



A Systematic Review of the Existing Literature to Evaluate What is Already Known of the Participatory Irrigation Management

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ABSTRACT

The Participatory irrigation Management (PIM) introduced in the 1970s provided for a decentralised and citizenry based irrigation with multi-actor involvement. Though welcomed and applied globally with great enthusiasm, the true impact of PIM still remains obscure. This work tries to demystify this obscurity to identify the nature of evidence and impact as reported by the works on PIM since 1980s. A systematic review of 51 works has been made from Asia, Africa and the Americas to understand both the spatial and temporal pattern of the works. The study finds the works were spatially biased towards Asia and Africa and the major part of the review was based in the decade 2010-2020. The quality of data of the reporting works was mainly based on secondary evidences and on smaller sample sizes. The study found the failure of the government as the major reason backing the rise of PIM and various internal and external factors were affecting its functioning. About 60% of the studies have used the water related outcomes for impact analysis. The study finds that the impact as reported by the papers has been mixed with 30% of the total works claiming the outcome to be a positive one while 45% reporting it as negative or negligible. The study hints at the weakness of the preceding works in attaining consensus on the methods and impacts of PIM. The works also fail to bring out the 'human' part of the practice where the socio-psychological aspects of the actors have remained grossly underrated and unreported.

Key words: Impact analysis, Irrigation management transfer, Multi-actor, Participatory irrigation management, Systematic review.

Management and efficient utilisation of the irrigation has remained a contested topic of discussion since long and has been put to various tests and research across the globe. This has been obvious given the crucial role played by irrigation in maintaining the world food security in the light of increased water scarcity (Mancosu *et al.*, 2015; Joy *et al.*, 2021; Kumar *et al.*, 2023; Rede *et al.*, 2025). One such effort to improve the irrigation sector had been introduced way back in the 1970s across the globe with the citizenry centered management of Irrigation. It was believed that the users themselves could be the best managers of irrigation if facilitated with proper training and awareness. This emerged from a global dissatisfaction with the traditionally managed irrigation systems that failed to bring desired results both in terms of quality and quantity of irrigation supply (Facon, 2002; Aarnoudse *et al.*, 2018). This effort came to be known variably as Participatory Irrigation Management (PIM) and Irrigation Management Transfer (IMT) and its introduction varied far and wide from Mexico to India to Africa, Australia, Indonesia, Japan and Philippines to name a few (Meinzen-Dick, 1997; Poddar *et al.*, 2011).

With the PIM in practice for about half a century now in various degrees and forms across the world, varied works have been taken up ranging from descriptive ones promoting the practice as testimonials from the reports of the donor agencies, working papers and government and non-governmental organisational reports to the quantitative ones attempting to statistically comprehend the impact of this practice (Gijer *et al.*, 1996; Vermillion, 1991; Restrepo *et al.*, 2007). The papers have been from all quarters of the

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world and have been present in all decades but none have been able to provide a clear picture of the outcome of this paradigm shift. While some have reported a positive impact of PIM (Facon, 2002; Uysal and Altış, 2010; Jadeja and Parmar, 2017), there have been reports of negative impact too (Facon, 2002; Ghosh *et al.*, 2008; Hussain, 2021) while there also have been inconclusive studies (Samad and Vermillion, 1999).

Taking hint from the previous studies, this work tries to highlight the nature, extent and impact and PIM by systematically reviewing the available literature. The study follows the framework provided by Senanayake *et al.* (2015) in assessing the global PIM practice over the years. Their work is one of the most robust ones on literature review to understand PIM and its impact (Cambaza *et al.*, 2020). In this attempt, it clubs the studies from 51 scholarly articles from across the nations and time periods to understand the practice of PIM. It unveils the temporal and spatial trend

of the existing works and focuses how the interest of the researchers on PIM has undergone shift over the years.

The present study was conducted in the summer of 2024 in the advanced research centre of the Department of Geography in the Lady Brabourne College, University of Calcutta. To understand the nature and impact of the PIM from the existing body of literature, a systematic review has been conducted. The work aims to bring out a universal view of the evolution and assessment of the PIM across varied socio-temporal frames by commissioning common codes and assessment criteria for the wide array of the papers. In this attempt the regional/local studies have been put to test in a larger and a more uniform global context (Senanayake *et al.*, 2015).

The search

Relevant publications from the academic data bases like Semantic Scholar, Science Direct, Web of science, Elsevier, Sage Journals, FAO reports, IWMI reports, Scopus, Research Gate, World Bank publications and search engines like Google Scholar were searched. The search was based on the following search words- "Participatory Irrigation Management", "Impact" or "outcome" or "analysis" plus "PIM", "evolution" "growth" or advancement of PIM, "resource management" "common pool resources" "Problems of traditional irrigation" "PIM in India". Apart from the 'white' literature from various journals, articles and books, the study also includes 'grey' literature from donor/ World Bank reports, working papers, theses and research reports.

The inclusion

The criteria for selection of relevant articles/ journals/ publications included- a) Original Publications b) full text articles c) published from 1980 onwards d) published in English e) included inputs on either 1. PIM as a concept and/or 2. Its evolution and/or 3. factors affecting PIM and/or 4. impact of PIM f) assessed the performance of PIM statistically g) has reviewed literatures on PIM. The criteria for exclusion of articles include- a) articles lacking relevance b) articles with variables which did not suit the selection criteria c) articles with limited presentation of findings. The flow chart indicating the selection criteria for articles has been listed under (Fig 1).

A total of 350 publications had been identified through database search. Out of these 308 remained after screening of duplicates; of which 164 titles were excluded after screening of abstract and 144 full text publications were selected. Of these, 51 have been selected for the study. From amongst the 51, 37 relate to conceptualization, 28 to relate problems of state managed irrigation and the rise of PIM, 8 relate to the sustainability analysis of PIM and 16 relate to the impact assessment of PIM.

The temporal trend

The study begins with the 80s decade as the PIM practice gained momentum in 1970s reaching its peak in the 90s

(Meinzen-Dick, 1997; Cambaza *et al.*, 2020). The trend shows that the frequency of publication was highest in the decade of 2010s while it was minimum in the 1980s. The trend has been rising over the years with a decline in the current decade. While the rising trend may be attributed to the increased research interest in the PIM practice over the years, the falling trend may be explained by only a short span of publication in the current decade spanning only for four years till now.

Thematic preference over the years

The thematic preference of the scholarly works considered for the study has also been evaluated. For this, coding was done to identify the major ideas present in the papers. The codes included: conceptualisation/idea of PIM, glitches of traditional irrigation management, Improvement of PIM over traditional irrigation, factors leading to evolution of PIM, Nature of PIM across the world/countries/regions, Policy interventions by governments/non-governmental organisations/donor agencies/World Bank, Impact Analysis of PIM, Institutional Features related to PIM, failure or success analysis. Then the papers were arranged according to their decade of Publication and the major thrust of each paper was identified.

Table 1 shows that each decade had a major theme. In the 80s decade when the PIM had just started taking roots, the major part of the papers revolved around the concepts of the community based resource management (Banki, 1981; Uphoff, 1986). This seeped further into the analysis of the process in the next decade with more preference for participant led irrigation management over the centralized traditional irrigation system (Vermillion, 1991; Mitra, 1992; Samad and Vermillion, 1999). In the next decade works of Facon (2002), Restrepo *et al.* (2007), Gandhi and Namboodiri (2008), have focused mainly on the factors that led to the rise and popularity of PIM by focusing on the failure of the traditional irrigation systems. The next decade with the highest frequency of publications stuck to similar scope of study with a little more thrust on the impact of donors on the working of PIM (Kulkarni and Tyagi, 2012; Aarnoudse *et al.*, 2018). The current decade has seen more focus on the impact analysis of PIM on the crop and water related outcomes and this trend can be traced from the later years of the 2010s decade. As evidenced from the works of Jadeja and Parmer (2017); Aarnoudse *et al.* (2018), in the decade of 2010s and in the works of Ahmed *et al.* (2020); Nyam *et al.* (2020); Hussain *et al.* (2021), in 2020s have focused on the impact analysis of PIM. On the whole, though few major themes have been enlisted decade wise yet these are not mutually exclusive and there is considerable amount of overlap in the themes across decades.

Spatiality of the study

The spatial analysis shows that most of the works considered have been from India followed by Africa and Thailand (Table 2). While two of the works have been based

on Pakistan and Asia, papers from China, Turkey, USA, Japan, Sri Lanka and Kyrgyzstan have also been studied. The total spatial count for the papers stands at 32 out of the total 51. This is because few papers are based on review of literature and on the policy intervention across nations (Restrepo *et al.*, 2007), which makes the identification of specific regions difficult in such papers.

The factors leading to the rise of PIM

The varied list of factors as identified by the papers and scholars has been summed up to identify four major factors that have conditioned the rise and popularity of PIM (Table 3). The frequency of occurrence of these four factors has been taken as a proportion to the total number of papers. About 60% of the total papers have reported the failures of Government as the major reason leading to the rise of PIM (Facon, 2002; Poddar *et al.*, 2011; Kulkarni and Tyagi, 2012; Aarnoudse *et al.*, 2018; Pek *et al.*, 2019). This is followed by a greater trend towards transfer of responsibilities to the users and has been reported by 36% of the papers (Uphoff, 1986; Vermillion, 1991; Mitra, 1992; Geijer *et al.*, 1996; Restrepo *et al.*, 2007; Gandhi and Namboodiri, 2012). About 28% of the papers believe that the interventions by donor agencies like World Bank and Asian Development Bank have made PIM more acceptable and lucrative to the governments (Chandrasekaran *et al.*, 2002; Armanios, 2010; Aarnoudse *et al.*, 2018; Cambaza *et al.*, 2020). Finally about 8% of the papers reported that PIM was introduced to reduce the financial burden of the government by curtailing the expenditure on irrigation through PIM and IMT (Meinzen-Dick, 1997; Groenfeldt and Sun, 1997; Samad and Vermillion, 1999; Restrepo *et al.*, 2007).

Evaluation of PIM

The papers have been divided in their decision of PIM's success, where while one group claims it to be success another presents it as a failure and a still another group remaining indecisive of the outcome. The papers have also varied in the use of indicators to assess the practice. Thus while some have considered agro-economic indicators (Uysal and AltıŞ, 2010; Pek *et al.*, 2019; Husain *et al.*, 2020), others have considered institutional and behavioural indicators to assess the rate of participation and in turn PIM (Ghosh *et al.*, 2008; Kono *et al.*, 2012). Thus the study has explored a diverse range of indicators and outcome as reported by the previous works.

Major indicators/Criteria used

Codes were assigned to club various indicators across papers under 8 heads. Three of them are from the agro-economic domain namely, crop related, water related and water fee collection indicator/ criteria; three related to the institutional features namely, awareness and training, participation and dispute resolution; one each criteria related to government spending and sustainability.

Majority of the papers have included the crop and water related indicators in their study (Table 4). The water related aspects of water supply, resolution of tail end deprivation, relative irrigation supply, irrigation water productivity among others to be the major indicators have been reported by 60% of the work (Uysal and AltıŞ, 2010; Aarnoudse *et al.*, 2018). About 45% of the studies have referred to crop related indicators namely; production, yield and economic returns, and about 35% of the papers have used the water fee collection criteria. About 25% (Awareness and training), 30%

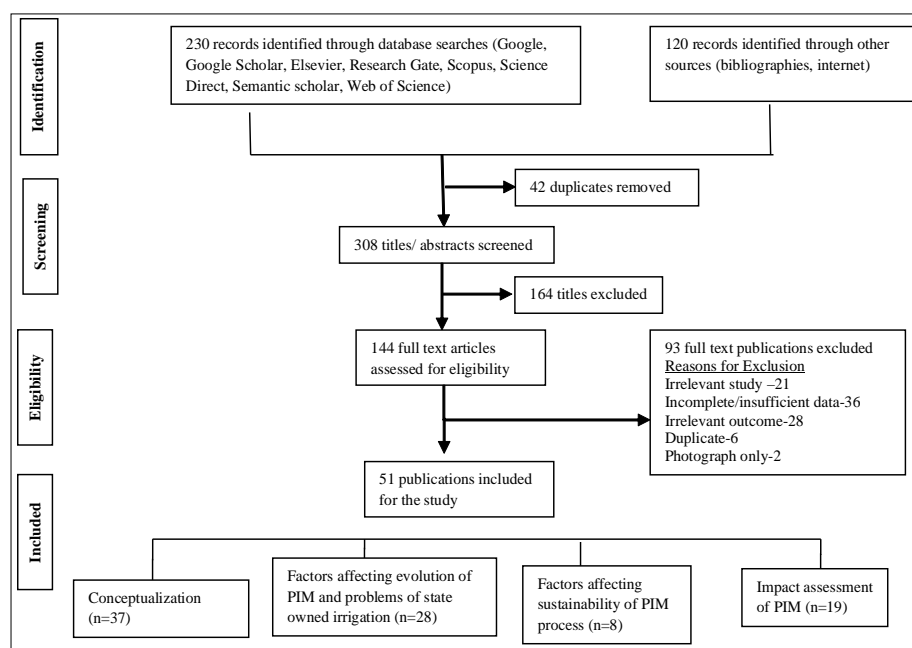


Fig 1: Flowchart showing criteria for selection of the literature relevant for the study after the PRISMA framework.

Table 1: Decade wise frequency and major themes of papers considered for the study.

| Decade | Frequency | Major focus of study |
|--------|-----------|--|
| 1980s | 2 | Concepts of participation and PIM |
| 1990s | 6 | PIM as a better technique over traditionally managed irrigation systems |
| 2000s | 17 | Problems and failure of traditional irrigation, factors leading to rise of PIM, PIM across the World, Policy interventions |
| 2010s | 23 | Intervention of donor agencies. Problems of PIM. Policy Analysis, Impact, Institutional features associated |
| 2020s | 7 | Impact analysis of PIM on water, crops and institutions |
| N=55 | | |

Table 2: Region-wise frequency of studies.

| Study region | Frequency of studies |
|--------------|----------------------|
| Kyrgyzstan | 1 |
| Turkey | 1 |
| US | 1 |
| Sri Lanka | 1 |
| Japan | 1 |
| Mexico | 1 |
| Asia | 2 |
| Pakistan | 2 |
| Thailand | 3 |
| China | 5 |
| Africa | 6 |
| India | 12 |

Table 3: Frequency of appearance of major factors leading to the rise of PIM across the world.

| Major factors leading to rise of PIM | % of the total papers |
|--------------------------------------|-----------------------|
| Government failures | 60 |
| Transfer of responsibilities | 36 |
| Donor intervention | 28 |
| Reduction in govt. expenditure | 8 |

(Participation related) and 20% (Dispute resolution) of the papers have included the indicators related to institutional set up. About 47% papers have claimed that PIM is impacted by participation by the users. Only 20% of the works have included government spending indicator. Finally, sustainability has been considered by only 20% of the papers. By sustainability, the strength of the project to sustain in the long run is checked.

The success rate

Although none of the papers have utilised all the eight indicators for assessing PIM, yet each paper used atleast three out of the eight indicators for analysis. Table 5 shows that 45% of the studies (23 papers) have reported that PIM has not been successful. Only 30% of the works have regarded the practice of PIM a success. Again 25% of the papers couldn't provide a clear view on the outcome of PIM. Considering the Region specific success rate, PIM

has been reported to be most successful in Africa, especially in the Sub Saharan region of Africa. Next it is followed by Asia, where the major part of success comes from India, China and Thailand (Sinclair, 2013; Zhang *et al.*, 2013; Zhou *et al.*, 2017).

The introduction of PIM across the globe has brought about radical changes in the irrigation scenario. While a lot many studies have assessed the PIM/ IMT yet a few provide a decisive result on its outcome or performance. This study provides a list of glitches that were encountered in the preceding works in general and the process of PIM in particular.

Works were found to be biased in favour of some regions in general and some countries in particular. For instance, in Asia India (Sinha, 2014; Shivamohan and Scott, 1994) and China have been more in focus while in Africa, the Sub Saharan region has got the maximum focus. This emerges as a hindrance in the impact assessment as region specific studies emerge as mere case studies failing universal application.

The study couldn't uncover any particular method or analysis technique that was developed by the preceding works to analyse the impact of PIM. While most of the studies did focus on the agro-economic and water related performance of the practice yet a consensus was lacking. But nevertheless, a loosely held method could be identified where the quantitative analysis used econometric techniques to measure the quantifiable indicators like crop outcome and irrigation supply while the qualitative analysis essentially involved a likert scale method to understand participation related results.

The measure of PIM's 'success' and 'failure' couldn't garner a common view or measure among the scholars. Again a bias can be traced in favour of the agro-economic conditions and econometric methods to understand the rate of success, especially among the quantitative papers. These papers have failed to focus on the more qualitative institutional aspects of the practice. The works are mostly evaluated on two factors- OandM of irrigation and recovery of user fees, but other factors like user satisfaction, water delivery, equitability of distribution and other factors related to the water delivery services remain grossly underrated. Aarnoudse *et al.* (2018) in their study of the Sub Saharan

Table 4: Identification of Various indicators utilised in the papers.

| Indicators | % of studies reporting the indicator | % of studies reporting positive impact |
|------------------------|--------------------------------------|--|
| Crop related | 45 | 51 |
| Water related | 60 | 49 |
| Awareness and training | 25 | 58 |
| Participation related | 30 | 47 |
| Water fee collection | 35 | 49 |
| Dispute reduction | 20 | 48 |
| Government spending | 20 | 57 |
| Sustainability | 15 | 25 |

Table 5: Evaluation of PIM as indicated by the papers.

| Evaluation | % of studies | Region |
|--------------|--------------|--|
| Positive | 30 | Asia (35); Africa (45%); others (20%) |
| Negative | 45 | Asia (30%); Africa (35%); Others (55%) |
| Inconclusive | 25 | Asia (35%); Africa (20%); others (25%) |

Africa have hinted at the lack of a proper evaluation scheme for WUAs that has impacted the proper monitoring of WUAs. Again only some papers have focused on the human part of this practice (Ghosh *et al.*, 2008; Fan *et al.*, 2018; Miao, 2015; Yang *et al.*, 2021). There have been attempts by Meinzen-Dick (1999) and Mungsunti and Parton (2016) to identify the traditional way of farmer managed irrigation systems that don't require external intervention. This demonstrates the inherent human tendency and capacity to form groups for resource management which needs to be highlighted in further research endeavours.

CONCLUSION

The study thus was an attempt to understand the views of the vast array of scholarly works on PIM/IMT. Though the quality of evidence as provided by the previous works impedes the authors from drawing a clear understanding of the impact of PIM/IMT, nevertheless these are invaluable sources on the practice. The study isn't a critique of the scholarly works but is just another attempt to add to the existing knowledge of works and to extract a systematic and general summary of the practice from the previous works. It also wants to add a new dimension towards analysing the rate of 'success' of PIM by celebrating the 'human' aspect of PIM/IMT. It urges a greater focus on the ability of the human enterprise in terms of the capabilities and attempts on part of the users and participants in making the practice a success. For this, the assessment of PIM may be based on the characteristics and participation of the users and their urge to form groups and participate. This may unleash further research avenues on the topic with a more 'human oriented' assessment of the practice as it is ultimately the actors at the various tiers who can behave in a way that will propel PIM towards its goal.

Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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