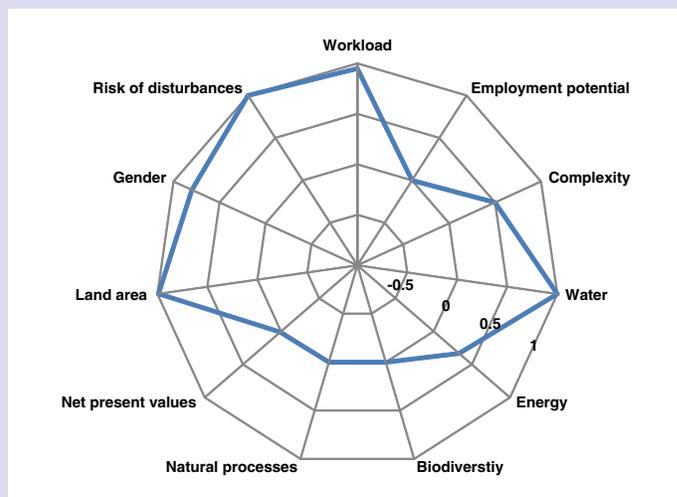


Key facts

- Assures a regular supply of one-day-old chickens and ducks for income and food security in rural areas.
- Technology is particularly suitable for women.
- Initial investment cost of \$170 is paid back after three months for chickens and five months for ducks.
- Potential yearly gross margin of \$836 for chickens and \$320 for ducks.

This graph summarizes the results of a sustainability assessment conducted for this technology. The closer the line is to the outer edge of the diagram, the better the technology performs in terms of the particular criterion.



What is a mini-hatchery?¹

- A sand-based mini-hatchery uses a simple wooden incubator to hatch chicken and duck eggs in rural areas to assure a regular supply of chickens and ducks for income and food security.
- The heat that is needed to incubate the eggs comes from kerosene lamps: the sand helps to retain and distribute the heat evenly inside the insulated cabinet.
- Besides the wooden cabinet and wooden or metal trays and racks, it uses cheap local materials such as quilts, sand to retain the heat, jute sacks and kerosene.
- The incubator should be placed in a separate hatchery room.

How was it developed?

- Mini-hatcheries have been used to hatch chicken and duck eggs in Egypt and China for some 3,000 years. In Bangladesh, these have been in use since the 1970s.
- In 1992, BRAC – a Bangladesh-based non-governmental organization – started a programme to promote the use of an incubator based on heated rice husk. However, the system was not widely adopted, largely because of poor management of fertile eggs in the supply chain.
- With financial support from the International Fund for Agricultural Development (IFAD), the Palli Karma-Sahayak Foundation (PKSF) – apex microfinance organization of Bangladesh – expanded the conventional incubation process, producing a more efficient and functional system,

building on an adapted, comprehensive training programme that covered all aspects of the rural poultry production chain. In particular, a four-week practical training programme for rural women was developed and carried out by a livestock agent at the village level.

Where do mini-hatcheries work well?

- Mini-hatcheries are successful in the climatic conditions of Bangladesh, although some reduce or completely stop the operation during the winter period from mid-November till February.
- An enabling economic environment is the key for successful adoption of this technology.
- The possibility of producing day-old chicks (DOCs) at low cost is one of the key factors in ensuring sustainability and economic viability. DOCs are difficult to transport from commercial hatcheries to isolated areas. It is, therefore, crucial to produce them on the spot in remote locations.

Who are successful adopters?

- In Bangladesh, the technology was promoted particularly for women as it can be operated at home.
- Successful adopters are smallholder chicken and duck producers who can ensure a regular supply of chicks and ducklings in the rural community.
- The technology is feasible in the absence of electricity and in areas short of chicks and ducklings.

¹ The information presented in this factsheet is taken from IFAD (2011). Manual on building and operating a mini-hatchery: Sand method. Rome: International Fund for Agricultural Development (IFAD). Available from: <http://www.ifad.org/Irkm/pub/hatchery.pdf>; and Mini-hatcheries: A viable technology to facilitate supply of day old chicks for rural poultry rearing, South Asia Pro-Poor Livestock Policy Programme – a joint initiative of National Dairy Development Board (NDDB) of India and IFAD. Available from: <http://sapppp.org/goodpractices/small-holder-poultry>.

Technological aspects

- The technology uses a production unit which is a wooden cabinet that is 135 cm tall, 230 cm wide and 105 cm deep. An incubator of this size can accommodate three hatching trays and incubate 1,200 to 1,500 eggs at a time. However, the cabinet can be smaller or larger, depending on the number of eggs the adopter wants to hatch at a time.
- In Bangladesh, depending on climatic conditions, the hatchery can be operated for eight months a year. With chicken eggs hatching after 21 days and duck eggs hatching after 28 days, this means that 11 batches of chicks and 8 batches of ducklings can be produced in one year.
- With regular maintenance, the hatchery can be operated at least for 6 to 10 years.

Equipment and facilities needed to operate the mini-hatchery

- An incubator consisting of a wooden cabinet lined with insulating material and equipped with trays to hold the sand to retain heat and eggs.
- Kerosene lamps to heat the incubator.
- Thermometers to monitor temperature in the incubator.
- A water bowl to maintain humidity inside the incubator.
- Fertile eggs.
- Egg trays.
- Chick boxes equipped with a heat lamp to keep one-day-old chicks warm.
- A candling box (a candle or light bulb placed in a container) to shine light through an egg to determine whether the egg is fertile, infertile or spoiled.
- Disinfectant for disinfecting the incubator.
- A hatchery room for the incubator built from low-cost local material such as bamboo, straw, hardboard or polythene. It should have a door and windows that can be closed to help control the temperature in the room, hence the incubator.

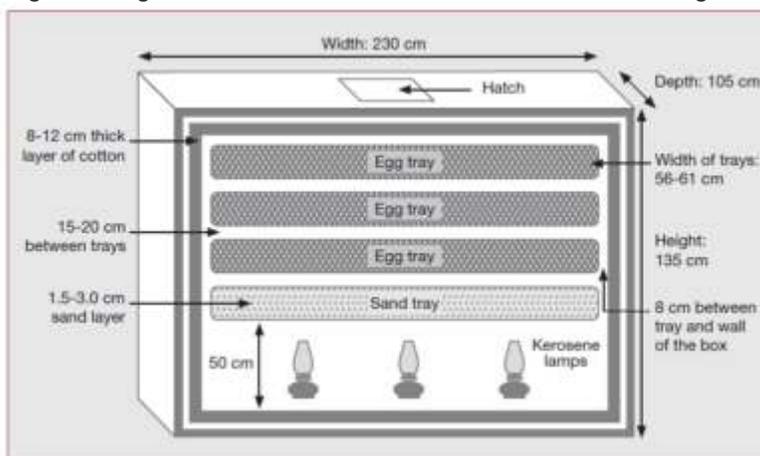
How to build a sand-based incubator

- Prepare a wooden cabinet 135 cm tall, 230 cm wide and 105 cm deep with a door as the entire front side.
- Make a hatch in the top of the cabinet to allow hot air to be released to regulate the temperature inside the incubator.
- Line the walls, roof and doors inside the cabinet with a layer of cotton wool (in rolls), 8-12 cm thick for insulation.
- Make four wooden or metallic trays, as well as four wooden or metallic racks on which the trays will rest.
- Install the sand tray 50 cm above the floor of the cabinet.
- Place the first hatching tray 15-20 cm above the sand tray, with each additional hatching tray set 15-20 cm above the previous tray.
- Ensure there is a gap of 8 cm between the edges of the trays and the walls and doors of the cabinet to allow air to circulate.
- Line the tray that will hold the sand with black cloth and fill it with a 1.5-3 cm thick layer of sand. Line the hatching trays with a layer of jute sacking and a black cloth.

How to operate the mini-hatchery

- Day 1: Use eggs from a flock that has at least one rooster or drake for every 10 hens or ducks. Choose well-shaped, standard-sized eggs, wash them with clean warm water in case they are very dirty. Place the clean eggs in egg trays and put these in a sunny place to warm them to 37.5° C (100° F). Alternatively, warm them carefully over a kerosene stove.
- Use the kerosene lamps to heat up the incubator to between 36.5° C and 37.5° C (98° F to 100° F), which will take about two to three hours. Always avoid producing smoke from the kerosene lamp which will kill the chicks inside the eggs. Once the incubator has reached the desired temperature, carefully arrange the warm eggs on the hatching trays. The eggs should be set at a 45° angle, with the narrower end pointing down.

Figure 1. Diagram of the sand-based incubator and its internal arrangement



- Controlling temperature and humidity: Place a bowl of water on the floor of the incubator to maintain humidity at 70 to 80 per cent. This can be monitored with a hygrometer. Monitor the temperature with a thermometer every six to eight hours (each time you turn the eggs over). If the temperature is too cold (below 36.5° C/below 98° F) increase the size of the flame of the kerosene lamps. If it rises above 37.5° C (100° F), open the hatch on the top of the incubator to release some hot air and reduce the flame size of the lamps or remove one or more of the lamps.
- Carefully turn the eggs over every six to eight hours from day 1 to day 18 for chicken eggs and to day 24 for duck eggs. Always check the temperature when you turn the eggs. Remove and throw away any broken eggs. Add water to the water bowl in the incubator whenever it runs low. This is important to maintain the humidity in the incubator.
- A candling procedure is performed on day 7 and day 14 for chicken eggs and on day 7 and day 21 for duck eggs. Place a candle or electric light bulb inside a box with an egg-sized hole in the side. Place each egg in turn into the hole and observe the pattern of light shining through the shell. **Fertile egg:** You will see a faint pattern of blood vessels. **Infertile egg:** These are transparent, with no sign of blood vessels. **Spoiled egg:** These are opaque. Remove all the infertile and spoiled eggs from the incubation chamber. Infertile eggs are still safe to eat after seven days, but spoiled eggs should be discarded. Spoiled eggs need to be discarded after 14 days. About 75 to 90 per cent of eggs from a good breeding flock should be fertile.
- Stop turning the eggs when chicks (from day 19 on) and ducklings (from day 24 on) start to hatch.
- **For chickens:** Cracks in eggshells are visible from day 19. Gently moisten the eggs with a wet cotton cloth once a day to soften the shell. This will help the chicks to hatch. On day 20, chicks will start to come out from the eggs and on day 21, most chicks will have hatched. If a chick is having difficulty getting out of the egg, wash your hands and then gently break the shell, taking care not to tear the chick's umbilical cord.
- **For ducks:** Cracks can be seen on eggshells starting from day 26. Gently moisten the eggs with a wet cotton cloth once a day to soften the shell. This will help the ducklings emerge. On day 27, ducklings will start to come out from the eggs and on day 28, most ducklings will have hatched. If a duckling is having difficulty getting out of the egg, wash your hands and then gently break the shell, taking care not to tear the duckling's umbilical cord.
- Chicks and ducklings are dry within 30 to 45 minutes after hatching. Once dry, they rapidly overheat in the incubator. Remove the chicks and ducklings as soon as they are dry and place them in a holding basket equipped with a heat lamp to keep them warm. One-day-old chicks and ducklings are ready to be sold or reared on the farm.
- Remove eggshells, dead animals and spoiled eggs from the hatching trays. Dispose these hygienically, for example, by burying in the soil. Once all chicks and ducklings have hatched, remove the cloth linings from the hatching trays and clean and disinfect the incubator thoroughly so that it is ready for the next batch of eggs. Common household disinfectants like Dettol® and Savlon®, locally available in Bangladesh, can be used at the dilution rate recommended on the product label.
- Good hatchery sanitation, consisting of 90 per cent good management and 10 per cent disinfection and fumigation, prevents disease in the hatchery. This includes daily washing and disinfecting of the floor of the hatchery room; removing broken, infertile and spoiled eggs as soon as you see them; removing eggshells and weak or dead animals immediately once the birds start hatching; and washing and disinfecting trays, jute sacks and black cloth thoroughly after all eggs have hatched.

Economic aspects

- The initial investment cost for the size of hatchery described above is \$170 (BDT 12,080)². This covers the costs of the incubator (135 cm tall, 230 cm wide and 105 cm deep), open weave trays, kerosene lamps and bulbs, thermometers, black cloth, cotton, jute sacks, a candler, water pot and marker, egg trays and a chick box.
- The variable production costs for incubating 600 eggs are \$80 (BDT 5,700) for chicken eggs and \$75 (BDT 5,300) for duck eggs. Both amounts include the cost of fertile eggs, kerosene, disinfectant, antiseptic solution and other inputs.
- The total value of a batch of 600 eggs is \$156 (BDT 11,095) for chick production and \$115 (BDT 8,161) for duckling production. Both amounts include income from sale of chicks/ducklings and infertile (edible) eggs after first candling.
- Gross margin from chick production: \$156 – \$80 = \$76 (BDT 5,395). \$836 can be earned per year if 11 batches are produced.
- Gross margin from duckling production: \$115 – \$75 = \$40 (BDT 2,861). \$320 can be earned with eight production cycles in a year.
- The initial investment can be paid back after three and five production cycles for chickens and ducks, respectively.

Table 1. Economic results for hatching 600 eggs

	Initial investment (\$)	Variable production cost (\$)	Gross value (\$)	Gross margin/production cycle (\$)	Production cycles/year	Gross margin/year	Payback period
Chickens	170	80	156	76	11	836	2.24 cycles
Ducks	170	75	115	40	8	320	4.25 cycles

² All monetary values are calculated based on an exchange rate of \$1=71 Bangladesh taka (BDT) as of September 2011 (IFAD, 2011).

- There are two economic factors behind this success: increased demand for poultry products at the village level mainly due to improved purchasing power of rural households; and improved communications/access with towns and urban markets.
- The technology can reduce women's workload significantly. Traditional hatching methods require women to wake up during the night to turn the eggs over. With the mini-hatchery, this can be done before going to bed and in the morning.
- The time required to operate a mini-hatchery is estimated at 100 to 120 minutes each day.

Environmental aspects

- Mini-hatcheries do not depend on electricity but alternative energy like kerosene fuel, which is available in remote locations with no electricity supply. Depending on the season (summer and winter), it is estimated that between 10 and 12 l of kerosene are needed for each production cycle.
- Autarky once the hatchery is set up: Assuming a total weight of 33 kg for 600 eggs obtained from within the community, and 12 kg kerosene and 1 kg disinfectant obtained from outside the community, about 72 per cent of the total inputs come from within the community while 28 per cent are from outside.
- Likewise, 72 per cent of inputs are from other farming activities since the eggs can be considered a by-product of poultry holding. After hatching, eggshells and dead chicks and ducklings are buried. Once decomposed, they can be used as organic fertilizer. After cleaning, the jute sack/cloth is reused for the next batch.

Social aspects

- Poultry breeders receive a better price by selling fertile eggs to mini-hatcheries rather than by selling eggs for food consumption. Hence, the economic benefit of this technology also extends to neighbouring households who can sell fertile eggs to the mini-hatcheries.
- The hatchery can be managed by one person. No one from outside the household is needed and, hence, no additional employment is created by this technology.
- The regular availability of poultry products in rural areas can improve the nutritional and health status of the rural population.

- All operators involved in the process are women. Interaction among the women operators of different mini-hatcheries is facilitated by a nationwide network of mobile phones.

Issues for replication

- For replication in other countries with a rural demand for chicks, the technology has to be adapted to different climatic conditions and its economic performance has to be re-evaluated.
- Hatchability rate is largely influenced by the quality, handling and conservation of fertile eggs before incubation.
- Profitability for poor women operating low-tech mini-hatcheries depends essentially on addressing management constraints across the rural poultry chain (e.g. solid knowledge of rural poultry husbandry and biosafety management principles, healthy birds from good genetic material, rapid communication and built-in linkages between producers of fertile eggs and the mini-hatcheries, and from the mini-hatcheries to chicken breeders).
- It is also important to ensure appropriate training (using a hands-on methodology) that covers a complete hatching cycle.

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Related topics

Rice-husk mini-hatchery model.

Useful links

Videos on mini-hatchery operation, parts 1 to 3 (link assessed on 08.04.2014)

- <http://www.youtube.com/watch?v=GlqCZXQrzX0>
- <http://www.youtube.com/watch?v=f5BIBu04-nc>
- <http://www.youtube.com/watch?v=IAeyifqiGXU>

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