	56.4	100 (484)
Annual Plans (1978-80)	47.0	53.0	100 (566)	43.0	57.0	100 (526)
VI (1980-85)	42.5	57.5	100 (652)	40.1	59.9	100 (588)
VII (1985-90)	39.1	60.1	100 (764)	37.1	62.9	100 (685)
Annual Plans (1990-92)	37.9	62.1	100 (811)	36.1	63.9	100 (729)
VIII (1992-97)	38.1	61.9	100 (863)	36.8	63.2	100 (772)
IX (1997-2002)	39.4	60.6	100 (940)	38.2	61.8	100 (809)
X (2002-2007)	41.2	58.8	100 (1027)	38.7	61.3	100 (872)
XI (2007-12)	41.6	58.4	100 (1089)	39.6	60.4	100 (874)
XII (2012-17)	41.0	59.0	100 (1135)	37.4	62.6	100 (878)



Note: Figures in brackets indicate total IPC and IPU in Lakh hectares

Sources: 1. Directorates of Economics and Statistics, 2011.

2. Government of India (2011), ‘Report of the Working Group on Major & Medium Irrigation and Command Area Development for The XII Five Year Plan (2012- 17)’, ‘Ministry of Water Resources, Government of India, New Delhi.

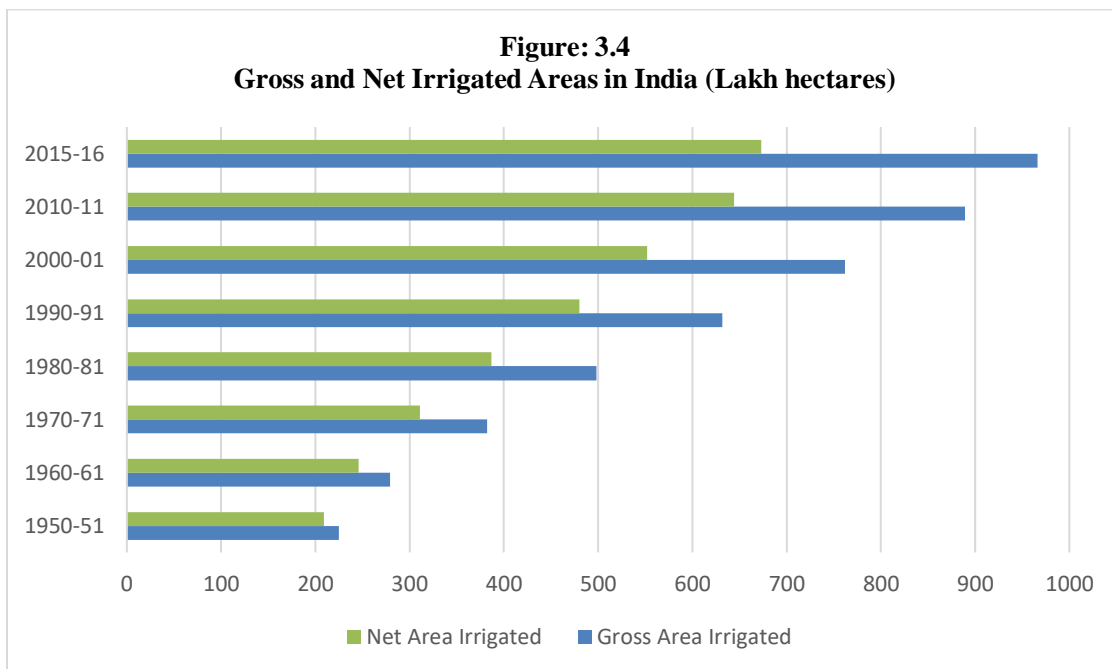
6. TRENDS IN GROWTH OF GROSS AND NET IRRIGATED AREA IN INDIA

The gross irrigated area in India expanded from 225 lakh hectares in 1950-51 to 966 lakh hectares in 2015-16 (Table 3). This growth is nearly 429 percent. This is quite important in the Indian context. Irrigation is currently accessible for more land than it was in 1950-51. During the same time span, the gross cropped area increased from 1318 lakh hectares to 1970 hectares. This is a 149 percent growth. In India in 1950-51, the percentage of gross irrigated area to gross cultivated area was 17.1 percent. However, by 2015-16, this share had risen to 48.2 percent. It means that just 17.6 percent of cultivated land in India benefited from irrigation in 1950-51. However, irrigation benefits up to 48 percent of all cultivated land in the country in 2015-16. Similarly, the net irrigated area has grown from 208 lakh hectares in 1950-51 to 673 lakh hectares in 2015-16 while the net cropped area increased to 1395 lakh ha (2015-16) against 1187 lakh ha (1950-51). Between 1950-51 and 2015-16, the percentage of net irrigated area to net cultivated land grew from 17.6 percent to 48.2 percent.

Table 3 Growth of Gross and Net Irrigated Area in India (Lakh Hectares)

Year	Gross Cropped Area	Gross Area Irrigated	Gross Irrigated Area as % of Gross Cropped Area	Net Cropped Area	Net Area Irrigated	Net Irrigated Area as % of Net Cropped Area
1950-51	1318	225	17.1	1187	209	17.6
1960-61	1527	279	18.3	1332	246	18.4
1970-71	1658	382	23.1	1408	311	22.1
1980-81	1726	498	28.8	1403	387	27.5
1990-91	1857	632	34.1	1430	480	33.5
2000-01	1853	762	41.2	1413	552	39.1
2010-11	1977	889	44.9	1415	644	45.5
2015-16	1970	966	49.1	1395	673	48.2

Source: Agricultural Statistics at a Glance – India (various years)



Source: Table 3



7. IRRIGATION BY SOURCES IN INDIA

Governments at both the central and state levels have spent vast sums on major and medium irrigation projects over a period of time. As a consequence, between 1950-51 and 2014-15, the canal irrigated area expanded from 83 lakh hectares to 161 lakh hectares. However, its share has declined. Canal irrigation's share of total irrigation fell from 39.7 percent to 23.7 percent (Table 4). During the same time span, the area irrigated by tanks decreased from 36 lakh hectares to 16 lakh hectares. And at the same time, the area irrigated by wells rose from 60 lakh hectares to 429 lakh hectares. In 2014-15, the proportion of well-irrigated area accounted for 62.8 percent of total irrigated area, compared to 28.7 percent in 1950-51 in India. The area irrigated by other sources rose from 30 lakh hectares to 75 lakh hectares. However, between 1950-51 and 2014-15, its relative share fell from 14.4 percent to 11 percent. Hence, it is clear that during a 70-year period, well irrigation was mainly used for the apparent reasons that it is cheap and ground water is an affordable irrigation source. When compared to other sources, tank irrigation is presently used less. Over the last 70 years, it has fallen from 17.2 percent to 2.5 percent.

Table : 4 Source-wise Net Irrigated Area in India (Lakh Hectares)

Year	Canals	Tanks	Wells	Others	Total
1950-51	83 (39.7)	36 (17.2)	60 (28.7)	30 (14.4)	209 (100)
1960-61	104 (42.3)	45 (18.3)	73 (29.7)	24 (9.7)	246 (100)
1970-71	129 (41.5)	41 (13.2)	118 (37.9)	23 (7.4)	311 (100)
1980-81	153 (39.5)	32 (8.3)	178 (46.0)	24 (6.2)	387 (100)
1990-91	174 (36.3)	29 (6.0)	248 (51.7)	29 (6.0)	480 (100)
2000-01	160 (29.0)	24 (4.4)	340 (61.5)	28 (5.1)	552 (100)
2009-10	167 (26.4)	16 (2.5)	390 (61.8)	59 (9.3)	632 (100)
2010-11	169 (26.2)	22 (3.4)	410 (63.7)	43 (6.7)	644 (100)
2014-15	161 (23.7)	17 (2.5)	429 (62.8)	75 (11.0)	682 (100)

Source: Agricultural Statistics at a Glance – India (various years)

8. IRRIGATED AREA ACROSS STATES IN INDIA

When all 29 states are included, Punjab (98.6 percent) has the most irrigated area, followed by Haryana (91.4 percent), Uttar Pradesh (79.7 percent), Bihar (69.3 percent), and West Bengal (69.3 percent). This might be due to the abundance of water resources available in the form of rivers such as the Ganga, Indus, and their tributaries. While some states have approximately 90 percent irrigated land, others have less than 20 percent irrigated land (Table 5). Assam has the least irrigated land, accounting for 9.6 percent total irrigated area. Other states with less irrigated land are Sikkim (11.5 percent), Jharkhand (13 percent), Mizoram (16.3 percent), and Manipur (16.9 percent). While the total irrigated land in India is 49 percent, the states that come close to this statistic are Himachal Pradesh (44.7 percent) and Andhra Pradesh (47.1 percent). Gujarat, Uttarakhand, and Tamil Nadu, for example, have more irrigated land than the national average. It is clear from the table that there are wide disparities among the states in respect of irrigated area.

Table : 5 Net Irrigated Area across States in India

State	% of Net Irrigated Area to Net Sown Area
Andhra Pradesh	47.1
Arunachal Pradesh	18.6
Assam	9.6
Bihar	69.3
Chhattisgarh	31.1
Goa	24.5
Gujarat	52.4
Haryana	91.4
Himachal Pradesh	44.7
Jharkhand	13.0
Kerala	18.4
Madhya Pradesh	42.3
Maharashtra	20.2



Manipur	16.7
Maharashtra	42.1
Mizoram	16.3
Nagaland	22.7
Orissa	29.9
Punjab	98.6
Rajasthan	42.2
Sikkim	11.5
Tamilnadu	58.8
Telangana	41.4
Tripura	24.2
Uttarakhand	50.0
Uttara Pradesh	79.7
West Bengal	64.0
All India	49.0

Source : Directorate of Economics & Statistics, DAC&FW, Govt. of India.

9. CONCLUSION

India's total irrigation potential is projected to be 139.5 million hectares, with 58.5 million hectares from major and medium systems, 15 million hectares from minor irrigation schemes, and 66 million hectares from ground water exploitation. India's irrigation potential has grown from 22.6 million hectares in 1951 to almost 90 million hectares at the end of 1995. After wells and tube wells, canals are India's second most important form of irrigation. The Canals irrigate those areas with broad plains, fertile soils, and perennial rivers. The plains of North India are primarily irrigated by canals. Uttar Pradesh has the highest irrigated area in India (17.6 million hectares). Punjab has the most irrigated area of all the States and UTs in the country, with 98.8% of its cropland irrigated. Mizoram is India's only state that is not watered.

Furthermore, since the gap between irrigation potential developed and use has grown over time, efficiency challenges in the execution of irrigation projects have arisen. Irrigation infrastructure can be improved further by bridging this gap, as around 88 percent of IPU has already been created. Because of its independent access and timely availability of water, ground water has become a prominent source of irrigation over time. However, there is a significant disparity between the ultimate and usable surface water potential.

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