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Working Paper
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HANDPUMP DEVELOPMENT

General aspects

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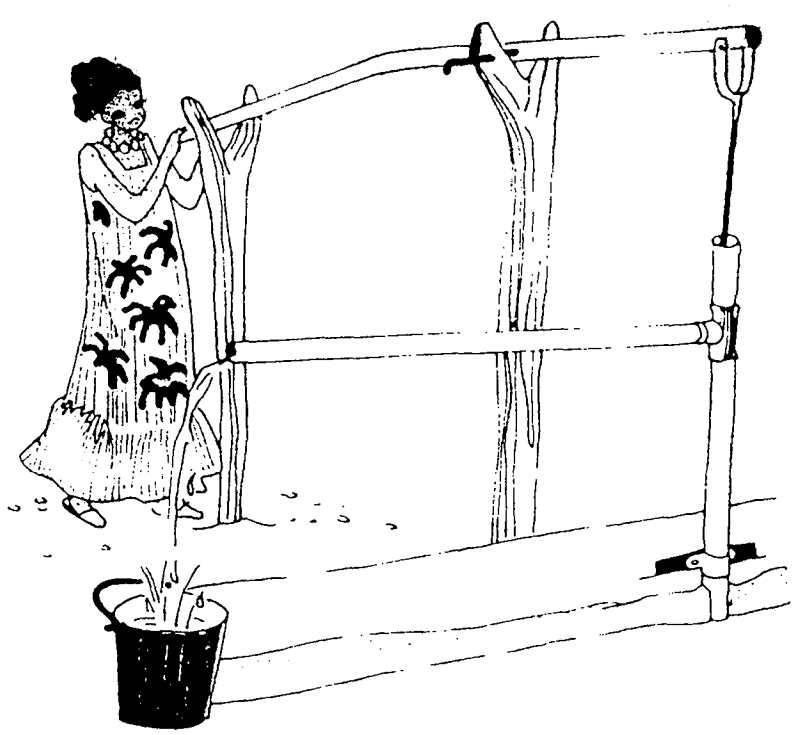

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1) Introduction

All persons involved in rural water supply programmes, the ~~installation~~ and the maintenance of handpumps will sooner or later discover (or already know):

THE IDEAL HANDPUMP DOES NOT (YET) EXIST.

A fact which was substantiated by the extensive UNDP/World Bank Handpump field- and laboratory testing.

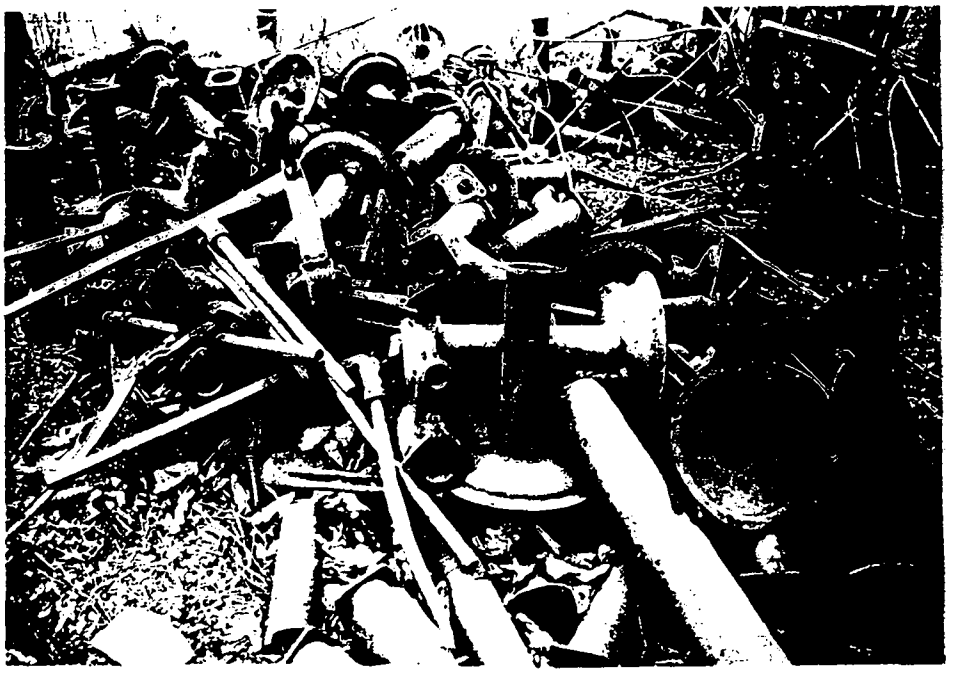

FIG 1 WATER SUPPLY PROGRAMME GHANA

Handpump graveyards give evidence of the various problems encountered. It is frustrating for the water supply programmes to be faced the reality that the one item which costs the least creates the biggest problems. A borehole costs 10 - 20 times the price of the handpump. Once the borehole is drilled, lined, the yield and the waterquality is proven it will last for a very long time without any maintenance.

But the device to pump the water up is very vulnerable, breaks down every few months,requires constant maintenance and repair and despite of all this, will corrode it-self to pieces within a few years.

And all this in the age when men fly to the moon and back with no apparent hassle!

It is now only too understandable that one gets frustrated about this and would like to use one's experiences to remedy the situation. The problems are known and very often one also has concrete ideas how to solve them. So what is nearer than to start developing a new handpump.

At first, all effort is concentrated in producing one or a few prototypes. And normally because of all the care they get these prototypes function very well. So one is led to the conclusion that the new pump is a pat solution.

But, is one really aware of what it implies to design, develop, test and produce a handpump?

Experience shows, it is relatively easy to make one good pump but it is very difficult to make a large number of good pumps.

RECOMMENDATIONS

Two actual cases of handpump developments are depicted in chapter 2 (Missionary Pump and the Industrially produced Pump). The conclusions drawn from this experiences (chapter 3) lead to the following recommendations:

Missionary Pump: Such a project should grow on its own. Every input from outside will endanger it as it might easily expand over its limitations.

Industrially produced Pump: Any decision to assist such a development should be made fully aware of the whole range of implications and with the intention to meet this commitment over a long period.

2) Handpump development and production

Two approaches are possible to produce handpumps:

a) The "missionary" pump. Handpump production on a very small scale, using only locally available materials.

b) The industrially produced pump. Handpump production in local or foreign industrial units.

The prerequisites for these two approaches are entirely different. To illustrate this postulation, accounts are given hereunder of two actual cases (a small scale approach and an industrial approach).

2.1 Pompe Malienne

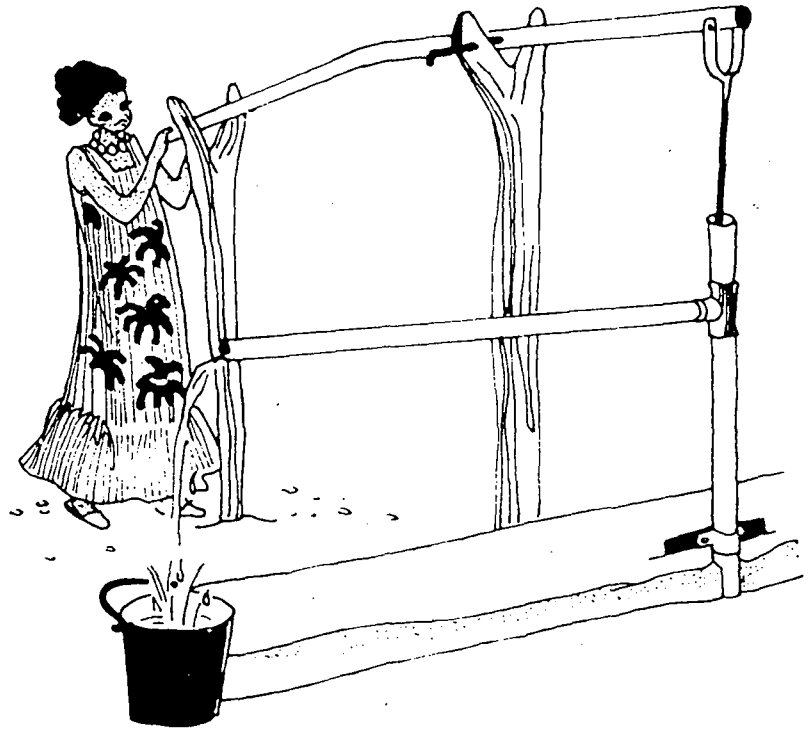

FIG 2 THE PUMP MALIENNE

The catholic Mission in Segou, Mali has a small workshop in which the pump "Malienne" is produced. The design follows basically the Pompe Sahorès which was initially developed in France as a pump for village production. The technology used in manufacturing this pump is very low and the pump is very crude. All materials are indigenously available (PVC pipe, construction steel, wood, leather, rubber from innertubes).

The workshop does not have drawings or any production manuals. And it employs only one fulltime mechanic and some helpers.

Production takes place in the manner that the customers come to the workshop and manufacture the pump under the supervision of the workshop personnel themselves. Making the pump takes approx. 2 days. This is possible because the design of the pump is of such low technology that no special skill is necessary for the production. The results of these manufacturing processes are very homespun pumps. The parts are not exchangeable and every pump is different from the other. Performance is obviously also reduced, the pump works only up to lifts of approx. 12 m.

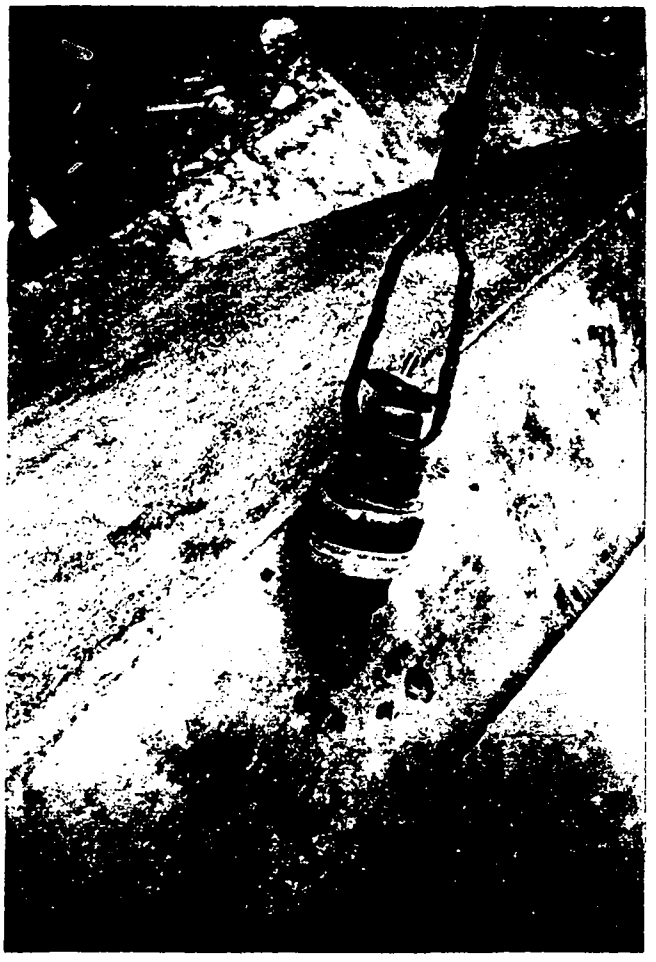

FIG 3 PISTON

Cost of the pump is 25'000.- CFA (60.- US $) including installation but not including the well. Up to the date around 300 customers have bought and built themselves a Malienne.

This system seems to work well, especially since this pump is in the true sense a VLOM*pump. Because every owner himself has built his pump, he is well capable to do repair work. The pump, due to its primitive technology, is obviously subject to many breakdowns which make preventive maintenance unnecessary as there will be every now and then a repair job to be done.

The limitations to this kind of approach are quite clear:

- Distribution has to be limited to the region around the workshop/mission. The purchasers who make their own pump in the workshop can not come from very far away. In all cases where repairs can not be made with the few tools that happen to be in the homestead the pumpowner has to go back to the workshop.
- The system with an owner making and maintaining his own pump does inevitably prevent community ownership. The pump is not designed for heavy use but can be useful as a water source for households and garden irrigation.
- Because of the private ownership this kind of pump is only feasible where ground water is abundantly available within the depth of less than 12 m and drilling or digging of the boreholes respectively the wells is easy and cheap. This is the case in Segou where all the wells are dug in the sandy ground along the river Niger.
- The pump does not fulfill hygenic standards as the wells and the pump can easily be contaminated. So standards of hygiene have to be low. One more reason which prevents it from the use in communities.
- In order to maintain continuity of such a programme a person who is responsible for it needs to be always with the programme. The design needs continuously to be adapted to the changing materials available in the local market. The workshop needs to be maintained and furnished with other work as it will not be profitable from pumpproduction only. These conditions are given in the case of the Catholic Mission in Segou where the priest who initiated this programme lifes for years in the community and will guarantee for the progress of the programme as long as he is there. In any other development projects where the management changes frequently such continuity will not be found and therefore such a programme could not be successfully run. Hence the above stated name "Missionary pump".

* VLOM Village Level Operation and Maintenance

2.2 Rower Pump

As an example of a handpump development of a pump which was intended for large scale distribution and industrial production the history of the development of the Rowerpump will be described. The Rowerpump might be not typical for a hand pump development project as the pump is a manual irrigation pump, a suction pump with a very simple design and the watermining conditions in Bangladesh are very favourable. From this point the encountered problems were not this grave as they would be in a programme for a drinking water pump with difficult watermining conditions.

This example was choosen to underline that even in favourable conditions and with a simple handpump concept a great deal of coordinated efforts are needed to achieve success.

The development history

The idea to make a simple manual irrigation pump with a direct action was formulated in 1978 by an agricultural engineer of the Mennonite Central Committee (MCC) in Bangladesh.

MCC established in the same year a working relationship with Mirpur Agricultural Workshop and Training School (MAWTS). The two organizations MCC with their experience in agriculture and irrigation and MAWTS with their engineering know-how joined forces and the first prototypes of the Rowerpump were produced.

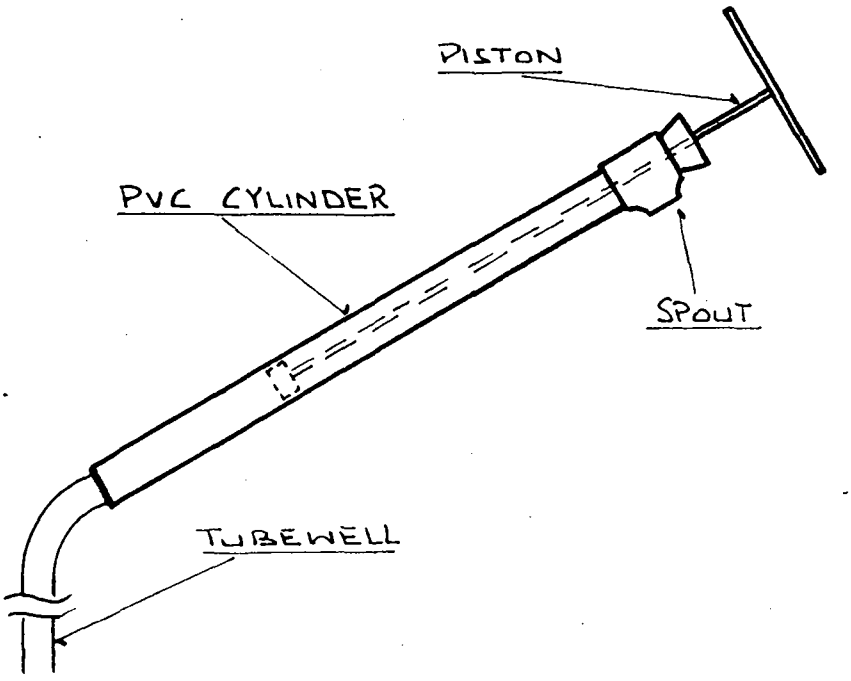

FIG 4 ROVER PUMP AT AN INITIAL DESIGN STAGE

These prototypes were tested in the field and in test rigs. They showed that the basic idea was feasible.

For the irrigation season 1979/80 the surgechamber (an airvessel just downstream of the foot valve) was introduced and the overall concept of the pump was finalized.

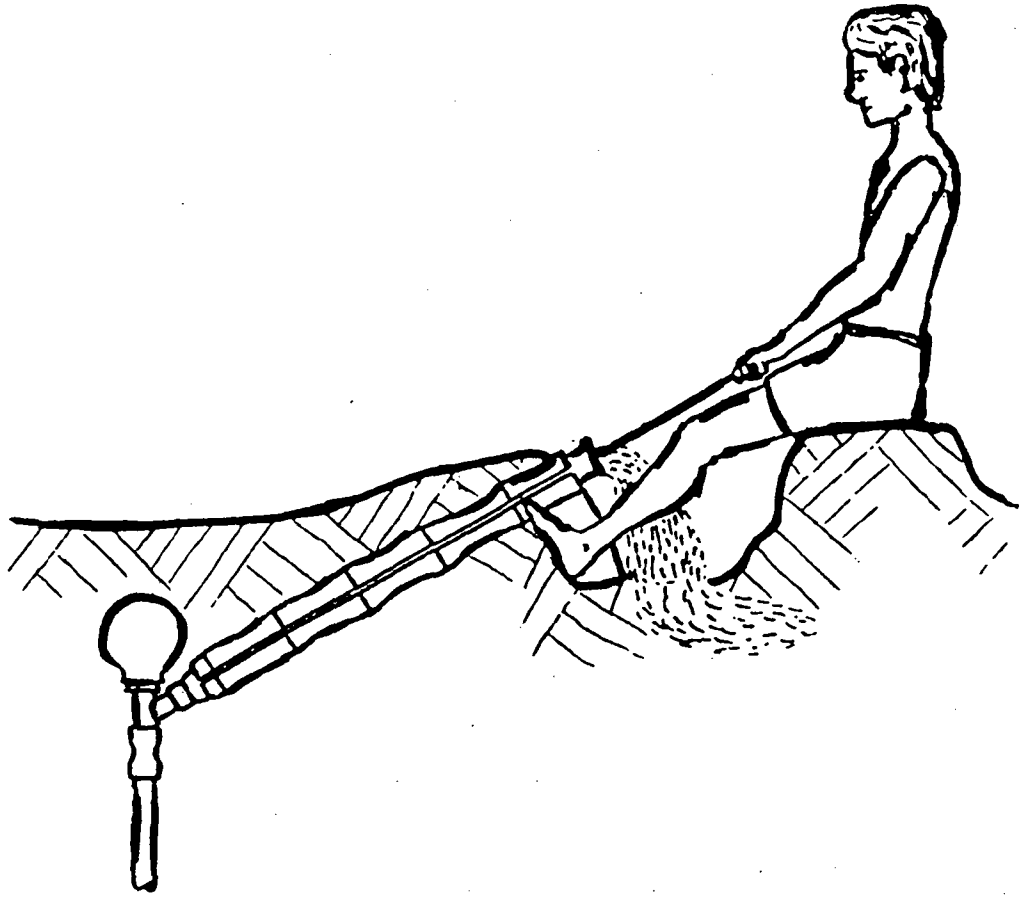

FIG 5 THE ROWER PUMP CONCEPT

Approx. 200 pumps were manufactured under industrial conditions at MAWTS. MCC organized and conducted the extensive field testing and surveying of the pumps which were used under the farmers management.

The close monitoring led to design improvements. The pump was simplified by reducing the overall number of parts and it could now be maintained without the need for any tools.

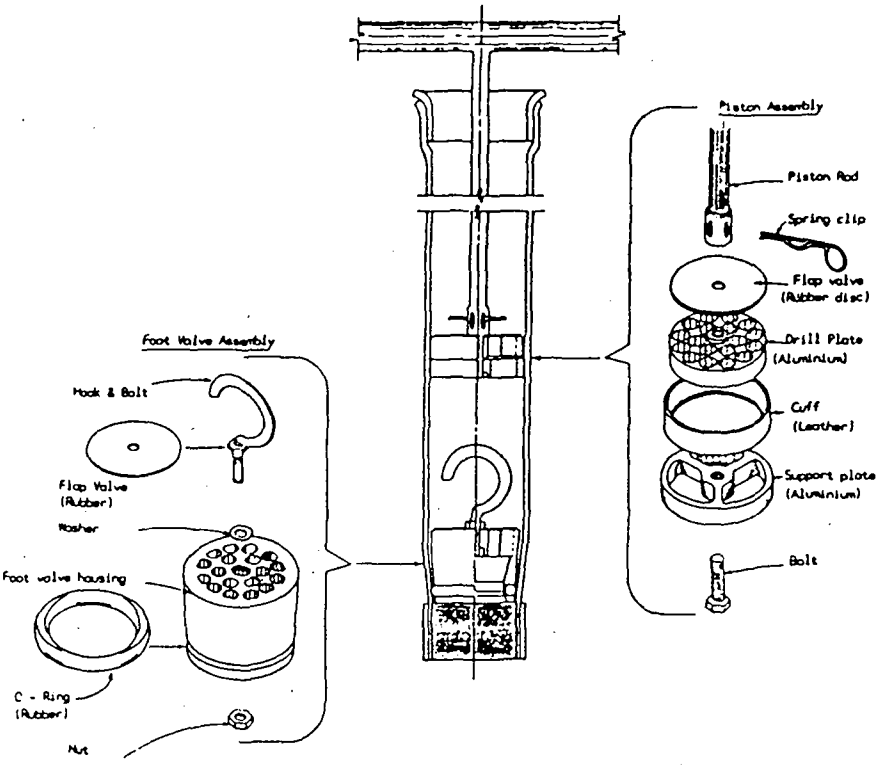

FIG 6 PISTON & FOOTVALVE, ASSEMBLY REQUIRES NO TOOLS

For the season 1980/81 all the in the previous year installed pumps were updated. And an additional 1000 Rowerpumps were produced and installed. Again MCC made a very close survey on over 50% of these pumps. The monitoring and the field testing revealed again more teething problems.
To remedy these difficulties the design was again improved.

Detailed production procedures were worked out. Jigs and Fixtures were made. Quality control standards were finalized and the checking procedures defined. (Every single component had to be passed by the quality control before it came to the assembly line. Every assembled pump had to pass a check again before it was sent to the store. At delivery the pumps were again checked jointly by MCC and MAWTS personnel before leaving the store. Despite all the previous internal checking in MAWTS, it was found that up to 30% of the pumps had to be rejected in this last inspection).

Parallel to the design and production engineering efforts, a marketing network for the Rowerpump was set up. Private dealers in the villages (hardware shops, etc.) were selected as sales points and spare part stockists.

The pump was laboratory tested in the Consumer Association (CATR) test facilities under the UNDP/World Bank handpumps test programme.

Despite all these efforts the sales of the pump did not meet the expectations and stabilized in the 1982/83 and 1983/84 season at approx. 1000. Minor design changes were introduced but basically the pump remained unchanged. But again a lot of detail work went into the improvement of the quality.

MAWTS undertook a big compaign providing training to numerous installation crews during this period. Previous experience showed that the correct installation was a very essential feature for the successful utilization of the pumps.

The recruting of private dealers and their training and motivation was another task which required a lot of patient spade work.

Credit schemes with the Bank of Bangladesh and the local Banks were establised. The aim was to achieve anunbureaucratic easy access to credits for small farmers who wanted to buy the pump.

In the season 1984/85 the endeavours of the previous years started to pay. Over 5000 Rower pumps were sold. The pump found recognition by the Government of Bangladesh (GOB) and the World Bank. It was included in the GOB Handtubewell Irrigation programme.

FIG 7 FARMER USING ROWER PUMP

Eventhough the Rowerpump is now well established in Bangladesh and over 10'000 have been sold attempts to replicate the pump production outside Bangladesh in India and Thailand were not yet very sucessful.

Summary

The analysis why this encouraging development could take place shows the following factors:

1) A sound concept for a manual irrigation pump was worked out at the beginning. And this generic concept was adhered to throughout the development process.

2) Within MCC and MAWTS was the competence available for a professional approach to design-, production engineering-, testing- and marketingproblems.

3) MCC and MAWTS were prepared to consider the development of the Rowerpump a long term process and ensured continuity over years.

4) Both organizations had sufficient funds available for the operational work and to establish all the necessary infrastructure. It was also possible to carry the risk for the first initiative farmers who bought the initially unproven pumps, these pumps could be modified free of charge.

5) Because of the close collaboration with other agencies engaged in handpumps (UNICEF, World Bank and many NGO's) numerous fruitful inputs were made into the programme from outside.

6) The project never lost its support from the donors also not in the period from 1981 to 1984 during which sales did not grow in the expected extent and many problems arose.

3) Conclusions

The two examples of the Malienne and the Rower pump show certain aspects with should be considered before a handpump development is undertaken.

If the objective of a programme is limited to a very small geographic region and if the surrounding parameters are within the limitations as described for the Malienne a similar programme would probably grow automatically without any project proposals as it is very cheap to realize. The danger of such a programme is that it might go beyond its limits by growing too ambitious. In this case (if too many pumps are distributed in a too big region) the infrastructures will be insufficient and the technical, administrative and managerial problems will be outsized for this kind of project.

Such a grassroot project needs to be confined within its limitations.

If a handpump is developed with the aim of large scale distribution or if the hydrogeological conditions and the population structure do not allow a very low-tech approach the problems will be more complex.

It is not enough just to have an idea how to improve a handpump design.

The plan for such a project should be based on a very clear conception of:

a) the objectives of the pump (lift, waterquality, VLOM principles, local manufacture, sustainability of repair and maintenance, etc.).

b) the scope of duties (who is doing what and how is it coordinated? Design, productions, quality control, testing, fielding, training, repair maintenance, etc.)

c) how all this activities can be financed and maintained

As mentioned above the Rowerpump might not be typical for all cases because conditions in Bangladesh are favourable and the pump is mainly used for irrigation. Working conditions of a community drinking water pump are much more severe. It can be therefore assumed that even more effort is required to come up with satisfactory solutions.

Every handpump project should keep its attention on the fact handpumps are only one link of the whole chain in rural water supply programmes. The participation of the local population is for these programmes essential. Expectations are aroused with the introduction of handpumps and if these hopes are shattered through bad handpumps confidence and goodwill of the users will be damaged. It is therefore important that the handpump project is planned and executed with prudence. Any attempts to take short-cuts in the development, testing or production will only increase the danger of failure.