**TIRTA** Tertiary Irrigation Technical Assistance



## SURVEY REPORT 1: EXISTING PUMP-LIFT IRRIGATION SERVICES AND POTENTIAL FOR EXPANSION

Main Report: Summary of Key Findings and Analysis

# Tertiary Irrigation Technical Assistance

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### ABSTRACT

Pump-lift irrigation schemes in Bojonegoro, Tuban, and Lamongan Districts are dominantly private sector and community investments and are currently serving 22,000 ha of paddy fields. Service providers and farmers are seeking expansion of services coverage. Villages report an indicative expansion potential of 6,600 ha. Expansion will need irrigation water to be conveyed further inland and across village borders. For this to become more attractive to providers and customers, ways will need to be found to improve efficiencies, reduce risk, and share costs.

## **EXECUTIVE SUMMARY**

TIRTA aims to improve the incomes of 10,000 small-holder farmers, by at least 60% by 2018. The programme is designed to achieve this in accordance with the M4P approach: namely by addressing the underlying constraints to the private-sector expansion of irrigation services. This can be effectively achieved if 3,500 ha of non-irrigated land is brought under irrigation. To this end, TIRTA will operate in three provinces: East Java, West Nusa Tenggara and East Nusa Tenggara, focusing on pump-lift irrigation in three districts of the Lower Bengawan Solo in East Java.

TIRTA conducted a two-staged survey to enable the team to develop a thorough understanding of the current pump-lift irrigation service market. Stage 1 identified potential sites for irrigation services expansion; Stage 2, identified and assessed the actors and stakeholders in the market. Together, these reports inform the identification of entry points, and the design of TIRTA's opening portfolio of interventions. This is the Stage 1 Report.

#### The current irrigation service market

**TIRTAs focus area is a 195 km stretch of the Bengawan Solo** which passes through 175 villages (desa), in the three districts. Here 279 pump stations – mainly private sector or community managed - serve around 22,000 ha of paddy fields. Over 60% of the river bank length and most of the pump-stations are in Bojonegoro. Pump-lift irrigation services typically reach 1-1.5 km inward from the river bank, and can penetrate up to 4km where the flood plain is relatively flat.

**Irrigation services are charged as a proportion of the yield of crop grown on the irrigated field** – typically 20% (15-25%). All providers are expected to contribute 10% of their net revenue to the village account through a donation which is used as a social fund, for repairs and to finance potential takeover of irrigation services from private entrepreneurs.

The survey revealed 66 villages with a total of 6,600 ha expansion potential. Most fields in these expansion areas are rain dependent paddy fields and produce one paddy crop annually, in some cases followed by a seasonal non-paddy crop (palawija). Access to irrigation will allow farmers on this land to grow 1-2 extra crops per year.

There are two dominant types of service providers: the entrepreneur/investor and community organisations. Other entities manage less than 10% of the stations. Entrepreneurs are often rice millers and provide the irrigation services not only for the financial profit obtained directly from the service fee, but also for increasing paddy supply to their mill; they are usually bound by formal agreements with the desa. Entrepreneurs are acquainted with operating machinery and with managing staff; have access to finance; have clear business motives (rather than social objectives); and are 'outsiders' for the community they serve, which makes them less vulnerable to pressure from their customers.

**Community organisations are a part of the desa** and are devoted to serving the common interest of the villagers in a not-for-profit manner. Initially, community organisations lack much of this, therefore, entrepreneur/investors are often in a much better position than community organisations to establish a new irrigation scheme – as such entrepreneurs are often the pioneers. However community organisations are often more persistent; socially motivated to serve as many fellow villagers, as effectively and as cheaply as possible; and may call upon their members to make voluntary contributions for the community's interest.

**Irrigation providers face serious investment risks** and this limits their appetite for expanding their services. An important one for entrepreneurs is the threat of being 'kicked out' and replaced by another entrepreneur or get 'taken-over' by the local community, before their contract ends. This is often motivated by a perception of high charges by private providers, or low service quality. A take-over usually occurs once irrigation infrastructure is in place and regular water distribution has been established. As a result entrepreneurs are reluctant to invest in large schemes and community organisation, and entrepreneur-provided services, differ remarkably in average service area: 105 ha versus 57 ha respectively.

**The Government has a number of roles and responsibilities related to pump-lift irrigation.** The Agriculture Service (Dinas Pertanian) and the Agriculture Extension Agency (Badan Penyuluhan Pertanian)

support irrigation at the basic level of the desa or tertiary unit while Public Works support irrigation at the higher level. Pump-lift irrigation schemes generally fall in this category and do not feature in the list of State assets. The Bojonegoro Administration has a substantial agenda for supporting paddy production and this includes development of a number of multi-desa pump-lift irrigation schemes. The Agriculture Service has the lead role. Where a scheme covers parts of several desa, Public Works has responsibility for the establishment of the Water Users' Association Federation.

**The Bengawan Solo is an inter-provincial river.** The central government's river basin organisation, 'Balai Besar Wilayah Sungai Bengawan Solo', manages the river basin. Water allocations are reviewed quarterly in the basin's council/stakeholder forum. The water balance includes an allocation for maintaining a minimum environmental flow to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Commercial businesses, such as industries, are required to obtain a permit from the Balai Besar in order to be allowed to use the river's water. So far, pump-lift irrigation stations have been exempted from the need to apply for a permit.

**The Government broadly welcomes pump-lift irrigation schemes.** While more sympathetic towards community organisations as provider - because the service costs to the farmers is lower – government recognises that it is difficult for communities to develop the capacity they need to fulfil this role. They are keen to learn from new private sector service provider models.

Among the **environmental concerns** relating to the Bengawan Solo, the most relevant are **land degradation** (mainly upstream), **flooding** (which destroys pump stations and the crop, jeopardizing payments to service providers); **water pollution** from industry and agriculture (textiles, food processing & agrochemicals) and **water diversions** in the dry season.

#### Constraints to expansion of pump-lift irrigation services

It will be TIRTA's task to catalyse the expansion process by helping the market develop capacity for dealing with, or removing constraints effectively. These include: **low efficiencies** and high real and **perceived risk**; lack of access to **financing**; physical (such as roads, railways, river/canals, residential areas); **Desa borders** pose serious institutional obstacles too as they may block developments from neighbouring desa. Also while diversification into non-paddy crops affords an opportunity to expand it poses a considerable risk for smallholders.

#### **Intervention Opportunities**

The survey has revealed that most of the expansion potential is in Kabupaten Bojonegoro. The 66 potential expansion blocks identified vary in size from a few hectares to 700 ha. At first glance, large blocks look more attractive as candidates for intervention but would be riskier to take on (technically, financially, socially, and local-politically) and will likely require a long lead-time. Small expansion blocks look unattractive because of high project transaction costs and relatively low development returns. However, at the early stage of TIRTA such small blocks could offer welcome learning and demonstration opportunities. Medium size blocks (25-100 ha) form a compromise. TIRTA therefore would do well by combining expansion blocks of various sizes in its first batch of case-specific interventions.

Analysis of survey results identified the following ideas for developing interventions:

#### A. Cross-cutting interventions: These address common constraints, and have the advantage of being scalable.

- Reducing risk: Reducing the financial risk will strengthen the entrepreneur's appetite in expanding their business. E.g. through crop insurance; cost-sharing infrastructure development with communities; developing co-financing mechanisms with the Dana Desa; and introducing more robust and transparent agreements, perhaps through access to affordable legal aid/mediation.
- Improvement of access to financing: Community organisations find it difficult to borrow money as they lack business acumen and business planning capacity. TIRTA could help local financing organisations developing a better understanding of the business of irrigation services; develop appropriate procedures for loan applications; and provide training to potential applicants.
- 3. *Improvement of pump station and canal efficiencies*: Realising the maximum potential for expansion of irrigation services will require demonstration that it is technically and economically feasible to irrigate fields at higher elevations. TIRTA could promote the establishment of a demonstration unit/service and other

information conduits to assess and show the technical possibility and economic gains from managing pumping and conveyance better.

- 4. Introduction of non-paddy crops and drip/sprinkler irrigation: The higher the water needs to be lifted and the further its needs to be transported in order to reach a field, the higher the cost of the service. Non-paddy crops consume considerably less water than paddy. TIRTA could promote development of a pump-lift irrigation services model for non-paddy crops with drip or sprinkler irrigation.
- 5. *Crossing desa borders*: TIRTA can use existing schemes with cross-desa-border services as demonstration units, to provide other communities with examples. TIRTA could invite/identify and engage all communities that face this challenge and launch an intervention specifically directed to helping them solve this issue.
- 6. Crossing roads and railways: There might be a huge potential for expansion of irrigation services if more irrigation canals could cross national highway No 20. TIRTA could engage all communities and service providers interested in expanding irrigation services to the other side of the road and launch an intervention specifically directed to helping solve this issue.
- 7. Liaising with local government and building capacity: The Bojonegoro Administration has planned establishment of a number of large pump-lift irrigation schemes, each covering some 5-7 desa, but struggles with implementation. TIRTA could offer local government assistance in developing its capacity for carrying out programs for development of pump-lift irrigation.
- B. Case-specific interventions:
- 8. Establishment of a new scheme: Where a local community has no or very little experience with managing pump-lift irrigation services, it tends to be strongly reluctant to establish a new irrigation scheme because of various risks and the financing challenge. In such cases, TIRTA may consider advising the local community to contract an entrepreneur/investor and provide guidance on how to do this best. Entrepreneur/investors are quite capable of assessing and managing the risks and finding the necessary financial resources, and interested in expanding their business.
- 9. *Expansion of an existing scheme, managed by a local community*: TIRTA may offer advice and assistance to the local community organisation with overcoming obstacles to expansion, such as technical solutions, co- financing and working out agreements with a neighbouring community.
- 10. Expansion of an existing scheme, managed by an entrepreneur/investor who is reluctant to undertake the expansion: TIRTA may assist the local community and the entrepreneur in researching and developing a business case for expansion.

## **1.** INTRODUCTION<sup>1</sup>

1

Upon completion (December 2018), TIRTA is expected to have improved the incomes of 10,000 small-holder farmers, by at least 60%. TIRTA is designed to achieve this in accordance with the M4P approach, namely by developing incentives for private sector initiatives in expansion of irrigation services. Assuming an average land holding per farmer of 0.35 ha, the above target would be achieved if 3,500 ha of non-irrigated land would have been brought under irrigation. TIRTA will operate in three provinces: East Java, West Nusa Tenggara and East Nusa Tenggara. In its first 18 months, TIRTA's operational focus will be on the expansion of pump-lift irrigation services along the Lower Bengawan Solo in three of East Java Province's Districts: Bojonegoro, Tuban, and Lamongan.

The Management Contractor's team for TIRTA commenced its work on 22 July 2015, setting out to develop over the first six months a thorough understanding of the current pump-lift irrigation services market in the above focus area, through a survey in two stages. The first stage concerns the identification of the most potential sites for irrigation services expansion; the second, an assessment of stakeholders in irrigation services expansion. This report covers the first stage.

**Stage 1** was completed in September - October 2015 and inventorised (i) all existing pump-lift irrigation services, recording the location of pump stations, the coverage, and the governance/management arrangement, and (ii) any perceived potential for expansion of pump-lift irrigation services. The pump stations were photographed and their GPS-recorded locations were plotted on an internet-based map. The map and photos can be visited via the following links.

Map : <u>https://www.google.com/maps/d/u/0/edit?mid=zEHQUP2Muvec.kzh9OZI17uvc</u>

Photo's : <u>http://www.panoramio.com/user/8843658</u>

During stage 1 interviews, the TIRTA team made acquaintance with numerous market actors who provided additional snippets of information. These snippets have been used to sketch an initial picture of the market, as presented in the Sections 2 to 5. An analysis of the data and information identified the obstacles that currently slow down or even block the pump-lift irrigation services' expansion process (Section 6). Finally, Section 8 presents recommendations for the development of a strategy for TIRTA for speeding up the expansion process.

For ease of reading, the numbers/figures presented in this Main Report are round offs of the survey results.

#### Figure 1: Map of the Bengawan Solo River Basin





Figure 2: Map of TIRTA's Operational Area along the Lower Bengawan Solo, East Java Province

#### Figure 3: Map of the Bojonegoro District with Administrative Division



Figure 4: Map showing the locations of pump stations along the Lower Bengawan Solo

(NB: Due to scaling, this Google map shows only 25% of the markers)



## 2. EXISTING SERVICES: 22,000 HA

The operational focus area for TIRTA's first 18 months covers a 195 km section of the Bengawan Solo, (Java's longest river) passing along 175 villages (desa), belonging to three kabupaten (districts): Bojonegoro, Tuban, and Lamongan. The survey covered 174 of these villages and counted there 279 pump stations, jointly serving ca 22,000 ha. Nearly all these pump stations are private sector or community investments.

#### The Bengawan Solo River Basin

The Bengawan Solo River is the longest river on the island of Java. It drains a watershed area of around 16,100 km2, discharging into the Java Sea to the north of Surabaya, after travelling about 600 km from the Sewu mountain ranges to the south south-west of Surakarta.

The Bengawan Solo River basin is geographically divided into an Upper Basin, with two sub-basins, namely the Upper Solo River Basin of 6,072 km2 in the West and the Madiun River Basin of 3,755 km2 in the East. The Lower Basin starts at Ngawi and has a river length of 300 km to its outfall and a drainage area of 6,273 km2

Nearly 2/3rd of the 390 km of left and right riverbank belongs to Bojonegoro, while Tuban and Lamongan cover slightly less than 1/5th each. It is therefore unsurprising that most of the pump stations are in Bojonegoro: 169 (2/3rd) of the total number of pump stations, while Tuban and Lamongan have around 1/5th each. However, only 40% (nearly 9,000 ha) of the total service area is found in Bojonegoro, while Tuban and Lamongan cover circa 30% each, meaning that at average the service area of the stations in Bojonegoro is substantially smaller than those in Tuban and Lamongan. Figure 1 and Figure 2 show the river basin and TIRTA's operational focus area.

Pump-lift irrigation services are provided by (i) entrepreneur/investors; (ii) community organisations, such as HIPPA, BUMDES, and Kelompok Tani; (iii) hybrids of (i) and (ii); (iv) individual farmers; and (v) Government. The first two models are the most common and the most significant in terms of service area coverage, and Section 4 discusses these in more detail

The current service model focuses solely on supporting paddy cultivation. Indications are that it developed first in the 1970s, in Tuban, probably near the border with Lamongan, and underwent a gradual development process, allowing it to cover fields situated further upstream along the river and further away from the river bank. Pump-lift irrigation services typically reach 1-1.5 km land inward from the river bank, and where the flood plain is relatively flat, up to 3-4 km. Nowadays, almost all paddy fields within this zone – as long as water can be brought there easily - are covered by one or another pump-lift irrigation service.

Irrigation service charges are agreed as a proportion of the yield – typically an entrepreneur/investor charges 1/5th and for more costly to service fields, 1/4th, while a community organisation may charge 1/5th to 1/7th. Some providers collect their fee in kind by actually harvesting a part of the crop on each field, others auction this right to a third party, and some collect cash on site when the farmer sells his harvest to a buyer.

Further from the river, adjourning some of the schemes, tiny to small (typically 1-2 ha, maximum 5 ha) groundwater pump schemes exist. The completion in 2012 of the barrage 'Bojonegoro', just upstream of Bojonegoro Town (see Figure 1), resulted in a higher water level in the river and a substantially higher ground water table. In response, the number of groundwater schemes in this part of the basin has multiplied. Customers of these services pay typically 1/3 of their harvest for this service, making it an expensive one.

The pump-lift irrigation services have always formed an important source of income for the village (desa) account, which is used for supporting poor and sick residents; for repairing small infrastructure works in the desa; or for building up a fund that will allow the desa to take over the irrigation services from the entrepreneur. Providers, be they community organisations or entrepreneur/investors, are expected to contribute 10% of their net revenue to the desa account through a donation. Key elements in a services contract with an entrepreneur/investor are not only the fees customers will pay, but also the contribution which the

entrepreneur/investor will make to the Desa account. However, for a number of years now, desa have received a substantial annual budget from Kabupaten to invest in desa infrastructure. While this makes the desa income from the irrigation service relatively less important, this does not reduce in anyway the enormous significance of irrigation services to the farmers in the desa.

## 3. EXPANSION POTENTIAL: 6,600 HA

Of the 174 surveyed desa, 66 reported potential for service expansion 'within reach' totalling 6,600 ha, which would be equivalent to a 30% increase relative to the current service coverage<sup>2</sup>. If the average size of land holding of a small holder is 0.35 ha (as per the TIRTA Design Document, 2014), full development of this potential would mean that 18,000-19,000 small holders would be able to raise their income.

These reported expansion blocks are usually adjourning currently served areas, but generally further from the river, and at higher elevations. Most fields in these potential expansion areas are rain dependent and produce one paddy crop annually, in some cases followed by a seasonal non-paddy crop (palawija). Seasonal rainfall varies from year to year and so do yield levels at these fields. When this land comes under irrigation, the farmers would be able to achieve an income increase of 60% easily, because they would produce at least two paddy crops, and three where the land is not flood prone. For a comparison of net production values of irrigated and not-irrigated paddy fields, see the Stage 2 report.

By far most of the reported potential expansion area is found in Bojonegoro: nearly 2/3rd (4,100 ha), while Tuban and Lamongan reported respectively 11% (700 ha) and 27% (1,800 ha). The three kecamatan in Bojonegoro with the largest potential for expansion are (see Figure 3):

- a. Kalitidu : 1,186 ha (9 blocks, varying from 6 to 450 ha)
- b. Malo : 890 ha (12 blocks, varying from 10 to 700 ha)
- c. Kanor : 725 ha (2 blocks, 225 and 500 ha)

Kecamatan Malo and the western part of Kecamatan Kalitidu are situated upstream of Bojonegoro barrage, within its zone of influence. The resulting higher water level in the concerned river section provides an important supportive condition for pump-lift irrigation. Kecamatan Kanor is on the border of the influence zone of Babat barrage, and enjoys somewhat supportive conditions, similar to but probably less pronounced than Kalitidu.

The TIRTA team categorised the blocks according to size, considering that this is a key indicator for efficient use of resources as well as complexity of arrangements.

#### 3.1 VERY LARGE BLOCKS (>=250 HA SOCIAL INCLUSION)

- 1. The largest potential expansion blocks, those with an area of 250 ha or larger, cover jointly 2,420 ha, which is 37% of the total reported potential for expansion. There are 6 such blocks, located in four subdistricts:
  - a. Kliteh (700 ha) in Malo Sub-district (District Bojonegoro)
  - b. Gedongarum (500 ha) in Kanor (District Bojonegoro);
  - c. Leran (450 ha) and Cengungklung (250 ha) in Kalitidu Sub-district (District Bojonegoro); and
  - d. Brangsi (270 ha) and Pelangwot (250 ha) in Laren (District Lamongan).
- 2. The 4 blocks located in Bojonegoro cover jointly 1,900 ha or nearly 80% of the total area of large blocks.
- In all six blocks, the current irrigation services provider is a community organisation: 1x BUMDES, 2x HIPPA and 3x Kelompok Tani.
- 4. In 2 of the 6 blocks, irrigation services expansion would be into one or more adjourning villages, thus

### 3.2 LARGE BLOCKS (>=100 HA BUT <250HA)

- 1. There are eighteen 'large blocks' with a size between 100 ha and 250 ha.
- 2. They cover jointly 2,489 ha, which is 38% of the total reported potential for expansion.
- 3. Of these, 9 blocks are located in Bojonegoro and cover jointly 1,205 ha or 48% of the total area of large blocks. Two blocks are in Tuban, covering 200 ha (8%), and 7 are in Lamongan, totalling 1,084 ha (44%).
- 4. In 6 of the above 18 blocks (33%), irrigation services expansion would be crossing village boundaries. This is a high percentage compared to the current percentage of about 1 in 10 pump stations serving across desa boundaries (see Annex: Technical Report, Section on Management

<sup>2</sup> 

This concerns interviewee-reported potential for expansion and likely includes over- and underestimates.

### 3.3 MEDIUM SIZE BLOCKS (>=25 & <100 HA)

- 1. There are 26 blocks of medium size between 25 ha and 100 ha.
- 2. They jointly cover 1,513 ha (23% of total potential) and have an average size of (1,513/26=) 58 ha.
- 3. Of these 26, 14 blocks are located in Bojonegoro and cover jointly 850 ha or 56% of the total area of large blocks. Nine blocks are in Tuban, covering 503 ha (33%), and 3 are in Lamongan, totalling 160 ha (11%).
- 4. Of these, 9 (33%) will serve across desa boundaries, 5 in Bojonegoro, 3 in Tuban, and 1 in Lamongan.

#### 3.4 SMALL BLOCKS (<25 HA)

- 1. Among the reported potential expansion areas are 16 blocks of less than 25 hectares.
- 2. They jointly cover 180 ha, or (180/6,602=) 3% of total potential, thus at average (160/16=) 10 ha.
- 3. In 11 of the 16 small blocks (63%) irrigation services expansion would be across village boundaries.

This is an important finding as it suggests that there is interest in small expansions across desa boundaries. Because such small expansions would likely not require costly technical solutions, this suggests that the institutional and management aspect of serving across desa boundaries might pose the main challenge.

## 4. PROVIDERS: ENTREPRENEUR/INVESTORS AND COMMUNITY ORGANISATIONS

There are two dominant types of service providers. The first type is the entrepreneur/investor, either engaged by a desa under a multi-year service contract, or providing services directly to farmer communities, without such a contract. The second type is the community organisation (desa-based organisations such as HIPPA, BumDes, Kelompok Tani). Other entities manage less than 10% of the stations.

Community organisation-provided services are slightly fewer in number of pump stations (total 123; HIPPA manage 101 stations, BUMDES 10, Kelompok Tani 12), but cover a much larger area (12,868 ha) than entrepreneur/investor -provided services (131 pump stations; 7,410 ha). This data reveals that community organisation-provided services and entrepreneur-provided services differ remarkably in average service areas: 105 ha versus 57 ha respectively.



Figure 5: Community organisation- and Entrepreneur-managed pump stations

Striking is that of all entrepreneur/investor-provided services (in terms of the pump stations managed by them) in the surveyed area, 89% is located in Kabupaten Bojonegoro. Within Bojonegoro, entrepreneur/investors-provided services indeed make up the majority: 69% of all services, against community organisations providing 21% of the services (the balance is by others). In Tuban and Lamongan it is the other way around: community organisation-provided services dominate with 82% and 78%, while entrepreneur-managed stations are few and make up for 17% and 10% respectively. These numbers most likely reflect the general trend where schemes originally established by entrepreneurs get taken over by a local community organisation. The schemes in Tuban and Lamongan are the oldest and most mature schemes, while those in Bojonegoro are the youngest.

The following sections compare the two principal management models

#### 4.1 THE ENTREPRENEUR/INVESTOR-SERVICES PROVIDER

Entrepreneur/investors often are rice millers and provide the irrigation service not only for the financial profit obtained directly from the service fee, but also for increasing paddy supply to their mill. In general, these entrepreneurs are not residents of the villages where they operate and thus for the local community 'outsiders'. In principle, they are expected (definitely as a matter of 'good manners') to establish an agreement with the local community organisation, with approval by the head of village, before they can operate. In its most formal shape, such an agreement is a multi-year contract, registered at/by a solicitor. There is a dynamic irrigation services market with a high degree of competition amongst entrepreneur/investors for contracts. Entrepreneur/investors may have operational agreements with more than just one village.

The theoretical standard process to obtain a (multi-year) contract is for an entrepreneur/investor to respond to an invitation to tender from a village's farmer community, represented by the board of its HIPPA (Desa-based Water Users' Association), or BUMDes (Desa-owned Enterprise), or Kelompok Tani (multiple Farmers Groups per Desa). Interested entrepreneur/investors present their offers in front of the board (and other members of the group), which then will select the one they prefer. The board signs the contract and the Head of Desa signs as witness.

The strengths of the entrepreneur/investors are:

- 1. Being acquainted with operating machinery and engines and managing staff
- 2. Having access to capital, be it own capital or borrowed
- 3. Having relationships with the desa and customers based on business principles of profit and loss (rather than social objectives), and
- 4. Residing elsewhere makes them less exposed to social pressure from their customer/community members

However, a serious and principal weakness is their vulnerability to the desa leadership's governance and associated dependence on a personal relationship with the head of desa. Within the desa boundaries, the power of a head of desa is very strong and usually much stronger than that of the outsider/business man. This has repercussions for the service agreement, as explained below. Other 'weaknesses' are that (i) their service is being regarded as expensive due to the relatively high fee they charge in comparison to the fees community organisations tend to charge; (ii) their reluctance to cover fields that are relatively costly to serve; and (iii) exposure to farmers requiring compensation where his canals run over their land.

#### 4.2 THE COMMUNITY ORGANISATION-SERVICES PROVIDER

Contrary to this, service-providing community organisations are part of the desa and are devoted to serving the common interest of the villagers in a not-for-profit manner. They are socially 'insiders', which has advantages and disadvantages. Their strengths are:

- 1. Continuity: being part of the wider desa administration and often members of its elite, their existence is rarely under threat
- 2. Being motivated to serve its members against the lowest fee possible, they will charge a lower fee than providers do
- 3. Being motivated to serve as many as possible of its members, they always seek to expand their services, probably even to fields where the 'profit margin' (fee collected minus cost of service) is negative (as long as it is balanced by positive income from other fields)
- 4. They can call upon their members to make voluntary contributions and/or make sacrifices for the community's interest, for example for allowing a canal to be constructed over their land

Its weaknesses form a particularly serious obstacle where it concerns the new establishment of an irrigation scheme:

- 1. Alien to organisational management and running machines
- 2. Lack of access to capital
- 3. High exposure to social pressure by community members: if they disappoint fellow desa members this will have repercussions for their social status.

The following sections expand on these differences.

#### 4.3 COMMUNITIES PREFER COMMUNITY ORGANISATION-PROVIDED SERVICES

The survey found from interviews that in general, communities prefer community organisation-provided services. Interviewees complained generally that entrepreneur-provided services are expensive, while some mentioned that they are inadequate in quality and that entrepreneurs are reluctant to expand their service area to include the more remote and higher land in the desa.

#### 4.4 ENTREPRENEUR/INVESTORS ARE THE PIONEERS

On the other hand, entrepreneur/investors have been and are indispensable for any new establishment of irrigation services. Community organisations of desa without irrigation services tend to decline taking on responsibility for investment and operation. They feel uncertain because of lack of experience in managing such services; the financial risk; social pressure to charge a lower fee than entrepreneurs do, and possible social repercussions in case of failure. Therefore, desa prefer/feel forced to contract an entrepreneur/investor for providing an irrigation service where previously there was none. Entrepreneur/investor providers have experience in these fields and are quite able to assess costs and risks. Based on several decennia of precedence, the market has come to accept their fee.

### 4.5 CROSSING DESA BORDERS

For a desa-based community organisation it is difficult to expand its service across the desa border, into a neighbouring desa, because (i) it has no authority there, (ii) its own constituents will worry about whether the cost and risks will be shared appropriately; and (iii) the neighbouring village finds it difficult to accept paying a higher fee for the service than charged to the farmers in the village where the station is located. Nevertheless a number of community organisation was found that had solved the issues and provided cross-border services.

For entrepreneurs, the above issues would not exist and they therefore face fewer administrative/political barriers to expanding services across desa boundaries. However, the survey found that the number of entrepreneur-managed pump-stations are fewer than community organisation managed stations serving across a desa border. This is because most entrepreneurs prefer to keep their service area close to the river, and thus smaller, thereby avoiding heavy investment in canals and the associated risk of losing this investment if their contract is ended before these costs are recovered.

#### 4.6 COMMUNITY TAKE-OVER FROM ENTREPRENEUR/INVESTOR

Entrepreneur/investors face serious investment risks and this limits their appetite for expanding their services. A primary risk is that they may get 'kicked out' and replaced by another entrepreneur or get 'taken-over', before their contract ends, notwithstanding the written agreement they have with the desa or community organisation. Indeed, the general pattern is that after a number of years, dissatisfaction among the desa leaders and/or community with the service sets in and a feeling emerges that – with the irrigation infrastructure in place and the water distribution pattern established – it should be possible to make a take-over, and subsequently reduce the fee and expand the service area to those who had hitherto been excluded from the services.

A positive approach by which entrepreneurs can avoid early take-over is by 'exemplary performance' and maintaining good relations with the community (example case: Sudarwadji, having one scheme that he has gradually expanded to now serve parts of 4 desa). Some entrepreneurs try to mitigate the risk of a take-over by including a huge fine in the agreement, to be paid by the desa or community organisation in case of an early end to the relation (example case: Desa Sukoharjo). Other entrepreneurs prefer to enter 'under the radar' by approaching a group of farmers directly and relying on a verbal agreement with them, rather than going for a formal agreement with the desa. For further detail on Sudarwadji and other entrepreneur/investors, see the Stage 2 Report/Annex: Technical Report/Lampiran 4.

### 4.7 THE SERVICES EXPANSION WAVE: FROM DOWNSTREAM TO UPSTREAM

Many of the entrepreneurs now operating in Kabupaten Bojonegoro, originally operated in Tuban only. The fact that there are so few community organisation-provided services in Bojonegoro implies that pump-lift irrigation services there are still relatively new and hence local community capacity to run schemes is still low.

This is easy to clarify, namely from the phenomenon that pump-lift height tends to be larger, the further upstream a pump station is established. A larger lift means a higher cost of pumping. Under conditions of level fees (i.e. where the fee has been effectively set by providers closer to source), entrepreneurs thus prefer to offer their services downstream. However, as downstream communities take over their schemes, offering their services to upstream schemes becomes relatively more attractive for entrepreneurs.

## 5. GOVERNMENT ROLES, CAPACITY, AND PERCEPTIONS

The Government has a number of roles and responsibilities related to pump-lift irrigation. The main ones are (i) public management and direct provision of irrigation services; (ii) public management and direct development of the river basin's water resources and distribution of bulk water; and (iii) public management of agriculture production and direct provision of agriculture extension. These are discussed briefly below, with more detailed information presented in the report of survey stage 2.

### 5.1 GOVERNMENT IRRIGATION SERVICES

Two administrative sectors have mandates with regard to irrigation: Agriculture and Public Works. These mandates are slightly overlapping, due to practical difficulties in defining limitations. At the basic level (desa level or tertiary unit level), the Agriculture Service (Dinas Pertanian) and the Agriculture Extension Agency (Badan Penyuluhan Pertanian) have the mandate to support irrigation: its technology (water diversion from the source, water distribution, and field water management); its organisational management (such as management by a farmers' group or water users' association); and its infrastructure development (construction of new canals, and their repair and rehabilitation). Larger irrigation systems, defined as either systems with a service area exceeding 150 ha; systems comprising more than one tertiary unit; or systems covering parts of more than one desa, Public Works has the mandate of supporting irrigation.

Within Public Works, responsibilities are distributed over three level of administration. The District level is responsible for state-owned irrigation schemes serving an area up to 1,000 ha; the province level for scheme between 1,000 and 3,000 ha, and the national level for schemes exceeding 3,000 ha.

The Agriculture Service is the most important agency for pump-lift irrigation schemes, because they are generally fall in the category of 'community irrigation systems' and do not feature in the list of State assets, managed my Public Works, and Public Works does not have resources for supporting the O&M of the schemes. Because they are generally smaller than 1,000 ha – they belong to the oversight-responsibility of the District Administration.

The Bojonegoro Administration has a substantial agenda for supporting paddy production and concrete targets to be achieved. This includes development of a number of multi-desa pump-lift irrigation schemes. The Agriculture Service is in the lead role, but is crop production technology focused and does not have much institutionalised capacity to support irrigation. Public work does have such capacity, but – as explained above - does not have much of a mandate in supporting irrigation in community systems. However, where a scheme covers parts of several desa, Public Works would typically have the responsibility to support the establishment of the Water Users' Association Federation.

### 5.2 RIVER BASIN MANAGEMENT

The Bengawan Solo is an inter-provincial river. The central government's river basin organisation, 'Balai Besar Wilayah Sungai Bengawan Solo', manages the river basin. District administrations should formally apply to the Balai Besar for any additional water allocation needed to support expansion of pump-lift irrigation services in their area. Such applications will be reviewed from the perspective of the overall water balance and presented for comments to the basin's stakeholder forum: Tim Koordinasi Pengelolaan Sumber Daya Air. The water balance includes an allocation for maintaining a minimum environmental flow to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems.

Commercial businesses, such as industries, are required to obtain a permit from the Balai Besar in order to be allowed to use the river's water. So far, pump-lift irrigation stations have been exempted from the need to apply for a permit.

#### 5.3 GOVERNMENT PERCEPTIONS WITH REGARD TO PUMP-LIFT IRRIGATION

The Ministry of Public Works/Balai Besar Wilayah Sungai Bengawan Solo stated that government-provided irrigation services (conventional gravity irrigation services, using a weir to divert water from a river) reach many

but not all farming communities and mentioned that the Government welcomes pump-lift irrigation schemes as a suitable complement to these. Indeed, several decades ago, the government made substantial contributions to the development of pump-lift irrigation. Upon completion in 1981 of the Wonogiri Dam and Reservoir, a Public Works project constructed 20 pump-lift irrigation stations along the Lower Bengawan Solo. In 1993, the project rehabilitated these stations and added 13 new ones. All stations were handed over to the local HIPPA. Some of these stations are still operating, while others have fallen in disrepair.

While more sympathetic towards the model with a community organisation as provider - because the service costs to the farmers is lower – government recognises that community-organisations find it difficult to develop the capacity they need to fulfil this role. Where this is case, the market-based model with an entrepreneur/investor as provider provides a solution, as long as all parties are happy with the arrangement. In addition, now that the government is promoting stronger private sector investment in infrastructure services provision, the entrepreneur/investor model offers an interesting example from which government would like to learn for possible future application to (conventional) irrigation services.

## 6. Environmental Impact Considerations

From interviews with government agencies and a quick search on the WWW the following environmental concerns relating to the Bengawan Solo were identified:

### 6.1 INFRASTRUCTURE WORKS<sup>3</sup>

Expansion of pump-lift irrigation schemes does not involve the building of structures in the riverbed. With few exceptions, the pump stations are semi-permanent structures, sitting on the inner slope of the river bank. To avoid becoming damaged, the installations are removed from their position prior to the onset of the flood season, generally December, and re-installed in March-April. Service areas are at average less than 100 ha and do (so far) not exceed 500 ha and, therefore, canals are of small size, typically with a width of 1-1.5 m and lined.

### 6.2 WATER DIVERSIONS

Peak water demand is during land preparation and a station would typically divert in the order of 0.8-1.2 l/s per ha of served area from its source. Thus, for the current service area of 22,000 ha, the total diversion would be about 22 m3/s and an expansion with 6,600 ha would raise this with about 1/3 to 28-29 m3/s. During most months of the year, river discharge exceeds this by far, but during the peak of the dry season river flow tends to become quite small and nears total water demand along the river. However, over the coming 10 years water availability during the dry season will improve substantially as a result of ongoing and planned infrastructure works that will increase the water storage capacity in the basin.

The survey included an effort to find out whether expansion of pump-lift irrigation services would face any water availability issues. The central government's river basin operator, (Perum) Jasa Tirta 1, which is in charge of all bulk water distribution in the basin, expressed concerns, mentioning that during the peak of the dry season, water availability in the Upper Basin (upstream of Ngawi) is critical and various demands are competing with each other. The irrigation management agency of Bojonegoro District Administration stated that there is no need to worry about water availability for pump-lift irrigation in the Bojonegoro-Tuban area, which is downstream of Ngawi. Indeed, the survey observed in September-November, the driest months of the year, when the flow in the Bengawan Solo was at a very low level, that the pump stations, then serving the planting of the second paddy crop, were operating without experiencing any difficulty. The year 2015 was an extremely dry year due to the strong influence of the prevailing El Nino.

With regard to the need for government permits for extracting water from the river, the River Basin Organisation (Balai Besar Wilayah Sungai Bengawan Solo) explained that commercial businesses, such as industries need such a permit but that so far pump-lift irrigation stations have been exempted. Jasa Tirta 1 suggested, though, that there needed to be a register of pump stations and area served, so that it could better calculate the needed water allocation.

### 6.3 PUMP TYPE

Nowadays, more and more pumps are driven by electromotors because diesel engines are cumbersome, require continuous attention, and are therefore expensive to operate. Environmentally, this is a positive development, because diesel engines' exhaust pollutes the air and lubricant oil is often spilled. In addition, the engines operated along the river often do not use the standard diesel fuel, but rather locally pumped up oil which has undergone a rudimentary household-industry-type refinement and is much cheaper: about half the price.

<sup>&</sup>lt;sup>3</sup> An Environmental Impact Assessment for TIRTA is scheduled for early 2016

### 6.4 FLOODING

Floods in the Bengawan Solo form a serious threat to the pump-lift irrigation service. Floods not only destroy pump stations, but also the paddy crop. When the crop is destroyed, there is nothing the service provider can collect as payment.

#### 6.5 LAND DEGRADATION

The one concern most frequently referred to is the degradation of the catchment area, which refers to the area where the river emerges, upstream of the Wonogiri Reservoir.

#### 6.6 WATER POLLUTION

Another concern is water pollution as a result of waste and wastewater being dumped into the river by factories located along its banks in upstream Surakarta and Karanganyar regencies<sup>4</sup>. The two regencies are home to dozens of textile factories as well as some 300 other plants that produce chemicals, monosodium glutamate and pesticides, in addition to a number of batik factories that release chlorine and dyes into the river. Some researches (2003) encountered high concentrations of heavy metals like lead, cadmium and copper in rice irrigated with water from the Bengawan Solo River. No references were found to nitrate concentrations and biotope conservation.

#### 6.7 SAND MINING

Illegal sand mining thrives in Bojonegoro and Tuban regencies, threatening the stability of the river banks and of bridge and bank protection foundations and cause high turbidity<sup>5</sup>.

#### 6.8 PROTECTED AREAS AND HERITAGE SITES

BAPEDAL, the environment protection agency of Bojonegoro District advised that there are no established protected areas and heritage sites in the operational focus area.

<sup>&</sup>lt;sup>4</sup> http://westjavawater.blogspot.co.id/2004/10/bengawan-solo-water-unsafe-for.html

<sup>&</sup>lt;sup>5</sup> http://en.tempo.co/read/news/2014/06/17/055585574/Illegal-Sand-Mining-Thrives-Again-in-Bengawan-Solo

### 7. OBSTACLES TO EXPANSION OF PUMP-LIFT IRRIGATION SERVICES

There are limits in terms of what is technically, financially, managerial, economically, and organisationally possible. Expansion of services faces numerous obstacles and is currently at best a slow process, as discussed in the following sections. It will be TIRTA's task to speed up the expansion process by helping the market develop capacity for dealing with, or removing the obstacles effectively.

#### 7.1 EFFICIENCIES AND RISKS

The primary challenge to expansion of services is in the economics of the operation. Where fields are further away from the river and at a higher elevation than a provider has so far been used to serve, there is a perception of risk and a reluctance to invest. This is unsurprising because cost and risk increase exponentially with the distance over which water needs to be transported. The factors underpinning the risk perception are discussed, as follows:

Firstly, a larger service area requires more water to be pumped from the river and to higher elevations, which increases the cost per volume of water provided to the expansion area higher. Secondly, the service provider has to fully finance the operational expenditures until the crop's harvest, which exposes him to further risk because his revenue is linked to the value of the harvest, which is in turn uncertain due to weather, pests and diseases, especially in an unproven area. Thirdly, the main contributor to the cost of expansion is the cost of constructing canals, rather than the pumps or engines. As canals are fixed assets these are sunk costs that cannot be recovered if the entrepreneur/investor is 'dismissed' early in his contract – something the survey found is not a rare occurrence. Finally, the longer an irrigation canal is, the more difficult distribution is and the larger the chance on blockages and breakages. This threatens the technical efficiency and the unit cost of the operation.

Given the above, a provider may regard a fee of 1/4th of the yield too low to cover the cost (and risk) of serving any more remote and higher fields. On the other hand, a higher fee will cut into the farmer's production margins. Farmers paying a fee of 1/3rd of their harvest for groundwater irrigation service suggests that there is flexibility to accommodate a higher fee.

Implicit to the above is that considerable further expansion of services coverage will require (i) improvement of efficiencies in the pump-lift and conveyance systems and (ii) reduction of business risks.

#### 7.2 FINANCING INVESTMENT AND OPERATIONAL COSTS

In general, entrepreneur/investors have adequate access to resources to finance the initial establishment of a new scheme and subsequent expansion. However, they tend to prefer a gradual development process and limit their ultimate operation to a manageable size.

Conversely, community organisations lack such access to resources and find it difficult to build up adequate capital, not only for establishment of a new scheme, but also for a subsequent expansion. They are reluctant to take a loan and banks are reluctant to offer a loan to them.

### 7.3 PHYSICAL OBSTACLES

Physical obstacles, such as a road, a railway, a river/canal, or a residential area pose case-specific challenges to expansion. In the case of road and railway crossings, overcoming these obstacles requires high cost infrastructure investments. An example of such an obstacle is the national road 20 section between Babat Town, Bojonegoro Town, and Ngawi. Providing a number of additional crossings for irrigation water in this road will make it possible for service providers to bring several hundreds of hectares under irrigation. Establishing these crossings will require high-level government agency action.

### 7.4 INSTITUTIONAL OBSTACLES

There are also administrative/organisational/institutional obstacles in the form of desa borders. These pose a serious obstacle to community organisation providers, more so than to entrepreneurs (see below). For community organisations to overcome these requires establishment of an arrangement with a neighbouring desa on sharing the burden of responsibilities and the benefits. Notwithstanding that, the survey encountered various cases of community organisation and entrepreneur/investor service providers having succeeded in crossing a desa border, and these could serve as role models for others

### 7.5 CHALLENGES TO INTRODUCTION OF NON-PADDY CROPS

Paddy cultivation requires lots of water. An obvious way to reduce the cost of irrigation to crop production would be to plant a non-paddy crop. However, this is easier said than done. The paddy production and trading system is highly developed: farmers have mastered the production technology; where irrigation services are adequate, yields are high and stable; the market offers all needed cultivation labour and other inputs; and the buyers of the crop are plenty and offer a good price.

For non-paddy crops this is not automatically so and typically irrigation is on demand and the fee paid in cash (Rp100,000 per 2,000 m2). An example of a promising non-paddy endeavour is the vegetable production area in Desa Tulungrejo. It has no problem selling its produce and prospects for raising sales are good, and the market wants to see a more regular supply. A less fortunate case is the star-fruit (belimbing) production area in Desa Ngringinrejo, Kecamatan Kalitidu (Bojonegoro). Producers struggle to find buyers for their quality produce. Hence, diversifying into non-paddy crops represents an interesting business opportunity as well as a considerable risk for smallholder farmers.

## 8. INTERVENTION CONSIDERATIONS AND OPPORTUNITIES FOR TIRTA

An analysis of the information above identified the following building stones for developing a strategy for TIRTA's interventions.

#### 8.1 ENTREPRENEURS IN THE EXPANSION VANGUARD

Community organisations are strongly reluctant to establish a new irrigation scheme, mainly because they are unsure that they will be successful, while the consequences of failure are serious. They are happy, though, to take over the provision of irrigation services from an entrepreneur, after service provision has stabilised and community members have come to accept the system - which may take about 10 years. They are also happy, after take over, to lower the service fee and to expand the service coverage to include as many paddy fields as possible. Entrepreneurs have a stronger business view and are reluctant to expand their services to areas where considerable investment in canal extension is required and/or where the cost of service to them is high, relative to the fee they can charge.

TIRTA will therefore need to take this into consideration for new schemes where the local community has no or very little experience with managing pump-lift irrigation services. Guidance, will need to be given towards assessing their management capacity and where necessary assisting the local community to contract an entrepreneur/investor. For this to be successful, TIRTA may need also to convince government of the suitability of this solution. For the entrepreneur to want to make the investment and for the community to get a good deal, a reduction of risk would be helpful (see below).

Where the expansion concerns an existing scheme managed by a local community, TIRTA's role will be one of advising and assisting the local community organisation in overcoming any obstacles, such as financing of the investment and working out agreements with a neighbouring community.

While in cases where an intervention is concerned with expansion of service coverage in a scheme being managed by an entrepreneur who is reluctant to expand his service, TIRTA may assist the local community and the entrepreneur in developing the business case for expansion.

Where a community wishes to take over the services provision from the entrepreneur and subsequently expand the service, TIRTA may assist the local community and the entrepreneur in sorting out the necessary arrangements.

#### 8.2 REDUCING RISKS

The pump-lift irrigation services business combines a high level of investment (canals, the pump station, fuel/electricity) with a high risk of incurring considerable losses. This factor is particularly important for entrepreneurs and holds them back from expanding their service area, and is likely the main reason for entrepreneur-managed schemes comprising only around 50% in size of community organisation-managed schemes. As explained above, costs and risks increase exponentially with distance from the pump station. The overall risk comprises a series of other underlying -risks:

- a. crop failure due to the weather, floods, crop pests and disease (this potentially causes by far the largest financial loss to the service provider)
- b. serious damage to the service infrastructure (pump station and canals) due to a flood
- c. early ending by the community of the services agreement: any investment in canals (fixed assets) are sunk costs and compensation by the community for this loss is uncertain
- d. corruption by his employees (e.g. by selling part of the fuel for running the engines to a third party)
- e. uncertainty about permits

Mitigating the above risks will strengthen the entrepreneur's appetite in expanding existing services and establishing new service schemes. It may also create possibilities for the community to negotiate a lower fee. However, each of these in turn requires other market system actors improving their performance. Accordingly, TIRTA could explore the following options:

- integrating into the agreement the obligation of the farmers to take crop insurance (see the detailed report of stage 2)
- making local communities responsible for establishing the canal network or for paying back within an agreed period the cost of any canals constructed and/or access to the power grid electrical power established by the entrepreneur (e.g. in the form of an add-on to the agreed service fee)
- helping communities to get some of the needed canals financed from Dana Desa
- helping communities to get some of the needed canals build by the Agriculture Service through JIDES program
- promoting better quality agreements (clarity and fairness), clear procedures for conflict resolution and claiming of damages, properly legalised, with adequate enforceability, and affordable legal aid

#### 8.3 IMPROVEMENT OF PUMP STATION EFFICIENCIES

The economic performance of pump stations in terms of their use of energy for lifting water from the river into the canal system cost of service is of enormous importance for the loss and profit account of the service provider. Pumps typically have an optimum suction height and operating pumps under conditions of a larger suction height is particularly energy inefficient and even harmful to the pump. Therefore, stations should have multiple operation platforms, making it possible for the pumps to be moved to a lower platform when water level has dropped remarkably. It was observed, though, that most pump stations are kept at the same level throughout the season, leading to inefficiencies and high operating costs per unit.

A very large potential for expansion of irrigation services will emerge when it can be demonstrated that it is profitable for fee-charging service providers and fee-paying farmers to irrigated fields at higher elevations than currently is regarded as the limit. Efficient pump operation will be a precondition for achieving such profitability.

TIRTA could therefore promote the establishment of a demonstration unit/service and other information conduits to assess and show the economic gain in managing suction height better.

#### 8.4 IMPROVEMENT OF ACCESS TO FINANCING

Community organisations find it difficult to borrow money. The first challenge is to overcome the fear that something will go wrong, for example a flood destroys the pump station and the crop. A second one is the need to provide adequate loan-guarantee assets. And a third is to submit a good quality business plan. TIRTA could help local financing organisations developing a better understanding of the business of irrigation services; develop appropriate procedures for loan application; and provide training to potential applicants.

#### 8.5 IMPROVEMENT OF CANAL NETWORK AND WATER DISTRIBUTION EFFICIENCIES

Because of the high cost of pumping, the efficiency of water conveyance and distribution in pump-lift irrigation schemes is much higher than in conventional gravity schemes. However, it is likely that further efficiency improvements are possible.

TIRTA could promote establishment of a demonstration unit to assess and show the economic gain in preventing canals from losing water because of percolation and cracks by using flexible lining materials, such as geotextiles.

#### 8.6 INTRODUCTION OF NON-PADDY CROPS AND DRIP/SPRINKLER IRRIGATION

The pump-lift irrigation services model along the Bengawan Solo is geared to serving paddy production systems. The fee is charged as a proportion of the harvest and providers are also paddy millers/traders. Paddy production uses lots of water. The higher the water needs to be lifted and the further its needs to be transported in order to reach a field, the higher the cost of the service. Non-paddy crops consume considerably less water. The survey encountered two areas where non-paddy crops are irrigated and water users pay a fee in cash for the service, before/upon delivery of the water. The irrigation is traditional, using small canals and basins, which is not so efficient.

TIRTA could promote development of a pump-lift irrigation services model for non-paddy crops with drip or sprinkler irrigation. The model would be most useful for application at fields at high elevation. It is important, though, for the farmers to make sure that there is a good market for the non-paddy crop they plan to grow. TIRTA (or perhaps PRISMA) may offer assistance in researching this.

Development of this model would need establishment of a demonstration unit to assess and show the feasibility.

### 8.7 CROSSING DESA BORDERS

The survey encountered various cases of communities which would like to see irrigation services being provided in their neighbouring desa expand into their area. This would then require canals to cross the desa boundary. If the provider of the irrigation services in the neighbouring desa is a community organisation, this usually means that an agreement needs to be established on sharing responsibilities, costs, and benefits between the two communities. The survey found several community organisation and entrepreneur service providers who have succeeded in crossing a desa border.

TIRTA can use the existing cross-border schemes as demonstration units, to provide communities aspiring to establish cross border services with examples from which they can then develop their own arrangement. TIRTA could invite/identify and engage all communities that face this challenge and launch an intervention specifically directed to helping them solve this issue.

### 8.8 CROSSING ROADS AND RAILWAYS

Field observations and satellite images suggest that there might be a huge potential for expansion of irrigation services if only it were possible for irrigation canals to cross national highway No 20's section between Babat Town, Bojonegoro Town, and Ngawi, and the railway adjourning to it.

TIRTA could invite/identify and engage all related communities and service providers interested in expanding irrigation services to the other side of the road and launch an intervention specifically directed to helping solve this issue. The matter would be brought to the attention of Public Works Directorate of Irrigation and Swamps, Jakarta, for follow up with the Directorate General 'Binamarga'.

### 8.9 INITIAL FOCUS ON BOJONEGORO

The survey has revealed that most of the expansion potential is in Kabupaten Bojonegoro. There is therefore much to say for TIRTA to start its first batches of interventions in Kabupaten Bojonegoro. This will provide a stronger focus to the team, reduce the need of liaising with agencies to those of just one district. Being based in Bojonegoro Town, this arrangement will save time and cost.

### 8.10 LIAISING WITH LOCAL GOVERNMENT AND BUILDING CAPACITY

The Bojonegoro Administration has a substantial agenda for supporting paddy production and concrete targets to be achieved. This includes the establishment of a number of large pump-lift irrigation schemes, each covering some 5-7 desa. However, capacity for carrying out pump-lift irrigation programmes effectively is only at an early stage of its development. The Agriculture Service is in the lead role, but is crop production technology-focused and has not yet developed much institutional capacity to support irrigation. Public Works does have capacity, but this is geared to conventional gravity irrigation systems and not to pump-lift irrigation. Furthermore, Public Works does not have a mandate (and thus no budget) for supporting irrigation in community systems.

TIRTA could offer the local government assistance in developing its capacity for carrying out programs for development of pump-lift irrigation. This could include a presentation of TIRTA's survey findings, a series of visits to existing pump stations, workshops for discussing observations, drawing conclusions, recommending any desirable modifications to planned programs, and developing and evaluating feasibility studies.

#### 8.11 CONSIDERATIONS IN REGARD OF SIZE OF EXPANSION BLOCKS

#### 8.11.1 VERY LARGE BLOCKS (>=250 HA) AND LARGE BLOCKS (100-250 HA)

The survey identified 6 potential very large expansion blocks and 18 large expansion blocks. At first glance, large expansion blocks look more attractive as candidates for intervention than small ones, among others because they seem to promise (i) a big contribution to achievement of the target within a short time period; and thus (ii) efficiency in TIRTA-resources use. However, it needs to be realised that especially very large blocks are likely much slower to develop than smaller ones due to complexity of arrangements and larger financing. In addition, some of them feature already in government programs and plans as future development targets, with implications for TIRTA's role, approach, methodology, pace of development (positives and negatives). It will likely require a lot of lead-time (organisational arrangements) before concrete technical actions can be undertaken and more time before results show and success can be confirmed; and are perhaps more riskier to take on, not only from a technical (much higher infrastructure capacities) and a financial point of view (much higher costs may be required than initially estimated), but also from a socially and local-politically view point (more difficult to reach and maintain agreement on all arrangements).

#### 8.11.2 SMALL BLOCKS (<25 HA)

Small expansion blocks look unattractive as candidates for intervention, mainly because each intervention will not contribute much to the achievement of TIRTA's target, while still requiring substantial effort, not in the least in terms of intervention logistics. However, it needs to be realised that especially at the early stage of TIRTA such small blocks may offer welcome (='learning') opportunities. Small blocks – if careful chosen – may offer relatively safe (low risk) possibilities to quickly demonstrate the positives of TIRTA and establish a good name, drawing the interest of other potential expansion blocks in participating.

#### 8.11.3 MEDIUM SIZE BLOCKS (25-100 HA)

Naturally, these form a compromise between the two above and combine the strong and weak point listed above in lesser strengths.

## 9. NEXT STEPS

The TIRTA Team's Updated Mobilisation Plan August 2015 projects an outreach achievement of 250 smallholders by the end of month 12 (June-July 2016). Assuming a (low) success rate in the first year of 33%, and an average land-holding of 0.35 ha, this means that the team should set out to facilitate a combined expansion of 263 ha. In year 1, the interventions will be case-focused, and the resulting expansions will form a basis for subsequent scale-ups and a set of more market-wide interventions.

Stage 1 of the survey (September-November) has provided the team with a thorough insight into the reality of the pump-lift services market in the project area. Based on this, the team envisages to follow the line of action in the table below.

No	Description	Indicative timing	
		(status on 11/02/2016)	
1.	Initial selection of 8 to 10 most promising from among the 66 villages	15/12/2015	
	which reported interest in and potential for expansion of irrigation	(completed, see Stage 2	
	services	report)	
	Based on Stage 1 findings, consider the need to		
	(a) produce a number of concrete expansions quickly, targeting 250-300 ha to be		
	brought under irrigation by June/July 2016: demonstrating positive impact will help		
	interest		
	(b) start early with facilitating a number of larger and more complex expansion		
	initiatives: while they will need more time for interventions to produce results, they		
	are area-wise essential for achieving the outreach target		
	(c) gain experience with different types of service providers: entrepreneur/investors		
	(d) test and demonstrate viable systems for production of irrigated non-paddy crops:		
	this is likely the best solution for small-holders cultivating land that is further away		
	from the river and at a higher level		
	(e) early on develop traction in District Bojonegoro, where most of the expansion		
2	potential is	21/01/2016	
Ζ.	selected blocks	SI/UI/2010	
	SEIECLED DIOCKS	(completed, see Stage 2	
2	Develop adaguate initial capacity for designing interventions	10/02/2016	
5.	Engage Dremark to provide capacity building	10/02/2016	
		(completed, see planning	
		workshop reporting and	
		immediate follow up work)	
4.	Prepare preliminary intervention designs	20/02/2015	
	Analyse for each of the above blocks what specifically the constraints, and their underlying causes to expansion are list the interventions that would beln the	(ongoing)	
	expansion happen, identify resources requirement and possible intervention		
	partners		
5.	Decide which blocks to approach for participation in year 1 and what	29/02/2015	
	interventions to undertake		
	Develop a set of criteria and critically evaluate the feasibility of each block.		
	Decide interventions.		
	Verify government has no objections, even endorses the plans	15/02/2015	
6.	Approach key stakenolders (communities, service providers, village	15/03/2015	
	leaders) and partners; make offers; and complete deals		

	Engage Promark for additional capacity building.	
7.	Implement the first season of the first batch interventions, monitor,	01/04-30/06
	re-assess, and adapt where necessary/useful	
	Have the MRM systems well-established	
8.	Review intervention season 1; plan for season 2; update strategies	15/07/2016

NB: The first part of this action plan has meanwhile been completed under Stage 2 of the survey (November – December 2015).