TIRTA
Tertiary Irrigation
Technical Assistance

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Tertiary Irrigation Technical Assistance:

Lessons Learned from Proving the Concept

AIP-RURAL **LEARNING SERIES**

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Tertiary Irrigation Technical Assistance:
Lessons Learned from Proving the Concept

Fouzia Nasreen, Nasir Ahmed, Giulia Salmaso

Background

Tertiary Irrigation Technical Assistance (TIRTA) is the second largest of AIP-Rural's suite of programs. TIRTA's overarching goal is to increase incomes for smallholder farming householders in Eastern Indonesia, pioneering the market systems development approach in the irrigation sector. The program aims to facilitate private sector investments in tertiary irrigation by addressing systemic constraints which were impeding (1) private sector participation in the market, and (2) smallholder farmers from accessing high quality irrigation.

TIRTA focused on two districts of East Java – Bojonegoro and Tuban, which lie across the Bengawan Solo river. Many tertiary irrigation service providers and equipment suppliers exist in these districts, and irrigation provision to farmers is not uniform.

This case study presents evidence towards proving the project's concept, in particular how it addressed the systemic constraints in the tertiary irrigation market. It uses evidence and information compiled from primary interviews (conducted in June 2018) and from impact assessments conducted by the TIRTA's Monitoring and Results Measurement (MRM) team.

Project Concept

Evolution of the TIRTA concept

The project's concept was designed to address systemic constraints in the tertiary irrigation sector, thus stimulating behavioural change in the private sector, increasing its interest and capacity to invest in irrigation schemes and resulting in benefits for smallholder farming households in the East Java region.

TIRTA's original concept focused on collaboration between *Himpunan Petani Pemakai Air* (HIPPAs)[1] and private sector investors to enhance the provision of tertiary irrigation to smallholder farming households. According to this model, private sector (investors) pay for rehabilitating irrigation infrastructure and/or for additions to it, and provide working capital. At the same time, HIPPAs and investors agree to share other functions,

1 HIPPAs are water user farmer associations registered at the district level to provide tertiary irrigation services to farmers. They receive financial support mostly from national or district budgets.

such as the operation and maintenance of the schemes, and collection of a service fee. The assumption was that by joining the strengths of HIPPAs communal links (and infrastructure from government programs) and the business-like approach of investors, tertiary irrigation could be efficiently and sustainably managed to serve the demands of village farmers.

However, by the end of TIRTA's first year it was evident that the collaboration model was more complex than initially thought and difficult to replicate. A major problem appeared to be the weak management capacity of the HIPPAs, their slow decision-making process, and strong limitations in accessing sources of finance for their expansion. In addition, HIPPAs and private sector providers were often reluctant to collaborate, mainly because of the high perceived risk on the part of investors of hostile takeover, and the limited capacity of both parties to negotiate and secure enduring agreements. HIPPAs' inherent dependency on government subsidies also limited their ability to operate in a business-like manner. As a result, TIRTA found it impossible to establish a joint model engaging HIPPAs and the private sector, and adapted its concept to focus on facilitating private sector-led irrigation service provision.

By developing the required technical services, and providing support for improving irrigation equipment and infrastructure, TIRTA aimed to stimulate awareness and investment, and reduce private sector risk. The following diagram presents the modified business model which the program facilitated. In this model, local investors/ private entrepreneurs take on the entire responsibility of investing in equipment and infrastructure, as well as managing service provision to the farmers. To kickstart this, and in the absence of other suitable mechanisms, TIRTA supported the establishment of new irrigation schemes by providing technical support and grants to local investors. When the installation was complete and linkages created with the technical service provider, TIRTA withdrew its support.

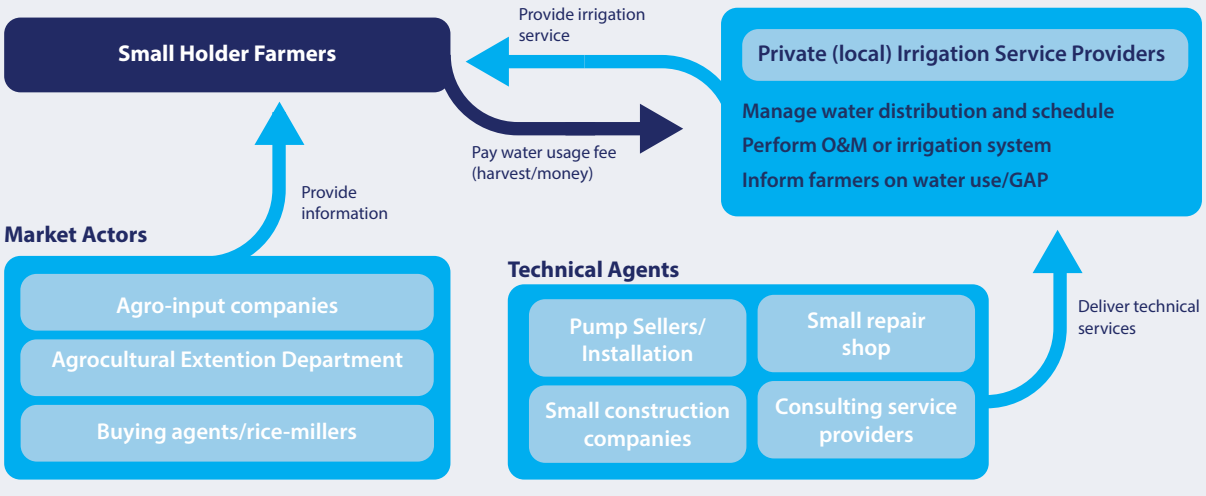
TIRTA applied a mix of intervention strategies to catalyse a private sector-led business model in the tertiary irrigation sector by addressing key systemic constraints. The intervention areas and rationale were:

- Facilitating provision for *irrigation technical assistance*. Poor irrigation system design, and operation and maintenance (O&M) remained the main factors leading to sub-optimal performance and gaps in operation of tertiary irrigation.

- Promoting *productivity enhancement* mechanisms for farmers. Integration of improved agricultural inputs and promotion of good agricultural practices (GAP) in the irrigation business model would help irrigation providers, as the profit and long-term sustainability of their irrigation businesses depended on yields (irrigation is paid for in-kind and as a share of the harvest).

- Supporting *irrigation management capacity improvement* for HIPPAs. Many HIPPAs are not functional and often fail to provide quality irrigation to farmers and/or serve only a limited number of farmers (significantly below the full irrigation system capacity).

Figure 1: Private Sector-Led Business Model In the Tertiary Irrigation Sector



Concept indicators

TIRTA's concept was tested according to two categories of indicator, measuring:

- **Progress towards systemic change**. This relates to sustainability of services promoted/facilitated by the project, such as turnover of project partners from the business; their investment in the business (beyond the amount committed under partnership agreement with TIRTA); extent of their commitment to invest again in improving/expanding the service; other investors copying the approach; satisfaction and income of farmers using the irrigation services; and business expansion plans integrating irrigation by supporting service providers such as pump producers and agro input companies.

- **Effectiveness of TIRTA approach indicators**. This relates to impact on the target group; the project's value for money (VfM) (its investment leverage); social return on investment (SROI); and investment per farming household.

Evidence Proving the TIRTA Concept

Progress towards systemic change

The following sections highlight the attributable evidence of systemic change under each of the intervention areas implemented by TIRTA.

- Facilitating provision for irrigation technical assistance

Irrigation service providers (ISPs) face the challenge of low return from the tertiary irrigation business, one of the main reasons being inefficiencies in the irrigation equipment and its set-up. TIRTA supported the introduction of consulting services through a Surabaya-based pump retail business, by (1) technical capacity development, and (2) assisting the marketing and promotion of their business offer to irrigation providers and other relevant stakeholders.

At the same time, TIRTA supported 17 private sector irrigation providers and HIPPAs to establish improved irrigation schemes, based on the assessment and recommendations of the consulting company. The ISPs included large and medium-sized entrepreneurs with various degrees of irrigation experience. The idea was to create a new service for ISPs which would assist them in the installation of effective and efficient irrigation designs and equipment, reducing O&M costs, as well as increasing the capacity of the irrigation schemes (measured by maximum hectares of land irrigated), thus increasing profits and sustainability, and potentially encouraging further investments.

Box 1: Positive uptake of services from consulting company

The consulting company provided technical recommendations to an ISP in Bojonegoro. The area this ISP covered was a difficult one for pump-lifted irrigation – far from the river and in a hilly area. By means of a pump audit and technical consultancy, the consultancy company provided the ISP with new irrigation techniques, using a high pressure main pump with no additional transfer pump. The ISP invested in new electricity installation and a high pressure pump, resulting in the irrigation 205 Ha of paddy field. This was beyond the expectations of the ISP, and those of other irrigation providers who the previous year had failed in their attempt to irrigate the area.

Realising the added value of the consultancy service, several ISPs (including HIPPAs) approached the consulting company for their services. This success story is now being used by the consultancy company to promote their service to other ISPs, including HIPPAs.

With TIRTA's support, the consulting company increased its confidence in dealing with irrigation providers, later being able to lead the negotiation and planning of an irrigation audit/expansion independently with new clients. TIRTA assessed the effectiveness of the services the consulting company provided and found that it led systematically to an increase in irrigated land. This proved the validity and appropriateness of the technical recommendations that the project had made to the ISPs[2]. In 2018, assessments of the project indicated an increasingly higher adoption rate by ISPs of the consulting company recommendations. In the same year, the consulting company conducted four new irrigation audits, developed irrigation system designs, and provided recommendations regarding water distribution network optimisation in four locations. Internal analysis shows that the ISPs have adopted 80% of the mandatory recommendations for setting up and improving their irrigation systems. They have decided on a phased approach to applying some of the recommendations, such as procuring new pumps to increase capacity, which requires considerable amount of investment.

2 Irrigation Case Studies, Gary Campbell, PT Collins Higgins Consulting, April 2018.

Signs that the consulting company is eager to adapt the business are evident. To better serve its clients, it recruited an ISP with good technical knowledge of the target location, to provide support with installation and repair. The company also integrated into their expansion plans the results of a remote sensing study[3] (conducted by TIRTA) to determine the potential land coverage of tertiary irrigation in the region. Promisingly, it has already sourced three new clients, has three more in the pipeline, and has been approached by 26 more ISPs without support from TIRTA, a clear sign of sustainability.

On the demand side, paying for consulting services was new to the ISPs. Over time, however, with TIRTA's facilitation through demonstrations, they realised the importance of the fee-based irrigation consulting service and responded positively to it. Irrigation providers have shown increasing willingness to pay for technical recommendations to improve, design and/or set up their irrigation systems. Ten ISPs were found to be paying for the consultancy services in varying degrees; in 2018, one ISP paid 100%, two provided 50% of the consultancy fees, while another provider procured a high-end pump from the consulting company, with the cost of a technical audit being embedded in the pump price. The company also received service orders from two independent irrigation providers – one ISP and one HIPPA – for technical recommendations to set up a new system and improve the existing system respectively.

3 Images for this study were produced by the Landsat 8 OLI-TIRS from NASA (National Aeronautics and Space Administration), recorded on August 15th, 2017 (the peak of the dry season). Landsat 8 OLI-TIRS was chosen because of its wide coverage area and frequent image-taking intervals, which simplify the analysis while maintaining high precision.

Conclusions

The above proves that systemic change is happening; ISPs have changed their behaviour and are adopting the new consulting service, becoming more efficient in their business as a result. At the same time, there is evidence of copying by other ISPs, and the consulting company is receiving new orders without support from TIRTA. It has realised the benefits of providing customised consulting services with the sale of its pumps and is independently investing further in expanding its business into new locations. Field observations show that 74% of farmers receiving irrigation services from the company's clients are very satisfied with the services received from ISPs, because they now receive water on time and continuously during the dry season, despite their distance from the irrigation pumps (other surveyed farmers who reported no change in service provision were located closer to the irrigation pumps and therefore receiving a good volume of water even before the intervention).

Nevertheless, although its good results mean that the consulting service is gaining traction among ISPs, further expansion and crowding-in of other similar services will take time and resources, and the magnitude of the demand may not be sufficient to send signals to the market. Recommendations of how to intensify the diffusion of the service are discussed in Section 4.

Co-investment by the irrigation consulting company amounted to AUD20,770. In addition to its commitment to TIRTA, it has invested in promotion and staff recruitment.

As a result of the intervention, the consulting company turnover was AUD136,050; turnover of those ISPs following the consultant's recommendations was AUD1,702,659.52

- Promoting mechanisms for productivity enhancement of farmers

The promotion of improved inputs and GAPs remains strategic to increasing the sustainability of irrigation businesses and ultimately encouraging further investments. As long as irrigation is paid for in-kind as a share of the harvest, incentives are high for ISPs to integrate the provision and promotion of better inputs and GAPs into their businesses. The commercial case is even stronger when ISPs are also rice millers, as the vertical integration allows them to generate higher returns from both businesses. At the same time, irrigation providers represent a key market segment which could be targeted by input suppliers, in view of the nature and size of their relationship with farmers. These business models, however, were untapped.

To address this, TIRTA partnered with two agro input companies to support a new business model of collaboration with ISPs for the promotion of quality agriculture inputs and GAPs to paddy farmers. In this model, ISPs become leverage agents for companies promoting quality agro inputs. With TIRTA's support, the two companies, through the ISPs, set up demonstration plots, farmer schools, farmer meetings and expos in different subdistricts. At the same time, the ISPs provided the input companies with a platform and linkages with farmers, thus de-risking the companies' investment and ensuring a good economic return.

Project assessments show that the integrated business model has been successful in penetrating the rice market and developing a distribution network. As a result of these linkages and the collaborative efforts between the agro input companies and the ISPs, the companies experienced a significant increase in sales in target areas. They conducted 193 promotion events in the field, of which 31 were facilitated by ISPs. During the first six months of implementing the model, one company experienced an additional turnover of IDR200.27 million (a 100% increase from the previous year); the other's additional turnover was IDR1.33 billion (a 150% increase from the previous year).

Observing the results of the new business model, a pesticide company came on board in 2018 and started collaboration with irrigation providers as a means of promoting its products in areas untapped by TIRTA's previous partners. Under the collaboration, the ISPs supported the company's activities, such as selecting demonstration plots and organising field events, by coordinating with the farmers in the area.

Seeing the benefits of the above model to farmers' productivity, ISPs also began to take on important roles as promoters, endorsers, and in some cases as retailers of quality inputs. Independently of TIRTA's support, two additional ISPs collaborated with the two agro input companies during the 2018 season, bringing the total number of ISPs supporting the companies to nine out of 17 TIRTA irrigation partners. Five of these ISPs started to operate as retailers for the input companies, not only as an additional earning source but also to ensure the timely availability of quality inputs for the farmers they serve. One achieved a turnover of IDR 26 million within one season.

Co-investment by TIRTA's two partner agro input companies amounted to AUD49,214. As a result of their collaboration with ISPs, they experienced an increase in sales of AUD418,057 by September 2018.

Conclusions

The above proves that systemic change is happening, and that agro input companies are realising the benefits of collaborating with ISPs and vice versa. The model was introduced to ensure GAPs among farmers, to off-set the risk of return on investment (as a percentage of crop produced) for the irrigation providers, who thus have an inherent incentive to collaborate with input companies. Input companies also see ISPs as 'real time agents', in that they are closest to the farmers with information on the cultivation calendar and a strong influencing factor. As rice is a sector primarily dominated by the government, private sector investment is traditionally low. However, TIRTA's intervention facilitated the willingness of input companies to invest more in the sector, simultaneously making irrigation a more attractive investment for ISPs. Assessments show that as a result of this intervention, farmer productivity increased by 28%.

- Supporting irrigation management capacity development of HIPPAs

Most HIPPAs run irrigation schemes below full capacity, meaning that fewer farmers access irrigation than the irrigation scheme could accommodate under optimal circumstances. Alongside common technical deficiencies of the irrigation infrastructure and equipment, they key constraint hampering the quality and coverage of the service is the lack of management skills needed to operate the irrigation schemes. The government gives responsibility for the major infrastructure to HIPPAs, whose staff do not receive sufficient management training to ensure they have the required capacity to run irrigation schemes properly and profitably. As a result, most HIPPAs eventually become financially weak, and often cease operation and close down due to bankruptcy.

Since the beginning of the project, TIRTA has directed some of its efforts towards supporting HIPPAs. However, it was significantly constrained by the HIPPAs' institutional shortcomings, which are beyond TIRTA's means, approach and scope. The program addressed HIPPA capacity issues by trying to integrate capacity development initiatives within the relevant public agencies mandated for these irrigation schemes. Capitalising on the interest of the Ministry of Villages (MoV) and its mandate, TIRTA took steps to support the Ministry (and its training centres) in the development of training modules to introduce irrigation business and management training, which ideally should become a prerequisite for any HIPPA wanting to obtain a government grant to start an irrigation service.

While this does not address all the inefficiencies associated with the HIPPA model, it gives HIPPAs a better opportunity to manage/improve their services. By the end of the project period, TIRTA had developed one training module, and facilitated Training of Trainers for 20 government officials from the MoV and other government agencies. The module has also been used to train members of 31 BUMDes[4] (out of 50 which applied).

Although too early to assess the training's impact, the MoV has committed AUD10,000 to provide more training during the first semester of 2019 (this, however, may not take place, considering other ministry priorities).

4 Badan Usaha Milik Desa, or Village-Owned Enterprises.

Conclusions

TIRTA made significant inroads in improving the situation of the HIPPAs by leveraging existing government agency initiatives. Its development of the training module in collaboration with the relevant agencies constituted a good start to addressing the issue sustainably. However, the module only focused on some of the more common HIPPA management issues; modules covered Entrepreneurship Skills, Technical Aspects (including identifying areas with irrigation potential), various Business Models (such as collaboration with BUMDes or the private sector), and the Development of Business Plans (to develop and run an irrigation business/service).

This means that some of the core and inherent structural issues of HIPPAs remained unaddressed, including governance, accountability and transparency. Furthermore, as the intervention was only piloted in in the last semester of the program it is difficult to assess the extent to which the government agencies will invest time and resources in the future to support HIPPA management capacity at scale.

Effectiveness of the TIRTA approach in the tertiary irrigation sector

- Impact on farming households

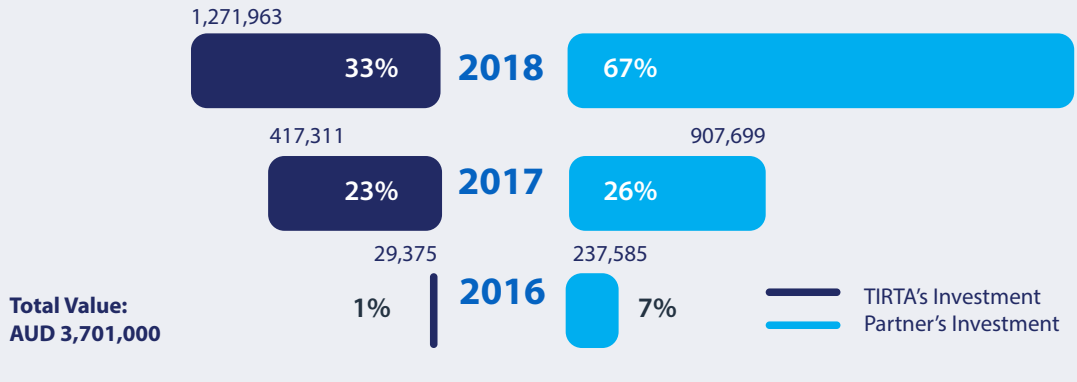
TIRTA's first intervention commenced in early 2016. Within 2.5 years of implementation the program had benefited (1) 5,550 farming households with an average net attributable income change (NAIC) of 164.75% through new or improved irrigation services, and (2) 5,844 farming households with an average NAIC of 14.78% from increased productivity (a key pre-requisite for irrigation providers to expand and sustain their service). TIRTA's outreach grew at a high compound semester growth rate of 135% over five semesters, and by December 2018, the combination of these two outreach indicators will be higher than the program's target by 3,167 farming households. An additional 600 farming households are expected to benefit from irrigation services as they complete their harvest during the first semester of 2019.

Nineteen ISPs have begun or improved their tertiary service provision to these farmers. It has become evident that access to irrigation increases farmers' productivity, especially in difficult regions like East Java. In addition, private sector-led irrigation service provision does have a business case and can operate sustainably, provided the necessary support systems are available. TIRTA interventions have addressed the systemic constraints in the sector, and as a result the ISPs and supporting private sector services have developed. However, to leverage the opportunities, diffusion of the successful models needs to happen. Section 4 presents the program's recommendations for boosting systemic change further.

- Value for money[5]

TIRTA's investment leverage shows a stable trend and gradual increase in partner investment, reaching a ratio of 2.04 in September 2018 (see Figure 2, below). This is expected to increase as partners continue with capital investment until December 2018. Through its partnership with ISPs, TIRTA contributed to developing efficient irrigation systems, in which the majority (~70%) of the investment is in physical irrigation equipment (pumps,

Figure 2: TIRTA's Investment Leverage 2016-2018

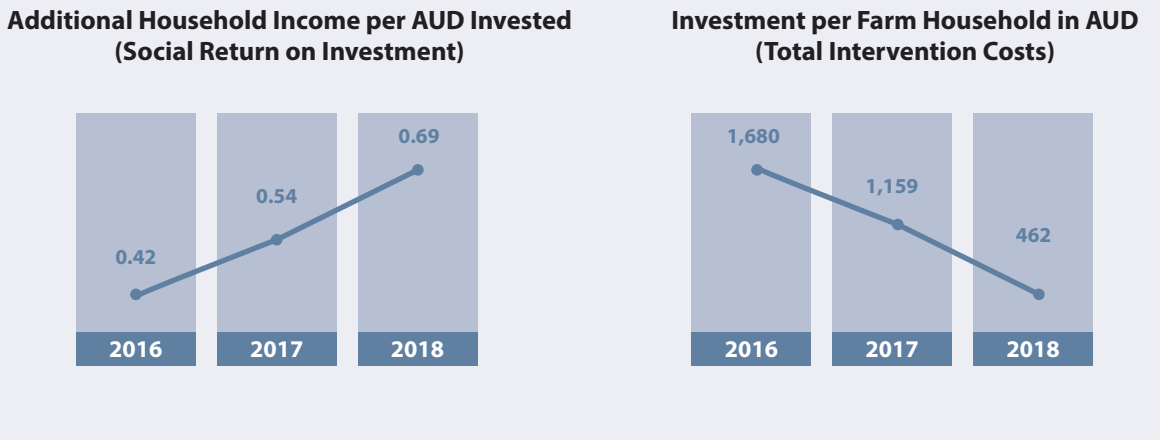


5 TIRTA Project Completion Report, October 2018.

accessories) and infrastructure (pump houses and distribution systems). As mentioned earlier, co-investment from TIRTA was essential to trigger partners' investment in the sector, starting from investment in infrastructure to supporting operational costs for providing irrigation services to farmers. The quality irrigation infrastructure invested in is conservatively estimated to last at least five years without need for major repair work, which provides a guarantee for continued delivery of quality irrigation.

Partners continue to make additional investments into expanding irrigation services, including through existing system improvement and regular maintenance. Four of TIRTA's partners have planned to invest an additional AUD136,185 to increase the capacity of the irrigation system by upgrading the infrastructure and equipment.

Figure 3: TIRTA - VfM analysis: Social Return on Investment and Investment per Farmer



As a result of TIRTA benefiting 10,746 farming households, SROI was at 0.69 by the end of December 2018. This figure will continue to rise as beneficiaries' net income increases over the coming seasons. As the majority of the farmers received new irrigation services in the second semester of 2018, using a conservatively estimated five-year time horizon until 2023 provides a more realistic measure of TIRTA's impact at the beneficiary level[6]. Assuming that farmers continue to benefit through access to quality irrigation services and are able to capture one additional harvest during the dry season, TIRTA's estimated average NAIC is AUD509.63 per farming household. After five years of implementation, TIRTA's SROI against total intervention cost will thus reach 4.16 by the end of 2023.

Investment per farming household is at AUD455.20 (including total intervention costs). Specific to the irrigation portfolio, data from 17 operational irrigation systems indicates that the total investment needed to irrigate one hectare of rice paddy ranges from AUD542 to AUD2,019, depending on the topographical constraints of the area. The value of investment in irrigation systems is much higher compared to other agricultural inputs, as water is an essential requirement for planting rice and has no input substitute. TIRTA and its partners have built irrigation systems which are considered cost-efficient compared to other types of irrigation investment across the world in a similar context, which ranges from AUD333 to AUD6,213 per hectare[7].

6 Conservative estimates by an industry expert suggest an irrigation system will continue operating efficiently for a minimum of five years, with only regular O&M costs and with no major capital investment.

7 The Partner Performance Assessment paper, Value for Money Analysis in the Tertiary Irrigation Sector states that pump-lift irrigation systems built with TIRTA facilitation are reasonably competitive compared to other types of irrigation system worldwide. Compared to pump-surface irrigation as part of a 20-acre trial (cost = AUD1,293 per Ha), the average pump-lift irrigation system is lower, at AUD1,029 per Ha.

Conclusions

TIRTA has proven effective VfM by facilitating a private sector-led tertiary irrigation sector which is benefiting a large number of farmers. The private sector has invested beyond its commitments to TIRTA, proving that it realises the benefit of the service. It also proves that investments in TIRTA interventions were made wisely and yielded the maximum return possible, given the program context of location and available resources.

Nevertheless, assessing the VfM of investing in irrigation (as opposed to other inputs and services) from a perspective of investment per farmer and SROI is currently challenging, as the vast majority of interventions have been developed in less than two years, and many have been live for only one semester.

If the localised signs of sustainability that have emerged so far (with several ISPs expanding their service and approaching the irrigation consultancy company with no program support) suggest that crowding-in is increasing and VfM improving, irrigation programs may become more expensive, and specific measured should be taken in place to ensure scale is a focus from the onset.

Lessons Learned and Ways Forward

Several of the lessons learned from TIRTA are relevant to (1) PRISMA-2, (2) existing and future initiatives in Indonesia's irrigation market, and (3) other irrigation programs globally which face similar challenges to those encountered by TIRTA. These include:

- **There is no common formula for partner selection and facilitation techniques in a thin, local (regional) market.** A thin and sub-regional market context such as private sector-led tertiary irrigation in Indonesia calls for a careful process of selecting and nurturing partners. Intensive effort is needed to choose from limited number of prospective partners (in this case, private irrigation providers) in order to form meaningful partnerships. It also requires strong facilitation support to guide partners through the initial phase of developing their capacity and implementing new business models. Withdrawal of this facilitation support needs to be a gradual process, and should only start when the partner has overcome the "behavioural block" to adopting and continuing with the business model. This requires a team with strong facilitation and creative skills to respond to a variety of unanticipated challenges in the local context.

- **Working with individual entrepreneurs poses a set of challenges which differs from those encountered when partnering with commercial enterprises.** In the context of a thin market where there are a limited number of irrigation providers, it requires time to strike a partnership deal with individual entrepreneurs, and switching to a new entrepreneur is not always a viable option. Also, the advantage of using a 'change agent' to influence an organisation's strategy is absent when dealing with individuals. Other major challenges include an entrepreneur's limited outreach coverage and financial capacity. TIRTA experienced a few instances where the irrigation provider failed to arrange the required investment in one go, and instead developed the planned irrigation system over two seasons, irrigating part of the planned expansion in one season and completing the system in the next. This also had implications for achieving the project's semester and overall outreach targets. In a context such as this, a project needs to invest significant time in developing trust and relationships, be flexible in its deal-making approach, and plan its outreach and relevant targets assiduously.

- **Demonstrated evidence of success due to adoption of technical recommendations is the most effective tool for stimulating demand of a newly introduced technical service** in a rural or semi-urban context. Market uptake for a newly introduced service such as an irrigation consultancy takes time, and acceptance gains momentum only when users of the service experience concrete evidence of success. In a semi-urban context where the process of change is sometimes slow, marketing of a novel service responds best through word-of-mouth and demonstrated evidence of value addition. TIRTA found that the irrigation consultant's offer started to resonate with irrigation providers when they observed other irrigation schemes experiencing success in terms of reduced operation costs, higher coverage, and ultimately higher returns.

- **The challenge of developing tertiary irrigation is complex and involves a combination of critical factors in addition to high capital investment.** High capital investment is just one of many complex issues arising in tertiary irrigation. Traditionally, irrigation fees are paid in kind (as a percentage of the harvest) and social norms usually discourage explicit written agreements with water users. Complicated issues which frequently arise include understanding of village administration and farmers' needs from the service provision and irrigation fee structure; irregular field boundaries or uneven topography requiring a complex distribution system; crossing farmers' land; risk of takeover when a new village administration comes into power; and water governance and availability from upstream sources. Other political economic factors include issues of trust, history, and formal and informal norms. Each of these constraints needed to be addressed separately and in coordination with the others.

- **Failing to recognise and address these socio-political factors may have significant implications for the success of a tertiary irrigation project**. There have been instances where one irrigation provider could not reach a deal on laying irrigation pipes across the fields of two villagers, resulting in failure to complete the irrigation system and start the service on time. A project therefore needs to develop 'master plans' around these kind of challenges and recognise the need to deconstruct constraints, using an adaptive and iterative approach to address them. All these factors require time and investment from the irrigation providers which results in the slow progress of their contribution to irrigation system development. This prolonged the horizons for achievement of TIRTA's outreach and impact targets.

- **Programs for tertiary irrigation should not be looked at in isolation – tertiary irrigation is an integral part of the overall irrigation system, which includes primary and secondary systems**. The sustainability of tertiary irrigation systems largely depends on upstream management of primary and secondary irrigation facilities. With several different 'layers' to the management of irrigation, overall management of performance at the farm level becomes even more challenging. With the growth of tertiary irrigation, there is also an increasing mismatch between the understanding of the demand for water at the tertiary level and the management of water resources at the primary and secondary levels. While water flow mapping by the river authority in TIRTA's working area shows that the project poses no significant risk to downstream water for ecosystems and water users, the program acknowledges that continued expansion of tertiary irrigation schemes needs better control and coordination with local authorities. TIRTA recommends that future tertiary irrigation projects include in-depth feasibility studies and thorough water management assessments during the project's design phase.

- **Heavy involvement of different government agencies in the irrigation sector makes it challenging to adopt a facilitative market systems approach**. The irrigation market at all three levels – in Indonesia, at the primary, secondary and tertiary levels – are all heavily dominated by the government. The government is solely responsible for primary and secondary level irrigation systems, including the development, management, maintenance and rehabilitation of large water infrastructure, including rivers, dams, reservoirs and canals. At the tertiary level, the government has empowered the farming community to manage their

irrigation systems; however, there is a high degree of overlap among different government organisations working in and contributing to tertiary irrigation. The Ministry of Agriculture, Ministry of Public Works, District Administration, MoV and BAPPEDA are all involved in some way in tertiary irrigation development. For example, the agriculture department is responsible for the capacity development of HIPPAs; the public works department is responsible for developing infrastructure, such as canals at tertiary level. However, in many instances the Department of Agriculture also provides hardware support to HIPPAs, creating confusion at the local level. In many villages, HIPPAs are integrated within BUMDes, who receive Dana Desa funding from the MoV. BAPPENAS and its district chapters are supposed to play a coordinating role among different agencies involved in irrigation; however, they appear confused regarding their individual responsibilities. There is also no single government authority to create an enabling environment for encouraging the growth of private irrigation provision at the tertiary level.

- **Successful facilitation is not all about grants or financial support**. Non-financial support provided by TIRTA constitutes an indispensable component of market systems development. While there is a heavy reliance on grants or financial support as an instrument to offset the initial risks of the new business model and influence the behaviour of the partner, other facilitation support provided by the progam is also critical in stimulating partner behaviour change and ensuring the partnership's success. TIRTA supported irrigation providers to obtain access to irrigation consulting services; these are critical to designing or improving efficient, cost-saving irrigation systems. Learning events, including exposure visits to successful irrigation sites, played a critical role in convincing partners to follow a proper design. TIRTA also facilitated matchmaking between irrigation providers and village heads to obtain official endorsement for the expansion of irrigation services. In addition, the introduction of local legal advisory services to ISPs allowed partners to secure their business legally against the risk of hostile takeover. As one irrigation provider testified, *"With an inter-village agreement,* [*I*] *feel more confident and safe in my investment, as there's a clear description (in the agreement) regarding the rights and obligations between the villages and me."*

- **Achieving (autonomous) scale in the tertiary irrigation market is complex**. While TIRTA's irrigation partners are continuing with their service and many have already started investing in further expansion, autonomous scale-up in other regions is complex. This can negatively impact upon VfM, especially if the program's length does not accommodate a potentially slower uptake and the inherent lengthier process needed to establish irrigation systems. To penetrate other areas of East Java, the following possible mechanisms exist:

    - **Replicate the consulting business model.** The significant learning and improvement acquired by TIRTA to date would make replication to other areas of East Java much quicker and cheaper. Success would rely on the presence of (1) a similar set of ISPs, and (2) a pump retailer with incentives and capacity.
    - **Scale-up through input companies**. Should any collaboration on improving outreach with multinational input companies prove successful in the Solo River basin, these connections may be utilised to expand this portion of the model into their other markets in East Java. However, it will still be necessary for TIRTA to seek out and build individual relationships with potential irrigation consulting firms.
    - **Leverage through pump manufacturers**. Moving upstream in the pump supply chain to find a pump manufacturer or distributor which operates over a wider geographical region (perhaps nationally) than the irrigation consulting company could prove an effective way of attaining more rapid expansion than through replication of the irrigation consulting model. It is likely to be helpful if the link is with a manufacturer of the types of pump which have proved popular with ISPs to date, and which has a network of retailers consisting of regional actors who can fulfil the irrigation consulting role.
    - **Promote dual roles of traders/ISPs**. On the demand side, large rice millers may have sufficient embedded incentives through to the farmer level to be interested in persuading their local trader network to act as ISPs, or to approach existing ISPs to act as traders. Other actors who could assist in improving diffusion mechanisms may include regional or national leasing firms (if the leasing model proves successful). Further investigation is needed to explore this possibility.
    - **Develop mechanisms for access to finance**. An important aspect of the tertiary business model is that it requires a high upfront investment. For scaling up and enhancing sustainability, the provision of finance for start-up ISPs is key to new private entrepreneurs to crowd-in. Other mechanisms, such as leasing of pumps and equipment, and joint investment by two or more ISPs, may be explored. Similar financial products/mechanisms may be developed to support HIPPAs to operate efficiently.

TIRTA

Tertiary Irrigation
Technical Assistance

Jl. Margorejo Indah I Blok A-535
Surabaya 60238, Indonesia

P. +62 31 842 0473
F. +62 31 842 0461

www.aip-prisma.or.id