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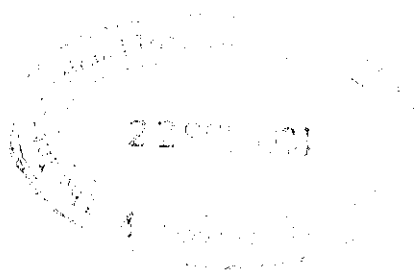
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Analytical

# Farmer Management of Groundwater Irrigation in Asia

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*Selected Papers from a South Asian Regional Workshop on  
Groundwater Farmer-Managed Irrigation Systems and  
Sustainable Groundwater Management,  
held in Dhaka, Bangladesh from 18 to 21 May 1992*



Editors: M. D. C. Abhayaratna, D. Vermillion, S. Johnson and C. Perry.

H 15148 C1



INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

# Experience of Community-Managed Tubewells in the Command of a Surface Irrigation Project

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## ABSTRACT

THE FARMERS OF an area situated in the tail end of a branch canal offtaking from the lower-middle reaches of the eastern main canal of Gandak Project, which was planned to provide surface irrigation to the western part of North Bihar, took an assertive initiative of rejecting the planned extension of canal irrigation on account of its doubtful benefits and definite damages to their area. Instead, they took the positive action of providing themselves with groundwater irrigation. They formed a registered society, named as Vaishali Area Small Farmers Association (VASFA) in 1971 charged with the responsibility of installation, operation and maintenance, and management of tubewells, the number of which grew to 36 during the course of a decade since the inception of VASFA. An experience of about two decades of the functioning of VASFA and the performance of the irrigation system provided by it indicate that VASFA was eminently successful in achieving its purpose and objective. Non-expansion of VASFA's irrigation membership, the stagnation of the number of tubewells under its management and other developments in the area indicate that the experiment of VASFA in its original form and activities is not replicable for other areas, primarily due to the change in the techno-economic context. However, the basic lessons of VASFA, i.e., adoption of an irrigation strategy appropriate to the agro-hydro-ecological regime of the area, farmers' control and management of irrigation and community initiative and action in the face of inaction or misaction of the government are universally relevant for development of sustainable and productive irrigation in North Bihar and other areas having similar socio-economic and agrohydrological conditions.

## INTRODUCTION

Nature has endowed North Bihar with extremely favorable resource factors for high agricultural production: fertile tracts of land capable of supporting multiple crops, congenial agroclimate providing an year-round growing season, ample water to satisfy all crop water requirements, sufficient manpower with skill and a longstanding tradition of agriculture. High and increasing

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population pressure on the inelastic land resources of the region and consequent encroachments in the flood plains of the rivers have led to inadvertently made interferences into the region's agroecological regime. Hence, the soil-water balance for productive agriculture has progressively deteriorated, resulting in decreasing agricultural productivity and production. Agriculture being the dominant economic activity of the region and the mainstay for the living of more than 80 percent of its people, this has led to increasing impoverishment of the teeming millions inhabiting the region, which in the past centuries was the center of prosperity in the Indian subcontinent.

It has been widely accepted that in order to realize the high agro-potential of the region, its agriculture has to be freed from the vagaries of an erratic monsoon and the soil water balance has to be effectively and sustainably restored and maintained. It was in this context that the essential role of irrigation for this humid alluvial plain was keenly perceived. Thus, two major irrigation projects, Kosi and Gandak, were implemented in the sixties and early seventies to provide irrigation to approximately 1,050,000 and 1,350,000 hectares (ha) of gross command area in the eastern part and the western part, respectively, of North Bihar.

More than two decades of experience in irrigation through these two projects have clearly brought forth a disquieting feature about their performance. While these projects, which are essentially state administered surface irrigation systems, have not achieved the envisaged outcome of increased production from irrigated agriculture, they have given rise to some adverse and counter-productive features in certain parts of their command areas. However, the initiatives and actions taken by the farmers, who were exposed to the benefits of irrigation but suffered from the inadequacy, unreliability and ill-effects of the state administered surface irrigation systems, have not only improved the performance of irrigated agriculture but also saved the systems from apathy and rejection by the adversely or indifferently affected intended beneficiaries. This paper deals with one such case study located in the command of the Eastern Gandak Canal.

## ORIGIN AND GROWTH OF A FARMER ORGANIZATION

Some farmers of an area situated in the tail ends of Vaishali Branch Canal, taking off at 558 Reduced Distance (RD) of Tirhut Main Canal (TMC), decided to organize themselves primarily in order to provide themselves with irrigation facilities. Several factors were at work to motivate the farmers toward this decision.

First, this area was inhabited preponderantly by small and marginal farmers who were incapable, financially and otherwise, of taking individual and independent actions in this matter. Second, the dreadful experience of drought which occurred twice with considerable severity in the middle- and late-sixties in most parts of the Bihar plains, including this area, and which woefully deprived them of the base of their subsistence by badly affecting agriculture, had brought forth the stark realization of the hazards of rain-fed agriculture, and consequently, of the imperativeness of protective coverage of their sole means of livelihood by irrigation. Third, programs launched under various government sponsored or government supported schemes to help agriculture in general, and to promote installation of tubewells for irrigation in particular, such as under the Freedom from Hunger Campaign, prompted the farmers to organize themselves in order to derive maximum advantage from them. And last, was the provision of inspiring leadership by a social organizer, Mr. K. D. Diwan, who acted as a catalyst with zeal and dedication in the extant situation. A registered society in the name of Vaishali Area Small Farmers Association (VASFA) was formed in 1971, the membership of which was open to small and marginal farmers of that area.

The dominant aim and activity of VASFA were installation, operation and maintenance, and management of tubewells for providing irrigation benefits, primarily, to its members and,

secondarily, to even its nonmembers. The fact that this area was imminently going to be covered by canal irrigation under the Gandak Project was no solace to the farmers of this area. Being situated in the tail end of a branch canal off-taking from the lower-middle reaches of a long main canal, the farmers knew of the uncertain benefits due to inadequacy or unreliability to which the supplies to their area will be necessarily subject, as well as of the unwelcome cost of waterlogging and loss of valuable lands which the construction and operation of canals would entail. In fact, they perceived the proposed extension of the distribution system of canal irrigation to their area as a potential threat, and one of the first things they did after formation of VASFA was to petition to the Gandak Project authorities to abandon the plan of extending the canal network to their area.

Taking advantage of technical assistance available under a few government sponsored schemes and of loan facilities offered by the banks, VASFA succeeded in installing 10 tubewells right in the first year in 1971 and another 16 in the following year. An additional 5 tubewells were installed in 1973 and a further 4 in 1975. Finally, one more tubewell was added to the VASFA managed group of tubewells in 1982, taking the total number up to 36.

This group of 36 tubewells was located in 15 villages of Vaishali and Saraiya blocks in the districts of Vaishali and Muzaffarpur, respectively. These tubewells are concentrated in three clusters which may be denominated as Vaishali Cluster having 16 tubewells, Bibipur Cluster with 13 tubewells and Madarna Cluster with 6 tubewells. The tubewells are of the sizes 10 centimeters (cm) and 15 cm with an approximately 50 meter (m) average depth of boring. They mostly have dually powered motors, diesel as well as electricity, of capacities varying from 6.5 to 8 horsepower (hp) for diesel pumps and 7.5 to 10 hp for electric pumps. The command areas of these tubewells depend upon several factors and vary from 4 ha to 18 ha. A typical command of a tubewell is illustrated in Figure 12.1. An aggregate of 317 ha is under the command of these 36 tubewells, benefitting about 780 VASFA members. The relevant details of these tubewells are given in Table 12.1.

## ORGANIZATION OF IRRIGATION THROUGH COMMUNITY TUBEWELLS

Irrigation through the group of 36 tubewells is managed through a 3-tier structure, as indicated below, under the overall stewardship of VASFA.

- i) *Tubewell Committee.* VASFA members under the command of each tubewell, numbering generally 20 to 25, constitute the Tubewell Committee and elect an honorary *Dalpati* (group leader) who heads the Committee and who is an ex-officio member of the executive committee of VASFA. He is assisted by an honorary manager/secretary who maintains all accounts and records. An operator for the tubewell is appointed by the Committee and he is paid on the basis of the running hours of the tubewell. The Committee is responsible for fixing the cropping pattern to be followed in a particular crop season, for deciding the priority in distribution of water which is generally on first-come first-served basis, for the fixation of the water rates to be charged from the beneficiaries and for the collection of charges which is done in advance.



Table 12.1. VASFA tubewells and their salient features.

Sl. number	Tubewell number	Village and block	Installation year	Construction cost		Size (cm)	Command area (ha)	Capacity of motor (hp)	
				(Rs)	(US\$)			Diesel	Electric
1	V1	Chakramdas(V)	1971	16,987	680	15	9.80	10.0	10.0
2	V2	Chakramdas(V)	1971	26,049	1,042	15	16.52	8.0	10.0
3	V3	Bania(S)	1972	15,659	626	10	10.00	-	7.5
4	V4	Bania(S)	1972	23,701	948	15	10.05	6.5	10.0
5	V5	Bania(S)	1972	15,482	619	10	7.33	6.5	-
6	V6	Bania(S)	1971	30,496	1,220	15	12.60	6.0	10.0
7	V7	Prahladpur(V)	1971	27,677	1,170	10	5.38	6.5	-
8	V8	Bania(S)	1972	21,340	854	10	6.26	6.5	7.5
9	V9	Bania(S)	1972	11,786	471	10	8.05	-	7.5
10	V10	Chakramdas(V)	1972	13,719	549	10	11.82	-	7.5
11	V11	Lalpara(S)	1972	2,012	805	10	10.10	8.0	7.5
12	V12	Chakramdas(V)	1972	8,343	334	10	5.88	6.5	-
13	V13	Ufraul(S)	1972	6,790	272	10	8.40	6.5	7.5
14	V14	Vaishali(V)	1972	4,753	190	10	7.63	-	-
15	V15	Vaishali(V)	1972	24,719	989	10	8.15	-	7.5
16	V16	Lalpara(S)	1982	7,660	306	10	2.60	5.0	-
17	M1	Madarna(V)	1971	15,456	618	15	13.10	-	10.0
18	M2	Madarna(V)	1971	14,475	579	15	6.17	6.5	-
19	M3	Madarna(V)	1973	19,160	766	10	6.87	6.5	-
20	M4	Madarna(V)	1973	17,132	685	10	5.04	6.5	-
21	M5	Haharo(V)	1973	12,905	516	10	8.18	6.5	-
22	M6	Haharo(V)	1973	17,457	698	15	12.84	6.5	7.5
23	M7	Haharo(V)	1973	15,755	630	10	3.89	6.5	7.5
24	B1	Bibipur(V)	1971	10,299	412	10	6.91	6.5	7.5
25	B2	Bibipur(V)	1971	17,623	705	15	13.48	-	10.0
26	B3	Bibipur(V)	1971	15,879	635	10	7.92	-	7.5
27	B4	Manora(V)	1971	18,840	754	15	8.83	8.0	10.0
28	B5	Afjalpur(V)	1972	16,333	653	10	8.91	6.5	7.5
29	B6	Manora(V)	1972	12,395	496	10	17.20	-	7.5
30	B7	Manpura(V)	1972	13,454	538	10	7.39	6.5	7.5
31	B8	Bibipur(V)	1972	11,370	455	10	7.52	8.0	7.5

(Continued on p. 132.)

Table 12.1 (continued).

32	B9	Bankhobi(V)	1972	17,469	699	10	1.72	8.0	7.5
33	B10	Belwar(V)	1975	17,044	682	10	12.06	-	7.5
34	B11	Belwar(V)	1975	17,131	685	15	17.86	-	7.5
35	B12	Belwar(V)	1975	12,162	487	10	6.91	6.5	7.5
36	B13	Belwar(V)	1975	11,517	461	10	4.86	-	7.5

Notes: (S) For Saraiya Block in Muzaffarpur District.

(V) For Vaishali Block in Vaishali District.

- ii) *Zonal Committee.* Each of the three clusters of tubewells constitutes a zone which elects an honorary zonal head, called *Pradhan*, who is an ex-officio vice-chairman of VASFA. The Zonal Committee helps the member farmers in the zone to get, apart from water, other agricultural inputs such as seeds, fertilizers and pesticides. It is also responsible for settling disputes that may crop up among the farmers in the zone.
- iii) *Apex Body.* An Apex Body for the management of all 36 tubewells is constituted by all Dalpatis and a few nominated members representing the bank, a cultural organization called *Vaishali Sangh* and related agencies. This body elects a chairman who, in consultation with the Dalpatis, nominate a secretary. The posts of chairman and secretary are honorary. Apart from co-ordinating the activities of the three zones, this body is responsible for planning and execution of new tubewell projects, procuring other agricultural inputs, liaising with the concerned government departments and other agencies, running the central workshop for repair and maintenance of tubewells, arranging technical assistance from the outside as well as training and employment of the members or dependents of the members.

The water rates are fixed on the basis of operation, maintenance and repair costs of the tubewell including remuneration paid to the operator as well as depreciation cost for repayment of loans. They vary from tubewell to tubewell as well as from time to time. The beneficiaries are charged on the basis of hours of operation of the tubewell to irrigate their respective plots. Charges are to be paid in advance based on the allotments of running hours. During 1991 Kharif, the water rates charged were Rs 15 (US\$0.6) and Rs 20 (US\$0.8) per running hour of the diesel pump for members and nonmembers, respectively. For electric pumps, the corresponding charges are less.

## PERFORMANCE OF THE FARMER-MANAGED IRRIGATION SYSTEM

Provision of irrigation through cooperatively owned and managed tubewells was a venture in both cooperative action as well as in rejection of what was perceived as an imposition of an inappropriate and counter-productive irrigation system. Based on the experience of about two decades, the performance of this venture can be analyzed in search of lessons to be learnt from a farmer-managed irrigation system. Such an analysis should be done on the basis of both agricultural performance as well as organizational performance.

## Agricultural Performance

The agricultural performance of this farmer-managed irrigation system can be best appraised with reference to that of the state administered and managed irrigation system prevailing in nearby areas having similar agroecological, hydrological and other relevant conditions. The VASFA Irrigation System differs from the nearby irrigation system in the following two significant ways:

- i) While the VASFA Irrigation System is based on the exclusive use of groundwater, the nearby system dominantly uses surface water distributed through canals.
- ii) In operation, each tubewell commanding a maximum area of 18 ha is independent of other tubewells in the VASFA System and hence is more responsive to the needs and requirements of the beneficiaries as it is more amenable to their control and management. The canal water supplies to the nearby counterpart areas are hydraulically subject to the supplies as well as demands in other areas of the expansive command of thousands of hectares. Also, the irrigation system providing water to these areas is administered by a hierarchical bureaucracy more bound by inflexible rules and manuals than by the demands of individual farmers.

These differences in the two irrigation systems may explain substantially, if not wholly, the following comparative performances:

- i) The cropping pattern practiced in the VASFA area is more diversified than that in the canal command areas. While in the latter, mostly cereal crops and sugarcane are grown, noncereal crops like vegetables and bananas as well as nonfood crops like tobacco are cultivated, apart from principal cereal and perennial crops, in the former.
- ii) As shown by the farm productivity and input information obtained for a few VASFA areas and a few nearby canal-irrigated areas in Laloo Chapra Command for kharif 1991, the productivity in grain output is about 1.5 times in the VASFA area while the inputs in terms of fertilizer applied and manpower employed per hectare are 2 times and 3 times higher, respectively, in the latter than in the former (see Tables 12.2 and 12.3).

Table 12.2. Sample farm productivity of VASFA area under tubewell irrigation, for kharif 1991.

Tubewells	Number of plots	Total area (ha)	Irrigation (hours)	Inputs per hectare		Outputs per hectare	
				Fertilizer (ha)	Labor (man-days)	Grain (quantity)	Fodder (quantity)
V2	3	0.691	13	70	78	28.20	13.90
V6	8	1.189	11	55	77	21.95	11.02
V11	3	0.335	42	84	128	22.40	12.40
V12	3	1.630	17	58	89	20.90	10.12
B4	17	1.709	17	74	80	27.00	14.00
B7	11	1.140	00	65	89	20.48	10.50
B11	6	0.450	17	56	78	22.20	12.11

Table 12.3. Sample farm productivity of Laloo Chapra Command, for kharif 1991

Outlet number	Number of plots	Total area (ha)	Irrigation provided (mm)		Inputs per hectare		Outputs per hectare	
			Number	Depth	(kg)*	(man-days)	Grain (quantity)	Fodder (quantity)
OL1	10	0.344	5/6	125	157+610	218	16.13	19.20
OL3	6	0.708	2	125	541+212	216	11.79	14.20
OL5	7	0.668	3	125	85+150	177	18.00	21.03
OR6	17	1.488	3	100	38+548	216	17.44	20.57

\* Quantity of urea + manure.

- iii) The long-term hydrological sustainability of tubewell irrigation is unambiguous. Running at an average of 4 hours per day, the tubewells in the VASFA area have served to maintain the water table within 0.5 m of rise or fall over the years. The same is not likely to be true in the canal command areas.

## Organizational Performance

The experience of organizational performance of the VASFA venture for the last 2 decades is interesting but mixed. There was very rapid expansion of tubewell installations under VASFA ownership and management for the first four years after it was set up, when the number rose to 35. A lone tubewell was added to the group in 1982 after a lapse of 7 years, taking the number to 36, where it has remained stagnant since then. Considering the fact that there has always been scope and a need for coverage of more and more areas under tubewell irrigation, non-expansion of VASFA membership for the purpose is somewhat intriguing. On a closer examination of the workings of the VASFA-managed tubewells, certain facts have come to light explaining this situation. One is the emergence of conflicts among the members of a tubewell committee over certain operational aspects, such as inter-sector priority in watering. Where the leadership provided by Dalpati is not effective or where management of the day-to-day working of the tubewells is not efficient, such conflicts are more liable to emerge and to remain unresolved. In such a situation, discontentment grows among the adversely affected members. Second, the Government's scheme to provide incentives and subsidies for installation of private tubewells to individual farmers has encouraged many farmers to go for their own shallow tubewells to meet their irrigation requirements, particularly in view of the fact that in the prevailing geohydrological situation, adequate discharge of good quality groundwater is assured even at low lifts. These two factors have combined to promote installation of an increasing number of private tubewells, both within as well as without the erstwhile commands of VASFA tubewells. Added to this is the emerging phenomenon of water markets which provide a viable alternative to meet the irrigation requirements in this area. This has resulted in the decline of original commands of several VASFA tubewells as well as in the stagnation of VASFA membership, which presently stands at 782.

VASFA seems to have realized that its role of promoter and facilitator of community-managed groundwater irrigation in the face of the proposed extension of the state administered canal irrigation system to the area is essentially achieved and is not poignantly relevant today. However, VASFA, as a farmers' association has a considerable role to play in protecting and promoting farmers' interests in other spheres of agriculture. Consequent to this realization, VASFA has also opened its membership, called Action Group as distinct from

Irrigation Group, to help those farmers who are not interested in getting benefits from VASFA-managed irrigation but would like to get assistance in other areas such as obtaining loans, seeds, fertilizers, etc. On this score, the membership of VASFA is increasing and is now 886.

## **SOCIOECONOMIC IMPACT**

No bench-mark socioeconomic survey of the area is available to facilitate an assessment of the socioeconomic impact of VASFA irrigation and related activities for the last two decades. However, a recent survey conducted in this area reveals certain socioeconomic features which help in understanding the performance, the successes as well as the failures of VASFA irrigation. An overwhelming number of people of this area, 94 percent of the population, engage in agriculture as their sole means of livelihood while the remaining 6 percent constitutes mainly of agricultural laborers. Therefore, this area is distinctly different from other neighboring areas where 12 percent to 40 percent of the people are engaged in other economic activities such as small businesses, government service, and other professions. Also, the caste composition of this area indicates that almost 97 percent of the population constitutes of upper caste and backward caste people whereas only 3 percent are scheduled caste people, as distinct from about 10 percent in other nearby areas. Also, this area is inhabited preponderantly by small and marginal farmers. About 50 percent of the farmers of this area own land up to 1 ha and another 48 percent own land of more than 1 ha but less than 4 ha. A negligible 1.5 percent of the farmers, as against 10 percent in the bordering areas, own more than 4 ha holdings.

These distinctive socioeconomic features of this area explain the origin and relative success of the VASFA experiment in farmer-managed irrigation systems. On analyzing the performance of each tubewell in the system, it is found that the few tubewells with farmers having bigger landholdings in the respective commands are more prone to disputes due to dominance of these farmers at the expense of smaller and marginal farmers. Otherwise, uniformity in the degree of dependence on agriculture, in landholding pattern and in caste composition have ensured identity of interests among the members and consequent success in performance of most of the tubewells in the VASFA System. This uniformity is also reflected in the income level of the farmers. While about 60 percent of the farmers in this area earn annually up to Rs 5,000 (US\$200) from agriculture, the annual agricultural income of the remaining 40 percent is within the range of Rs 5,000 (US\$200) to Rs 10,000 (US\$400). About 8 percent of the farmers earn incomes from other sources up to a maximum of Rs 5,000 (US\$200) annually. Thus, there is virtually a complete absence of people belonging to high income groups in this area.

Although this area is marked by a lack of general or even isolated affluence, it has been learnt through personal interviews that the socioeconomic condition of this area has undergone remarkably positive transformation during these two decades. There is visible and palpable improvement in the agricultural performance of this area compared to its pre-VASFA status. Out-migration of labor from this area has been almost completely arrested. On one point the farmers are emphatically unanimous; they will never like the canal system to be extended to their area.

## CONCLUSION

In conclusion, what can we say about the nature, performance and outcome of the VASFA experiment and about the feasibility as well as the desirability of its replication for other areas?

Based on the analysis presented, it can be said that VASFA essentially represented a community action, inspired by a dedicated leadership, to fulfill an apparent and demanding need to provide irrigation in order to free agriculture, the only source of subsistence in an area inhabited preponderantly by small and marginal farmers, from helpless dependence on the vagaries of the monsoons. This action was assertive in the sense that it involved deliberate rejection of an inappropriate irrigation system of doubtful benefits and potential damaging effects to this area, and was facilitated by certain positively helpful schemes in operation at the time. The VASFA action has, by and large, achieved sustainable success largely because of the socioeconomic homogeneity and consequent identity of interests of the beneficiary farmers.

Nonexpansion of the VASFA Irrigation System and membership after 1982 is only an indication of the changed context and, by no means implies a failure of the experiment. VASFA in fact seems to be aware of this change and is in the process of adapting to it by shifting its emphasis from irrigation to other agriculture related services for the benefit of its members. The eminent success of VASFA in achieving its original objectives is testified by the improving socioeconomic status of its members from a base line of abject poverty, and the continued life and vigor of the established system.

Deriving from the fact of the nonexpansion of the VASFA Irrigation System since 1982, one can certainly say that VASFA in its original form and activities, is not replicable for other areas, primarily because the change in techno-economic context that has occurred in VASFA area is true for other areas as well. However, some very useful lessons can be learnt from the VASFA experiment and experience which will be applicable for other areas, particularly to humid alluvial plains equivalent to North Bihar. They are as follows:

- i) VASFA has advocated and promoted an irrigation system that is appropriate for the agro-eco-hydrological situation of the concerned area, which was the use of ground-water for irrigation in this case. Appropriateness of irrigation strategy is the first requisite for the success of the system.
- ii) Decentralized control and management of an irrigation system helps to make irrigated agriculture more productive and remunerative. Experience of the operation of the VASFA Irrigation System indicates that private tubewells are even more desirable in this regard.
- iii) VASFA has laid stress on community initiative and action in the face of government's inaction or inappropriate action, particularly in a matter which is so critical for the life and living of the people. This lesson is, of course, not only irrigation specific but is of wider implication and applicability.

## ACKNOWLEDGMENTS

The authors wish to express their gratitude to Shri S. K. Lal, retired Chief Engineer of the Water Resources Department, Government of Bihar, for his help and guidance in the work, which has largely formed the basis of this paper. The authors also acknowledge the assistance provided by the Faculty and research personnel of the Centre for Water Resources Studies in verification and analysis of data and information which has been either incorporated or otherwise made use of in

preparing the paper. Data collected and provided by the field observers of the Water and Land Management Institute, India; field engineers of the Water Resources Department, Government of Bihar; and other related agencies under the India-IIMI Collaborative Research Programme are duly acknowledged.

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