



## FISCAL ASPECTS OF IRRIGATION ADMINISTRATION IN MAURYAN PERIOD: A COMPARATIVE STUDY WITH PRESENT

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### ABSTRACT

This paper has focus on comparative study of fiscal aspects of irrigation administration in Mauryan period (322 BC to 185 BC) with practice in present day India. Kautilya's Arthashastra, inscriptions on rocks and pillars and other archaeological findings are the source of information for Mauryan period as documented in literature. Irrigation objective at present is social welfare whereas in Mauryan period, it was to enrich the government treasury through taxes on irrigation and agriculture. Irrigation charges were much higher in Mauryan period as compared to the charges being paid by farmers at present. Mauryan currency of Pana (a silver coin weighing 3.5 gm) has been equated to Rs 237.5 in terms of equal wheat grain purchase power in year 2016 AD. This equivalence has been used for comparison of irrigation staff salary, purchasing power of the employees and irrigation taxes, penalties. Ratio of highest salary to lowest salary was 400 during the Mauryan period and it is only 10 now suggesting egalitarian nature and a possible cause for inefficient functioning of some irrigation projects at present. Severe penalties for violation of irrigation rules suggest that the Mauryan state could not be defrauded and hence resulting in efficient irrigation. Assuming that per capita requirement of wheat grain as food has remained same from Mauryan period till present times, wheat grain equivalent to salary has been used as surrogate for purchasing power (and hence salary). Purchasing power of Chief Engineer and highest paid bureaucrat is almost same now whereas it was only 4.2% of the purchasing power of councilor in the Mauryan period. Purchasing power of skilled labour was 5.9% of purchasing power of Chief Engineer in Mauryan period. It rose to 33.3 % in 1996 AD and then came down to 12.5% of salary of Chief Engineer in 2016 AD.

**Keywords:** Mauryan period; irrigation; fiscal comparison; pana, penalty.

### INTRODUCTION

The irrigation had been the one of the well administered practices in ancient time in India. This article covers profession and diffusion of agriculture, irrigation administration, lift irrigation and surface irrigation works from ancient time and upto 1000AD. On the subject of dams and canals, evidences from south India and Srilanka offered special material. Chaube et al (1997) had earlier authored a paper entitled "Lessons from Ancient Works of Irrigation & Agriculture in Indian Subcontinent (Up to 1000 A.D.)".

Information regarding fiscal aspects of irrigation administration during the Mauryan period (322 BC to 185 BC) is available in various forms such as literature (Arthashastra by Kautilya, Kamajataka literature), Junagarh rock inscriptions, inscriptions on Ashoka pillars and other archeological findings of the period. Commentaries by various authors (Rangarajan, L.N. (1987), Sharma, R.S. (1995), Mulla Zubin R. & Vylder G.D. (2014), Srinivasan T.M. (1970) on the Arthashastra and other literature provide useful information on the subject of irrigation and its management. An attempt has been made in this paper to extract and synthesize the available information on fiscal aspects of the irrigation administration during Mauryan period (322 BC to 185 BC) and compare it with practice in present times in India to draw some lessons.

Ruled by the Mauryan Dynasty from 322 BC to 185 BC, the Maurya empire extended over an area of 5 million square

kilometers (152% of the present area of Republic of India) at its zenith under the rule of Ashoka. Kautilya (also known as Chanakya and Vishnugupta) wrote *Arthashastra* (meaning Economics) which laid down the foundations of governance including construction and maintenance and management of irrigation works.

### MAURYAN CURRENCY AND ITS EQUIVALENCE WITH RUPEE

Silver coins of four denominations, viz., pana (also known as Kasharpana), *ardh-apan*a (half pana), *pada* (quarter pana) and *ashta-bhaga*, or *ardhapadika* (one eighth pana) were being issued from the mints of the Mauryan empire (Gupta, P.L., 2013). However, pieces cut from full pana coin have also been discovered suggesting that cut pieces were also accepted as legal tender. Gupta, P. (2013) mention that silver coins, weighting between 2 to 3 grains (one sixteenth of a pana) were also used in transaction during Mauryan period.

#### Equivalence of Pana in Rupee Currency:

In the Arthashastra it is mentioned that "an annual salary of 60 panas is equal to one adhaka of grain per day and one adhaka is "enough for four meals for one Arya male" (Rangarajan, 1987) Mulla et al (2014) considered individuals in urban areas earning less than Rs. 10,314.20 per annum to be "below the poverty line". Based on this definition of poverty line, Mulla et al (2014) equated annual salary of 60 panas to Rs. 10,314.20 per annum and suggested that the value of one pana in Kautilya's period is equal to Rs. 171.90 in present time.

In the present study, another approach is followed for valuation of Pana into Rupee. *Adhaka* is the Sanskrit name of the weight unit corresponding to 2.56 kg (Sharma P. V.

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1998). Annual grain requirement of one person is 934.4 kg grain (=365x2.56 kg grain per day) which he could buy from his salary of 60 Pana in a year. In other words one Pana could buy 15.573 kg of grain.

In the year 2016 (year of implementation of 7<sup>th</sup> Pay Commission), minimum support price for wheat grain was Rs 1525 per quintal (GOI, 2015). It means 15.573 kg grain could be bought from Rs.337.5. Therefore **one Pana may be equated to Rs. 237.5 in year 2016**. Similarly, in year 2019, minimum support price for wheat grain is Rs 1840 per quintal (GOI, 2018). Therefore one pana may be equated to Rs 286.5 in year 2019. Figure 1 below depicts the coins of equivalent value in Mauryan period and in the year 2016.



**Figure 1: Pana (weight 3.5 gram) in Mauryan period equivalence to Indian Rupee in year 2016**

Only silver metal was used in the Pana in Mauryan period. But now varieties of metals are used in the Rupee coins. Information on amount of various metals in the coins is available in (i) Schmidt Tracy, Michael Thomas (2018) and (ii) Michael Thomas (2018).

It is important to note that Coins of Rs 200 and Rs 20 denomination are not in circulation. These coins have been issued as part of numismatic collection because cost of

hierarchical while organizations which have relatively small pay differentials are said to be egalitarian (Mulla, et.al (2014)). Extent of hierarchy in a particular organizational structure can be measured by the ratio of the wages of the highest paid member in the hierarchy to that of least paid member of the hierarchy.

Arthashastra states that senior officers receive forty-eight times the salary of a clerk, and ministers double that. The ratio of the clerk's salary to that of the chief minister was approximately 1:96. High pay differentials and the severe penalties for violation of irrigation rules during the Mauryan period, suggest that the Mauryan state could not be defrauded by the people or its officials. This is in striking contrast to the taxation and other regimes prevalent at present in India.

Rangarajan (1987) provides details on the principles of salary fixation and actual salaries of government servants during the time of Kautilya. In the present study, maximum and minimum salaries of government employee and ratio of the salaries in Mauryan period have been compared with those in present time. Five different years of present time correspond to the years of pay revision by Central Pay Commission (CPC) in India (table 1).

Ratio of maximum and minimum salary of Government employees was 400 in Mauryan period suggesting an extremely hierarchical organization. On the other hand, this ratio is 10.1 in 2016 A.D. indicating highly egalitarian structure of society in present times. Further, the ratio has been gradually declining from 36.4 in 1947 to 10.1 in 2016.

Mulla, et.al. (2014) referring to various authors in his paper points that the extent of inequality in the pay structure as measured by the salary ratio has important implications on

**Table 1: Monthly Salary of High level Officers and skilled labour and Ratio of Salaries**

Time in history	Unit	Maximum **	Minimum ***	Ratio of salary
400 B.C.	Pana	4000	10	1 : 400
1947 A.D. (I <sup>st</sup> CPC*)	Rupee	2000	55	1 : 36.4
1957 A.D. (II <sup>nd</sup> CPC)	Rupee	3000	80	1 : 37.5
1972 A.D. (III <sup>rd</sup> CPC)	Rupee	3500	196	1 : 17.9
1996 A.D. (V <sup>th</sup> CPC)	Rupee	26000	2500	1 : 10.2
2016 A.D. (VII <sup>th</sup> CPC)	Rupee	182200	18000	1 : 10.12

Note: \*Central Pay Commission: \*\*councilor/bureaucrat: \*\*\*skilled labor

metals used in these coins is significantly higher than the value of coin.

### **PAY DIFFERENTIALS IN GOVERNMENT OF MAURYAN PERIOD AND NOW**

The Maurya Empire was extremely efficient in irrigation administration but officials at higher level were paid disproportionately higher than their relative output simply by virtue of their position in the hierarchy. Organizations which have relatively large pay differentials are said to be

organizational outcomes such as individual effort, individual performance, risk-taking, employee turnover and organizational performance.

Government of India has made massive investment in irrigation sector since independence in 1947. But crop production has been much below optimal level even after implementation of command area development programme in several irrigation projects. Egalitarian wage structure could be one of the reasons for inefficiency in irrigation sector.

**PURCHASING POWER OF SALARY OF IRRIGATION STAFF-THEN AND NOW**

In order to have meaningful comparison of salaries, attempt has been made to work out amount of wheat grain that could be purchased from the salary. It is reasonable to assume that per capita requirement of wheat grain as food has remained same from Mauryan period till present times and wheat grain equivalent to salary could be used as surrogate for purchasing power (and hence salary) in regions having agriculture based economy. A vast discrepancy prevailed in payment of salaries to labour, craftsman and engineers as compared to the highest salaried job.

Officiating priest, King’s Guru and the councilors received the highest salary of 4000 Pana per month whereas King’s

physician and Chief Engineer received 167 Pana per month only. Table 2 gives comparison of the salaries paid in 400 B.C. and now in present times i.e. after 2400 years. Labour for digging irrigation canals got very low salaries in Mauryan period as compared to present day salary. Salary paid to labor in 400 B.C. is almost same as was paid to lowest Indian labour by British East India Company in 1800 AD. Engineer, craftsman and labor receive much higher salary now (in terms of equivalent wheat grain) as compared to the Mauryan period.

**OWNERSHIP OF WATER WORKS AND WATER TAX**

Conditions for ownership of water works, water tax and its exemption are compared in table 3.

**Table 2: - Wheat Grain Purchasing Power-Then and Now**

Time in History	Unit	Highest Salary	Salary of Chief Engineer	Salary of Carpenter, craftsman	Ratio of Purchasing Power	
					Chief Engr. & Highest	Craftsman and Chief Engr.
400 B.C.	Pana	4000	167	10		
	Equivalent Wheat Grain <sup>#</sup> in 2016AD (Kg)	62292	2601	156	1:24	1:17
1996 A.D. (V <sup>th</sup> Pay Commission GOI)	Rupee	26000	20000	2550		
	Equivalent wheat grain * (Kg)	6842	5415	671	1:1.3	1:3
2016A.D.(VII <sup>th</sup> Pay Commission GOI)	Rupee	182200	144200	18000		
	Equivalent wheat grain <sup>@</sup> (Kg)	11948	9456	1180	1:1.3	1:8

Note:<sup>#</sup>4000 Panas = Rs949960 @1 Pana= Rs237.49, Wheat grain price in 2016 is Rs 15.25 per Kg, Wheat grain equivalence in 2016 =949960/15.25=62292.46 Kg  
 \* Wheat grain price in 1996 was Rs 3.80 per Kg (source: [http://dwd.dacnet.nic.in/statistics/wheat\\_msp.htm](http://dwd.dacnet.nic.in/statistics/wheat_msp.htm))  
 @ As per GOI (2015) price of wheat grain price was Rs 15.25 per Kg in 2016

**Table3:Conditions for Ownership of Water Works, Water Tax and its Exemption**

As practiced in Mauryan period	As practiced now in India
<b>OWNERSHIP</b>	
Irrigation works such as embankments and tanks could be privately owned and the owner was free to sell or mortgage them.	Tanks are mainly owned by village level societies. Private tanks also exist
The ownership of tank lapsed, if tank had not been in use for a period of five years, except in case of distress.	No such condition exists at present.
Anyone leasing, hiring, sharing or accepting a waterworks as a pledge, with the right to use them, was required to keep them in good condition.	There are a large number of government owned tanks which need proper maintenance but no rule for transfer of ownership.
Owners may give water to others in return for a share of the produce grown in the field, parks, or gardens.	Water at head of minor canal is given to a cooperative society and society is responsible to collect the water charges

In the absence of the owner, either charitable individuals or the people of a village acting together, shall maintain waterworks.	Gram Panchayats/Panipanchayats (Water User Associations) have been formed for maintenance of irrigation works at minor canal level.
<b>WATER TAX/RATE</b>	
<u>Tax for water use from water works built by the king:</u> a) One-fifth of the produce if water is manually transported. b) One-fourth of the produce if water is carried by bullocks. c) One-third of the produce if water is lifted by mechanism into channels.	Irrigation development in India is based on concept of social welfare. Irrigation charges are nominal. Not adequate to meet even maintenance expenditure. Due to socio political reasons, collection of irrigation charges from the farmers is rather difficult.
<u>Tax for water use from natural reservoirs:</u> one-fourth of produce when field is irrigated from rivers, lakes, tanks and springs .	No tax is levied. Use of natural source such as river, lake, spring is not controlled by government.
<b>EXEMPTION FROM PAYMENT OF TAX</b>	
Five years exemption for building or renovating new tanks and embankments.	There are several government sponsored schemes providing incentives to rural population in building/renovating new tanks, rejuvenation and maintenance of tanks.
Four years exemption for renovating ruined or abandoned water works.	
Three years for clearing water works over-grown with weeds {3.9.33}.	

Irrigation charges were much higher in Mauryan period as compared to the charges being paid by farmers at present. Irrigation charge was considered as an important item of revenue in the Arthashastra which provides a long list of taxes as source of revenue. Arthashastra mentions: *‘The king shall bestow on cultivators only such favour and remission as will tend to swell the treasury and shall avoid such favour which deplete it’*.

Present day water rates are neither based on project cost nor on farm benefits. As such several irrigation projects have actual benefit cost ratio lower than one.

### **MONETARY VALUATION OF PENALTY FOR VIOLATION OF RULES**

At present, there are various irrigation Acts and Code of practice to regulate irrigation practices in different parts of India. For example, “The Northern India Canal and Drainage Act VIII” was enacted in 1873 for regulation of irrigation practice in United Provinces (now Uttar Pradesh) and Punjab. However, penalty for violation of irrigation rules is not so severe as it was in Mauryan period. For example, delayed payment of irrigation water charges by farmers and sometimes vennon payment is very common in north India. Furthermore, irrigation development in India is based on concept of social welfare and it is not viewed as source of revenue.

Quarrel among the farmers concerning irrigation facilities had existed during Mauryan period and such quarrels exist

in present times as well. Arthashastra had laid down strict rules for water use and penalties to settle conflicts about priority water use. Large pay differentials as discussed earlier and the severe penalties for violation of rules suggest that it was most unlikely that the Mauryan state could be defrauded by the people or its officials. This is in striking contrast to the taxation and other regimes prevalent at present in India.

An attempt has been made to work out the Indian Rupee equivalent of penalty prescribed in Pana currency during Mauryan period (table 4). Arthashastra mentions three levels of standard fine for various type of crimes and violation of rules (Rangarajan (1987)):

- a) Lowest SP: 48 to 96 Panas;
- b) Middle SP: 200 to 500 Panas;
- c) Highest SP: 500 to 1000 Panas

It is also mentioned in Arthashastra that Magistrates shall determine whether to levy highest, middle or lower standard penalty (SP) taking into account person sentenced, the nature of offence, the motive and its gravity, the circumstances prevailing, time, place, consequences while maintaining a balance between the interests of the king(state) and the offender. Thus flexibility is provided to the magistrates to decide level of penalty and fix amount from within the range of decided level of penalty.

**Table4: Penalty for Violation of Irrigation Rules and its Equivalence in Rupee Units**

Cause	Penalty	Equivalence in Rupee
Causing damage to another's ploughed or sown field by letting water overflow from a reservoir, channel or field	Compensation according to damage	
Causing damage to gardens, parks and embankments	Double the damage	
Natural flow from a higher tank is prevented to fill the lower tank which has been in use for at least three years	Lowest SP & emptying of higher tank	Rs 17100& emptying of higher tank
Failure to maintain an irrigation facility	Double the loss caused by failure	
Letting water from a dam out of turn, obstructing the flow of water to a user with a right to it	6 panas	Rs 1425
Obstructing or diverting a customary water course	72 Pana <sup>@</sup> (Lowest SP)	Rs17100
Building a well or a dam on someone else's land	72 Pana <sup>@</sup> (Lowest SP)	Rs17100
The person selling or inducing someone to sell water works	350 Pana <sup>#</sup> (Middle SP)	Rs83121
Witnesses to the transaction (for not preventing it) of selling or mortgaging a charitable waterworks	750 Pana*(Highest SP)	Rs178117
Breaking a dam having water in reservoir	Drowning in the same place	
Breaking a dam having no water in reservoir	750 Pana*(Highest SP)	Rs178117
Breaking a dam which is abandoned or it is in ruins	350 Pana <sup>#</sup> (Middle SP)	Rs83121

\*Average of highest standard penalty range (SP),<sup>#</sup>Average of range for middle standard penalty(SP); <sup>@</sup> Average of range for lowest standard penalty(SP)

## CONCLUSIONS

An attempt has been made in this paper to extract and synthesize the available information on fiscal aspects of the irrigation administration during Mauryan period (322 BC to 185 BC) and make comparison with practice as followed now after 2400 years.

Whereas water charges for various types of irrigation were much higher (being important source of revenue), the wages paid to labour; technicians and engineers were quite low in Mauryan period. In contrast water charges now are comparatively quite low and wages paid are much higher as objective of irrigation is equitable distribution of benefits & social welfare.

Violation of irrigation rules attracted high penalty during Mauryan period resulting in efficient irrigation compared to significantly less penalty and suboptimal irrigation at present.

In Mauryan period, Pana (3.5 gram silver coin) was the currency in which salary of staff was paid and penalties determined. Ratio of the wages of the highest paid Government employee to that of least paid employee was 400 in Mauryan period. On the other hand, this ratio is 10.1 in 2016 AD indicating highly egalitarian structure of

Government organization in present times. Further, this ratio has been gradually declining from 36.4 in 1947 to 10.1 in 2016. Egalitarian wage structure could be a reason for lack of staff motivation and inefficiency in delivery of irrigation service.

In order to have meaningful comparison of salaries, attempt has been made to work out amount of wheat grain that could be purchased from the salary. It is reasonable to assume that per capita requirement of wheat grain as food has remained same from Mauryan period till present times and wheat grain equivalent to salary could be used as surrogate for purchasing power (& hence salary) Purchasing power of Chief Engineer and highest paid bureaucrat is nearly same now whereas it was only 4.2% of the purchasing power of councilor in the Mauryan period. Purchasing power of skilled labour was 5.9% of purchasing power of Chief Engineer in Mauryan period. It rose to 33.3 % in 1996 AD and then came down to 12.5% in 2016 AD.

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