Chapter 11
Smallholder Pig Value Chains Development and Livelihood Security

S. K. Mondal, K. S. Das, and S. S. Singh

Abstract World food situation indicating more incidences of mal- and/or undernutrition in developing countries points towards a future thrust on the low-cost animal protein production across the globe. The most cherished species may be the pig as it has some unique inherent characteristics as regards to growth rate, feed pattern, and fecundity. The scientific medium- and/or low-input pig management and pork production systems can have a tremendous potential for filling the current gap of demand and availability of animal protein in low-income countries. Managing pigs in a technologically improved way in terms of breeding, feeding, health care, and bio-safety and making the target group, i.e., small and marginal farmers well aware of these techniques, would capacitate them for ensuring their livelihood security at both individual and household levels. This would also enable them to take up future challenges in the face of globalization and financial hardship, if blended well with the policy-related essential modifications and institutional/organizational change. Thus, mobilizing pig resources can be a better weapon for fighting hunger and malnutrition in the future world.

Keywords World · Pig management · Livelihood · Health · Breeding

1 Introduction

The present world food situation, indicating 925 million undernourished people mostly concentrated in the developing countries (especially those in protracted crises), compels the world leaders, both at national and international levels, to exercise

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the food security activities involving social rebuilding, livelihood provisioning, livelihood promotion, and livelihood security. Most vulnerable undernourished population of the world today are directly or indirectly involved in livestock farming activities due to their regional climatic harshness to conventional agriculture (Sansoucy 1995; Horowitz 2001). Again, the pig production in particular is a tradition in those communities, giving an extra point for cashing on this sector to imprint a social touch to the strategic development of these communities. In India too, the social development programs involving livestock component are an essential component of overall development, and recently, the Tribal Sub-Plan is directed towards the integrated approach of piggery development.

In this country, the indigenous pigs, during the 1940s and 1950s, were being kept under scavenging system of rearing with almost "zero input" and without considering the economics of production (Anonymous 2002). This was traditional for some specific tribes or communities, and their occupation and livelihood involving this traditional system of pig rearing would blend well with their landless and migratory situation. However, the then need of the community would also become fulfilled by the said farming. Gradually, Indian population exploded, so also their need or demand, leading to exploitation of more and more resources available at hand. The traditional non-descript indigenous pigs were no longer in a position to meet up the ever-increasing demand of the traditional tribals, leading thereby to improvement in existing genetic stock, their habitation, their production, and their cost-effective management. Thus the scientific management of pigs evolved. The import of improved exotic breeds, e.g., Large White Yorkshire, Middle White Yorkshire, Berkshire, Landrace, Duroc, Hampshire, Tamworth, Wessex, Saddleback, etc., for crossbreeding as well as adaptability studies during the late 1960s and early 1970s opened the avenue for taking up research projects on pig production leading to development of technologies for scientific pig breeding, feeding, housing, and control and treatment of swine diseases (Bhat et al. 2010). Then the gradual shifting from the traditional pig farming to scientific hygienic and economic pig production was started. During the last 40 years, the technologies are being developed by various institutions and transferred to the pig farmers for uplifting their living standard as well as socio-economic condition. Very recently, a trend is evident that people across all the social strata are coming forward with their schemes for scientific pig farming, thanks to societal changes due to increased literacy and increased demand for animal protein in the diet.

Pigs are distributed worldwide, and they possess wide adaptability to various climatic conditions ranging from extreme temperate climate of the United States to extreme tropical conditions of the African continent (CAST 2001). The world population of pigs is more than 941.2 million contributing to the most efficient pork industries in the industrialized nations of the world. In third-world countries, the importance of pig production sector and pork export is gradually increasing. In India, pig rearing is traditionally very popular among the tribal, backward, and economically weaker section of the society. Over last four decades, the zero or marginal input situation of this traditional pig farming is gradually changing with a paradigm shift of the society finding the swine production enterprise more profitable and remunerative.

1.1 Future of Pig Farming

Pig rearing is a tradition among the tribal, backward, and economically weaker section of the society in India and other developing countries. Over the last three decades, the zero or marginal input situation of this traditional pig farming is gradually changing with a paradigm shift of the society finding the swine production enterprise more profitable and remunerative. The present-day swine production is a profitable enterprise in all parts of the world, including India. The initial sporadic imports of improved exotic breeds by the Christian missionaries and subsequent piggery development programs taken up by the Government were mainly involved with the swine breeding for either the genetic improvement of the indigenous pigs or performance evaluation of the imported breeds. Since 1945, the gradual increase at the annual rate of 4.6% in pig population in India has indicated a steady growth of the swine production enterprise. The availability of domestic as well as export market for pork makes it more and more attractive. Moreover, the thrust by FAO for research on less-known species and relatively less remunerative agriculture because of gradual shrinking in average land holding due to societal changes and socio-cultural shift towards increasing acceptance of swine production by wider spectrum of the Indian population have a holistic impact on today's more comprehensive, modern, and scientific pig farming.

The Indian Council of Medical Research (ICMR) has recommended for 34 g/d meat consumption, but the availability of meat was 16 g/d in 2000 with the meat production of 4.25 million tons. This demand-supply gap for meat in general and pork, in particular, is gradually widening in these days of escalating protein hunger. Therefore, it is high time to streamline the breeding policy, to identify suitable breeds (preferably two or three), and to understand systematic improvement of indigenous pigs. This improvement in the genetic material of indigenous pigs through systematic breeding and subsequent selection is important for a giant stride in improving this sector.

One of the best meat-producing animals in the world is the pig that has high prolificacy with short generation interval, better mothering ability, faster growth, most economic feed conversion efficiency, and high dressing percentage. An integrated approach for livestock farming is the key to address various challenges faced by developing countries in achieving the food and nutritional security for growing human population (Ke 1998). Among all livestock species, the pig is the most potential source of meat and very efficient feed converters next to broiler. Apart from meat, pigs also produce bristles and manure. Pig farming registers quick returns because of its early attaining marketable weight within 180–240 days. There is a good demand of pig products, viz., ham, pork, bacon, sausage, lard, etc., at domestic as well as export market. Pig rearing creates employment opportunities for rural poor farmers, and it uplifts the living standard through supplementary income. Recently, a dramatic shift towards small- to medium-sized commercial pig farming with growing interest in self-employing educated rural Indian youth is being evident.

With the gradual change of societal and religious taboos, scientific pig rearing is gaining popularity day by day across the globe, and pig husbandry is being

considered as one of the remunerative livestock enterprises. Pigs, as a potential meat-producing livestock species, possess the following advantages for a successful farming in the future:

- The pig has the highest feed conversion efficiency, which means they can gain maximum live weight consuming a given amount of feed than other meat-producing animals, except the broilers.
- The pig has ability to utilize the wide range of feed stuffs like forages, grains, garbage, and the poor-quality feed and can convert the same into high value meat. But, feeding of damaged grains, imbalanced rations, and garbage may cause low feed conversion efficiency.
- The pig is prolific and has shorter generation interval. A sow may be bred at around 240–270 days of age and may farrow twice per annum. It produces 6–12 piglets per farrowing.
- Farming of pig needs small investment particularly on the buildings as well as equipment.
- The pig is known for its higher dressing percentage (65–80%) comparative to other livestock species (less than 65%).
- Pork is a most nutritious meat which contains higher fat, lower water, and better energy value as compared to other meats. Pork is rich in many vitamins, e.g., niacin, thiamine, and riboflavin.
- Pig's manure/wastes are used in agricultural farming and fish pond as bio-fertilizer.
- An increasing demand of pig's fat has been found in soap manufacturing, poultry feed preparation, paint, and other chemical industries.
- Pig husbandry gives quick returns due to its early marketable weight.
- There is a good demand of different pig products.

2 Pigs as Resources

Pigs have become gradually important in the rural economy particularly in the north-eastern region of the country as well as in other parts. The pig provides food and nutrition to the huge number of marginal/small farmers and the landless rural people. This species has become particularly important for the socio-economic development programs running across the country for the tribal and down-trodden class of the society. Gradual shifting from traditional pig rearing to the scientifically managed pig farming on a commercial is happening today. World population of pigs is about 800 million. India possesses around 16 million pigs accounting for 2% of the world population. In India, pork production stands at 2.33 lakh tons, and the contribution of pork to the total meat produced in this country is around 8.2%. The value of pork products is 0.97% of total animal products, while it is 5.53% of total meat including meat products. Value of exported pig meat is Rs. 11.3 million (about 316.3 tons) against a total worth of Rs. 61,604 lakhs from the export of the meat

including meat products. Value of swine bristles production is 30.42% of total hair production (Rs. 3780 million). The pigs and their products contribute Rs. 1797 crores annually to the national economy accounting for around 1.5% of the Gross Domestic Product (GDP) from livestock sector. But, in India, pigs are yet to gain their full production potential due mainly to wider adoption of most primitive form of pig rearing. Therefore, commercial pig farming under the intensive and semi-intensive systems of management following improved technologies will be crucial for realizing the potential of this unique meat-producing species. Relatively high demand for pork and pork products, especially in gradually increasing urbanized and semi-urbanized areas with potential of higher economic return, have been driving many businessmen, progressive farmers, professionals, the ex-servicemen, and the educated youth to take up pig production enterprise on a commercial scale.

In this context, more and more region-specific and farming system-specific technology development is the need of the day. For newer technologies to be developed, a road map of the research is necessary, and again, to draw a full-proof road map for future research, there is a need for the step-by-step procedure of technology development (Steinfeld 1998) which is typically outlined with the help of the technologies generated since its beginning. Therefore, the present document is a chronological account of the research works on pig production done at IVRI which is expected to cater the needs of the scientists, researchers, policy makers, and planners to assist them in outlining the future research strategies for further improvement in the socio-economic conditions of the weaker and down-trodden sections of the society in particular and the whole society in general.

3 Present Scenario of Pig and Pig Products

3.1 Pigs in Global Economy

World beef, chicken, and pork production totalled 275.2 million tons, in 2011, said UN's Food and Agriculture Organization (FAO), being 40% pork, 36% poultry (mostly chicken and turkey), and 24% beef. It represents a rise of 25%, or an additional 55.1 million tons of meat, compared to 2001. Of this increment, 30.6 million tons, or 56% of the total, was of chicken meat; 19.1 million MT, 35% of the total, of pork; and 5.4 million, 10% of the total, of beef (CAST 2001).

In the stream of the production increase, the share of each meat in the world production changes, with beef going down to 24% from previous 27%; pork, shrinking from 41% to 40%; and chicken meat rising from 32% to 36%. It is worth noting that while in 2001 the chicken meat production was equivalent to 76.5% of the pork production, in 2011 it was equivalent to about 90%.

3.2 Contribution of Pigs to Indian Economy

The average production from pigs in India is comparatively very less than developed countries of the world. The main cause of this is the zero input farming and non-adoption of improved swine production technologies by the traditional pig keepers. This leads to non-significant contribution of this animal resource to national income. Nowadays, farming of pig is not restricted any more to the backward class people. During 2008–2009, the worth of Rs. 2498 crores was generated from pork production. Pigs contribute significantly to the Indian economy by providing sustenance to the rural poor across the country, especially the north-eastern hills region. As per literature, pig population of this country is 11.13 million (Livestock Census 2012) which comprises around 1.18% of total population of world. The production of pork in India was 2.36 lakh tons (2009–2010). In 2010, contribution of pork to total meat produced in India was 5.9%. Value of pork products was 0.9% of total products from livestock, while it is 5.5% of the total meat including meat products. Pigs have very little contribution in Indian exports. Around 504.9 tons pork were exported in 2008–2009. The export value from pork was Rs. 27.9 million against a total export value (Rs. 8455 million) from meat/meat products. The value of swine bristles production was 30.42% of total hair production, which was about Rs. 3780 million. The pigs and their products contribute around 1.5% of the Gross Domestic Product (GDP) from livestock sector annually which contributes around 29.64% of agricultural GDP of the country.

Growing urbanization, rising per capita income, unfolding globalization, etc. are actually boosting the demand for high-value commodity like meat. With the fast changes of socio-economic conditions, there is rapid shift of dietary habits towards non-vegetarian food items. Due to this reason, demand of pork and pork products in the domestic market has substantially increased during the last decade, and the price per kg pork has jumped into Rs. 100–120/- from Rs. 30–40/-.

4 Scientific Pig Farming

Scientific rearing of pigs is to be resorted to for gaining better livelihood of the target people across the world, i.e., the down-trodden, the economically backward, and the resource-poor sections of the society. A holistic knowledge in various aspects of swine management will be pre-requisite for the application of various management-related technologies for capacity development of the targeted population. Therefore, a detailed description of the scientific way of pig management has been given here.

4.1 Breeding Management

Pigs are the meat animals and are being reared for production of high-quality animal protein from so-called low-quality roughages and concentrates. The suitable animal must grow well in the given feed and habitat situation. For this, selection of proper breed for the specific locality is of utmost importance. The growth rate and mortality are the two major determining factors; a compromise between the two is needed for selecting good genetic stock (Mondal & Verma 2011). A crossbred population might be a better solution to this rather than exotic animals. The local non-descript pigs (having average litter size at birth of 3–6) are to be crossed with the exotic improved breed (having average litter size at birth of 12–14) suitable for the locality to produce the crossbred population of desired exotic inheritance level (having average litter size at birth of 8–10). However, the recommended level of exotic inheritance should be up to 75%; 62.5% crosses usually register a good growth and disease resistance.

4.2 Feeding Management

Feed is the single item in the gamut of whole pig farming, which costs about 60–70% of the total cost production. Feed is the most important component that influences the profit from a swine enterprise. Successful swine production needs careful planning and an efficient management of feeding. The feed should be selected based on the tendency of pig farming for being more specialized and intensified even in rural areas. Through proper breeding and selection, rapid growing strains of swine have been developed. Owners of the farms now plan to market their hogs at 5 months of age instead of 7–8 months that was a practice a few years ago. Apart from this, planning for large litters (piglets at a time) and for breeding to farrow twice a year forces the swine producers to adopt refined methods of scientific feeding programs (Prasad 2000). Some important points to remember while feeding the swine are as follows:

- Feed the animals with best feeds to meet up their nutrient requirements.
- Give adequate concentrates with quality protein in their daily ration.
- Provide adequate vitamins and minerals with special emphasis on B-vitamins.
- Provide adequate clean potable drinking water during all the seasons.
- Give adequate exercise to the animals, either through paddock or small good-quality green pastures.
- Feeding of colostrum within a short period from birth is a must for the newborn piglets.
- While feeding the piglets, high-quality and more fortified diets are to be included in the ration.
- Before weaning at 6 weeks of age, it is better to provide adequate creep mixture of good quality for increased growth rate.

- Sufficient quantity of swine grower ration must be provided.
- Proper feeding of pregnant sows as per their nutritional requirements is very essential to increase litter size and to decrease the chances of piglet anemia.
- Nutrient requirements of lactating sows depend upon her body weight, age, stage of lactation, litter size, litter weight, etc.
- Conventional feed ingredients like maize, groundnut cake, wheat bran, and deoiled soya bean cake can well be used for pig feeding along with proper fish meal, mineral, and vitamin supplementation.
- Locally available non-conventional feed resources (kitchen and hotel wastes, cold storage wastes, warehouse wastes, etc.) may be utilized in place of balanced ration to minimize the cost for sustainable pig farming.
- Category-wise feeding regimes must be practiced to meet out all the nutrient requirements. The following specifications may be adopted to feed different categories of pigs (Table 11.1 and 11.2).

Table 11.1 Nutrient requirements for growing and finishing pigs

Type	Weaning pigs	Growing pigs	Finishing pigs
Live weight (kg)	5–12	12–50	50–100
Daily gain (kg)	0.30	0.50	0.60
Protein and energy			
Crude protein (%)	22.00	18.00	14.00
DE (Mcal/kg)	3.50	3.50	3.30
ME (Mcal/kg)	3.36	3.36	3.17
Inorganic nutrients (%)			
Calcium	0.80	0.65	0.50
Phosphorus	0.60	0.50	0.40
Sodium	–	0.10	–
Chlorine	–	0.13	–

Table 11.2 Nutrient requirements for breeding and lactating pigs

Type	Breed gilts	Lactating gilts and sows	Young boars and adult boars
Live weight (kg.)	110–250	140–250	110–250
Protein and energy			
Crude protein (%)	14.00	15.00	14.00
DE (Mcal/kg)	3.30	3.30	3.30
ME (Mcal/kg)	3.17	3.17	3.17
Inorganic nutrients (%)			
Calcium	0.75	0.75	0.75
Phosphorus	0.50	0.50	0.50
Salt	0.50	0.50	0.50

4.3 Housing Management

Pig houses, otherwise known as sties, should provide protection against inclement weather and proper hygienic conditions for maintaining their healthy growth. In India, semi-indoor system of swine farming in loose houses is generally suitable. However, at places of extreme climatic conditions, some locally suited modifications of structural designs and construction materials may be sorted out under some expert opinion. Separate sties for different ages should be provided for proper management in respect of feeding, weighing, as well as hygiene (Sastry et al. 1983). As per BIS standards, various dimensions are as follows (Table 11.3).

Boar must be housed in individual stall grouped under one roof. Number of breeding boars to be kept in the farm would decide the number of stalls to be constructed. For gilts and dry sows, simple loose houses with cement-paved floor in covered area and brick-lined floor in open area should be provided separately on larger farms, however, together on smaller farms. These sties may be put in a row, and a relatively smaller group (3–10) of pigs should be housed. Each farrowing-cum-nursing sty should accommodate one sow with its litter. Advanced pregnant gilts or sows are transferred to these sties around a week before due date of farrowing and are left here during nursing period also. This should be roomy enough for sleeping space of sow as well as roaming space for piglets. Guard rails should be provided along the walls 25 cm above the ground level to avoid crushing of piglings. For housing fatteners, 15–30 pigs should be housed in each pen depending on their age. Piglets that are weaned should be housed in weaner piglet sty in a group of 30 up to 6 months of age.

The feeding and watering space required for various categories should be proper and as per standards as these have a direct influence on the production and reproduction performance of pigs. The BIS has recommended the provision of manger (feeding) and waterer (drinking) space as presented in Table 11.4.

Table 11.3 Standard space requirement for various categories of pigs

Type of animal	Floor space requirement (m^2)		Maximum number of animals per pen	Height of shed at eaves (cm)
	Covered area	Open paddock		
Boar	6.0–7.0	8.8–12	1	200–250
Farrowing sow	7.0–9.0	8.8–12	1	
Weaner/ fatteners	0.9–1.8	0.9–1.8	30	
Dry sow/gilt	1.8–2.7	1.4–1.8	3–10	

Table 11.4 Feeding and watering space requirements for different categories of pigs

Type of animal	Space per animal (cm)	Total manger length in a pen for 100 animals (cm)	Total water trough length in a pen for 100 animals (cm)	Width of manger and water trough (cm)	Depth of manger and water trough (cm)	Inner wall's height of manger and water trough (cm)
Growing pigs	25–35	2500–3500	250–350	30	15	20
Adult pigs	60–75	6000–7500	600–750	50	20	25

Table 11.5 Vaccination schedule against different pig diseases

Sr. No.	Name of disease	Type of vaccine	Time of vaccination	Duration of immunity period	Remarks
1	Foot and mouth disease	Polyvalent tissue culture	At about 6 months of age with booster done after 4 months	One season	After booster dose of vaccine, repeat every year during October/ November
2	Hog cholera	Lapinized	After weaning	1 year	
3	Swine pasteurellosis	Classical bovine	At about 6 months of age	1 year	

4.4 Health Management

Pigs are naturally susceptible to common swine diseases like swine fever and foot-and-mouth disease, besides occasional injury/wound, fever, and gastro-intestinal complications. Conventional treatment with analgesic, antipyretic, and hepatic boosters in appropriate dosage would yield desired results without much complication in general, but, on the other hand, some specific expertise in some surgical cases like tooth clipping in breeding males, castration for making teasers, etc. would also be required (Banerjee 1991). The medication in fatteners mainly involves the agents for vaccination and deworming apart from a few therapeutic agents used during their shorter farm life of about 6–8 months. Signs of illness should be noticed at least twice a day. These are fever, low feed intake, unusual/abnormal discharge, abnormal behavior, etc. The animals should be protected from commonly occurring diseases. During outbreak of contagious diseases, the sick and the healthy animals must be segregated immediately. Side by side, other disease control measures are to be adopted at the earliest. Deworming of the animals should be done regularly. Feces of adult pigs should regularly be examined to check the presence of eggs of internal parasites, and the infested animals should be treated with suitable drugs. The animals should be washed during hotter parts of summer days to reduce heat stress as well as to promote sanitation. Recommended vaccination schedule should be strictly followed for preventing some common pig diseases (Table 11.5).

4.5 Reproduction Management

The gilt becomes ready for breeding by the age of 6–8 months depending upon the breed and nutritional status. The sexual maturity in boarlings is noticed by the age when they are of 6–8 months. The breeding of males and females of similar size, conformation, and temperament is preferred. The heat period lasts up to 5 days in sows, which may be reduced considerably if earlier mating/service is done. The length of estrous cycle in pigs is 18–21 days. The usual male-female ratio in an ideal breeding stock is 1:10. It is desirable to detect the animals in heat twice a day, preferably morning and evening. The services should be given twice in a heat period. The gestation period lasts for about 114 days and should be accompanied by proper nutrients. The post-weaning heat is usually observed after 3–10 days of weaning. Before breeding of sows, special nutritional supplementation for increasing the number of ova and decreasing the chances of early embryonic mortality is needed.

4.6 Symptoms of Heat in Females

After attaining the age of sexual maturity (6–8 months depending upon the breed), the gilts experience the cyclic pattern of behavioral estrus (heat). The common signs of heat in females include swollen and reddened vulva, excitement, restlessness, mounting others or allowing mounting by others, twitching of tail, and "lordosis" or immobilization in presence of male/teaser. Typical interest in following the attendant is usually observed during the morning check. The best indicator is the immobilization response of estrous female. As a reaction to a combination of visual (sight), auditory (sound), olfactory (smell), and tactile (touch) stimuli originating from the boar, sows and gilts in estrus exhibit this immobilization response.

4.7 Signs of Approaching Farrowing

- Pregnant females become lethargy during the last week of gestation. Most of the time they spend in the closed area. Pregnant females are found lying down most of the time in the chamber.
- Feed intake goes down in the last week. On the day, pregnant females stop taking feed but consume water frequently.
- Volume of mammary glands increases abruptly. Milk secretion starts on the day of farrowing. Turgidity of teats is prominent.
- Just 10–12 h before farrowing, a peculiar behavior of nest building (the most significant behavior) with or without bedding materials is seen.
- Biting of bars or any other hard materials and occasional twitching of tail are the common behavioral signs.

- Restlessness, straining, increased respiration rate, frequent urination, and increased frequency in standing up and lying down are common behavioral activities during the onset of farrowing process.

5 General Management

5.1 Neonatal Care in Pigs

The newborn piglets are prone to thermal variations, and there is need to protect them from extreme cold weather conditions by providing the artificial heat sources like *bukhari*, brooder box, etc. After the completion of farrowing, the naval cord of the neonate is usually cut at a distance of 2.5–3 cm from the body, and tincture iodine solution is applied over it to ensure prevention of entry of any type of infection. The needle teeth (4 pairs) are removed along with the naval cord treatment to prevent the chance of injury to the udder and teat of the mother as well as in the snout and adjoining areas of the piglets.

Care and management of piglets is one of the most important activities in pig farming. Profitability of any farm is positively correlated to a number of healthy piglets born as well as weaned per sow in a year. Piglet management starts from the day it is born till their separation from the mother (weaning). The advanced pregnant sow is allowed to remain in the farrowing shed for the period from farrowing to weaning. The following items are required to be kept ready in the farrowing shed to ensure proper peri- and neo-natal care and management:

- Bedding materials, viz., straws, wood scraps, bhusa, saw dust, etc.
- Scissors or knife to cut naval cord of piglets.
- Tooth cutter if clipping of tooth is practiced.
- Antiseptic solution, viz., savlon, betadine to apply over naval after cutting.
- Cotton threads to tie naval chord of piglets.
- Wooden box with heat lamp as brooder to provide heat particularly in winter season (December to January).
- Cotton rolls.

5.2 Management of Pregnant and Lactating Females

A female pig remains in two physiological stages, viz., gestation and lactation, in most of the productive life cycle. The success of these two life processes determines the worthiness of a female and thereby profit for the farmer or producer. Therefore, females need scientific care and management during gestation and lactation.

5.3 Care of Sow During Gestation

Care of sow during pregnancy is care of piglets that are to take birth. Proper feeding with balanced diet during gestation increases birth weight of piglets and increases the chance of growing up to adult stage as mortality of healthy piglets is very less. Proper feeding and housing environment during lactation reduces mortality of piglets and augments the reproductive efficiency of sows. Healthy nursing sows come into heat about 7–10 days after removing piglets from female. Housing, breeding, and feeding are the three major basic aspects of sow rearing.

5.4 Care During Farrowing

A female seldom needs external help during farrowing. However, there should be strict vigilance as difficult farrowing needs manual help. Piglets are generally born either head first or rear feet first. Sometimes, piglet is covered by placental membrane. In such case, the membrane should immediately be removed to facilitate breathing; otherwise, leave the piglet by itself. Piglet stands on its own feet within 2–5 min of birth. Sometimes, piglets cannot stand due to slippery floor. Piglets can be manually pushed towards dry areas to enable it to stand. If naval cord does not detach from dam, that may also prevent piglets from standing. The cord should be manually severed by an aseptic knife. In severe condition, it is wise to consult a veterinarian. In very cold climate (December to January) when environmental temperature goes down to below 10 °C, it is very important to dry the piglets immediately after birth with a cloth. They can also be kept under heat lamp in brooder box.

A special farrowing pen is constructed for pregnant sow for farrowing. Construction layout is the same as described above. Farrowing pen should be dry and floor should be concrete and level. Normal desirable ambient temperature in the chamber is to be 22–28 °C. The minimum floor space requirement for a farrowing female is 7–9 sq. m. for covered area and 8–12 sq. m. for open paddock. Sows are kept individually in the farrowing chamber. Iron pipes (guardrails) are fitted in three sides in the closed area. The guard rails should be constructed 8–10 cm from the wall and at 8–10 cm height from the floor (Tiwari et al. 2009). Preferably, water trough should be constructed in the run. Overflow of water in the closed area sometimes make the floor slippery and unhygienic. The slippery floors make the movement of sow very difficult. Pregnant females are brought to this special chamber before 1 week of farrowing. Before shifting to farrowing chamber, the females should be sprayed with chemicals like botox or cypermethrin (1%) to get rid of lice and mite from the body. The walls and floor should be cleaned and scrubbed thoroughly before shifting of animals. Disinfectants like lime, bleaching powder (3% w/v), and washing soda (4% w/v) should be sprinkled.

At farrowing time, special attention should be given to the sow while allowing it to farrow by itself if the condition permits. Normally, the farrowing process

completes in 1.5–3.0 h. Sows seldom require assistance while farrowing, unless the sow exhibits restlessness and excessive straining, and the interval of expulsion between two piglets is more than 15 min. Females giving birth for the first time, older, overweight, or nervous sows may have more farrowing problems. Large-sized piglets, effort of expulsion of two piglets simultaneously, and piglets entangled with umbilical cord sometimes lead to condition of asphyxia. In this condition, death of piglets due to hypoxia is very common. The placenta comes out within 1–6 h after the last piglet comes out. The placenta should be removed from the chamber as soon as it expels. Its consumption is detrimental to the health of the female.

5.5 Care of Sows During Lactation

Proper feeding and housing environment during lactation augment the reproductive efficiency of sows. Piglets can be weaned earlier if they grow faster; that may happen if nursing females are well fed. Healthy nursing sows come into heat earlier after lactation period, thereby increasing its efficiency of producing more litters per year. Piglets are solely dependent on dam's milk production during the first 20 days of life.

6 Capacity Development and Pig Production

Worldwide ownership of pigs largely constitutes the small and marginal farming population specifically in third-world countries. This pattern has necessitated the need of extensive support services to the targeted pig producers in terms of legislation, veterinary services, input supply, market access and transport, etc. apart from the extension services (Dietze 2011). In true sense, the capacity development in terms of knowledge as well as skill needs a typical farming system-specific blending of all the abovementioned components for promoting/mobilizing pigs as resources across the global economic spectrum. These drivers/factors of support systems for the required capacity development in pig farmers have been discussed below.

6.1 Extension Services

Investing in public extension service sector and encouragement to private services have become essential when pig farming has to exert positive impact under small-scale farming system. To improve overall pig husbandry practices which lead to enhance safe pork production as well as production of pork products, extension works in agriculture sector require support. The service rendered in this sector must

assure knowledge transfer in good pig husbandry practices with local setup. Farmer Field School (FFS) has been developed in livestock as well as has provided effective transfer of the technical knowledge on matters related with production. FAO developed a method that is basically a concept of "learning-by-doing" approach in which small-scale farmers have got opportunity for learning directly through field experience.

Extension services are required to use a combination of production knowledge as well as skills especially in the training programs in marketing and such other business-related skills. Sustainable pig enterprise can be possible when there is an assured market for pork and other pig products. It can prosper if small farmers have knowledge about marketing, understanding of their local markets, and can sell the pig products. Small-scale farmers should also know about the method of calculating costs, estimating yields, as well as evaluating potential profit. Knowledge about practices related to business, e.g., farm record keeping, cash flow and gross margin, etc., are also very essential for successful pig enterprise. In addition, extension is required to contribute towards improving overall health of pigs, safety, and hygiene issues associated with pork products. Coupled with appropriate and in-depth training, the small-scale pig rearers can learn the knowhow associated with hygienic and safe practices through simply following "prevention is better than cure." The role of extension workers to support small-scale farmers in pig production enterprise covers the areas which range from making the opportunities as well as challenges in pig production sector and other related sectors like supply of feed, credit availability, medicine supply, marketing improvements, and encouragements to farmer associations.

6.2 Legislation

The majority of legislation found today particularly in developing countries like India lacks pro-poor initiatives which can support pig enterprise in small scale (Birthal & Taneja 2006). Participating in formal food supply chain, food safety regulations involving needs, necessities, and practicalities, role of health, production, and standards of food safety are among those important bottlenecks for small farmers when they want to access various types of more formalized marketing chains, and this forces the small-scale farmers to remain within informal and almost uncontrolled sector. The development of standards which consider small farmers along with institutionalized support systems results in enhanced livelihoods security. Such approaches have become successful in sectors like dairy in many countries in the globe.

Need for a legislation facilitating provision of a good business environment is there for its application at both national as well as local levels. Implemenation of such a legislation must encompass the general agricultural sector as a whole, and swine production sector in particular in rural areas. This will be possible only when the legislation related to land, private credit institutions, and trade and training

services will be properly blended for the overall goal of promoting sustainable pig production in smaller scale. Such blending requires a full-proof plan involving all the stakeholders starting from input suppliers to retailers.

6.3 Veterinary Services

The veterinary services, typical for pig enterprises, are almost negligible apart from some public health hazards emerging in recent years. Otherwise, the livestock health services as a whole can be well-utilized for specific purpose of maintaining pig health. Overall, the para-vets, community health personnel associated with animals, and public sector animal health professionals can cater to the technological needs of the small-scale pig farmers. At the same time, there should be a binding legislation regarding pig health for the large-scale pig producers in the aspects related to vaccines, medicines, and services rendered by the public sector technical persons. Approach may be top-down, meaning the application should be effected at national, then regional, and then local level for efficient veterinary services.

Besides, slaughter and the surroundings of slaughter houses are to be optimally controlled by veterinary professionals in order to have a safe and hygienic production of pork and pork products.

6.4 Financial Services

Due to poor resources, the small pig farmers are not able to access the regular financial services, and this results into subsistence farming and not market-oriented farming. The situation may be tackled to some extent by extending certain kind of promotion and creation of congenial environment for credit institutions by assuring their credit profitability by strengthening the small pig farmers. The marketing options available with the small farmers are to be more open, and start-ups for the piggery enterprise may be with incorporation pregnant females and distribution of their offsprings as in dairy sector. More profitable market for small farmers and extended credit systems through planned schemes will surely boost the capacity of doing piggery business in small farmers.

6.5 Input Supply Chains

The most important input for the pig production is the feed and that too in a fair price. And if this is assured, then the enterprise will automatically flourish. The characteristic problem of small-scale producers is that the inputs like feed, improved equipment, medicines, etc. are not locally available, and thus they require a supply

chain for these inputs. This chain will be successful once the ease of doing business will be in place for input suppliers. Concentrate feed at comparatively less prices and knowledge of mixing local ingredients can well help the small-scale pig producers along with sophisticated slaughtering technique.

6.6 Access to Markets

The availability of good-quality genetic materials is the biggest constraint in sustainable small-scale pig production. Market standards set by large pig producers are generally not met by the native breeds, and poor productivity of such breeds and such constraints are being faced by small pig farmers. Apart from the genetic materials, the inputs and products are also a part of established market chain. If the small farmers are to be an active part of it, there should be the formation of farmer-producer organizations (FPOs) as well as commodity associations.

Further, contract farming can be another option for small-scale producers, but their agreement and conditions should not be dominated by large players while their marketing interest must be protected. Awareness for consuming pork and pork products and development of infrastructure like transport can also help in promoting small pig production enterprises.

6.7 Transport

As the small-scale pig rearers are located at remote rural areas and the potential market for the pork is in the city areas, there should be fast and efficient transport system to maintain an effective production-consumption axis. The persons associated with such transport of perishable items may be made technologically upgraded to reduce loss. The vehicles, refrigerated transport system, will also help in increasing profit too.

6.8 Organizational Options and Gender

Building capacity in the farmers, input suppliers, and transport workers through suitable organizations and making them aware of the formal demand-supply chains can improve the status of the small producers. The formal public institutions can properly address the issue of capacity development. Again, the farmers' organizations, commodity associations, etc. can make the small pig farmers, processors, butchers, etc. able to respond to various market situations more boldly by increasing their risk-taking ability (Ashdown 1992).

Another dimension of rural small-scale pig production in most part of the world is gender issue. Being typically managed by women and children, pigs have an advantage over other livestock. This concern may be well addressed by forming some women farmers, organizations that may take care of the issues related to ownership, credit facility, and marketing by women.

7 Target Groups for Capacity Development

In developing countries like India, small and marginal farmers represent >86% of farm families having holding size of <1.2 ha live in diverse production condition with high risk. Fragmented land units don't allow the small farmers to have individual farm resources, e.g., tractors, draught animals, bore/tube wells, and such other sophisticated agricultural machineries for different operations. Till date, the focus was on maximization of yield/growth rate only and that too for rich farmers. To fulfill basic requirements of such households like food for humans, fuel, feed, fodder, and fiber, a focused attention to livelihood enhancement options through system approach is warranted.

Indiscriminate fragmenting of land units results from weakening of traditional concept of joint family along with unchecked growth of human population. Approximately >85% of total farm families were converted to small and marginal farmers with land <1 ha. Majority of inputs became costlier and out of reach of small farmers, and this results into less- or un-economic and less- or un-sustainable farming. Today's need of higher scale of urbanization and growth of industrial sector as well as infrastructural growth necessitated to look for growth vertically rather than horizontally so far as agriculture is concerned. The characteristics of small and marginal farmers are that they are in general illiterate, are financially handicapped, and have small holdings which are scattered and unsuitable for high-tech farm machinery. A lot of efforts aim at increasing per unit productivity of various components of production systems but lack in integration through following a holistic approach involving whole farming system.

Smallholders require support for taking advantage of opportunities given by a continuous expansion of pig production sector and for managing risks involved in increasing competition as well as closer linkages with present newer value chains. This needs significant as well as sustained innovation in food and agricultural production systems at all levels – global, national, and regional – and technological innovation, capacity building, mixture of policies, and institutional change and investment that are gender-sensitive and are responsive. There is an ample scope to improve technical knowledge among school dropouts, rural youth, and farm women about small-scale production through providing capacity development training programs at farmers' doorstep.

8 Livelihood Security and Pig Production

Livelihood of a person refers to their "means of securing the basic necessities-food, water, shelter and clothing- of life." Livelihood is defined as "a set of activities, involving securing water, food, fodder, medicine, shelter, clothing and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/ her household on a sustainable basis with dignity." Usually, these activities are accomplished repeatedly. Livelihoods include range of off-farm and on-farm activities that provide various procurement strategies of food as well as cash. In this way, each household has several probable sources of earnings that constitute the household's livelihood (Beckwith 2000). Such entitlements are mainly based on subsidies which a household may have, and the household's position in social, legal, political fabric of the society (Drinkwater and McEwan 1992). Livelihoods are considered secure when household has "secure ownership of, or access to, both tangible and intangible resources and income earning activities including reserves and assets, to off-set risks, ease shocks, and meet contingencies" (Chambers 1989). Another view is that households have livelihood security while they have the ability to acquire, utilize, protect, develop, exchange, and benefit from the assets as well as resources (Ghanim 2000). As per Frankenberger (1996), household livelihood security (Fig. 11.1) has been defined as "adequate and sustainable access to income and resources to meet basic needs (including adequate access to food, potable water,

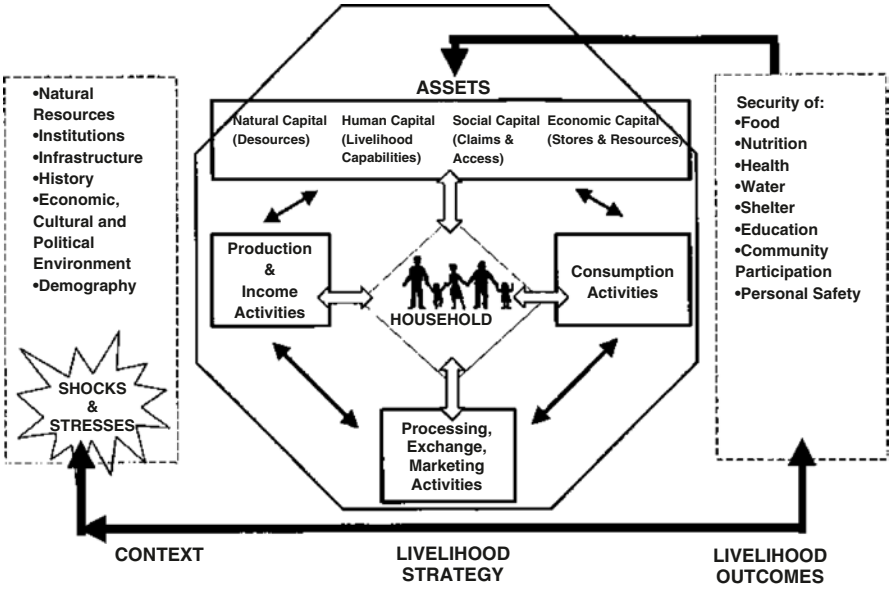

Fig. 11.1 A model of household livelihood security. (After Frankenberger and Drinkwater 1999; Carney 1998; Drinkwater 1994; Swift 1989)

health facilities, educational opportunities, housing, and time for community participation and social integration."

The livestock farming systems practiced by small and poor farmers in developing countries have lower productivity (per animal or land unit) than that in industrialized/developed world. Many reasons of lower productivity are enumerated. Management system present in small holder situation is low-or no-input system, allowing animals forage on own, feeding on waste, or plants which otherwise go unused. Mostly, relatively higher price of feed and low price of livestock products result in insufficient incentives for using purchased inputs in order to convert to intensive farming systems. The poor farmers mostly keep a mixture of livestock species and trade off specialization to get protected against risks. Resource constraints faced by the poor pig keepers are landlessness, information access, and financial and provisioning of services, and their various reasons for pig rearing include following:

- Food production.
- Income generation.
- Providing manure.
- Power production.
- Financial instruments.
- Enhanced social status.

9 Way Forward

Pigs play a major role in livelihoods of most of the backward and the poor, and therefore, inclusive development, based on their skills as well as resources, has the ability to contribute to both faster poverty reduction and rapid economic growth. Reconstituting the swine sector under livestock-related policy and the institutional framework, for ensuring that the policies, the program, and project permit men and women for taking full advantage of many livelihood (pig related) services rendered by livestock as well as for contributing to economic development, needs three important changes.

Firstly, the dominant "production, productivity, and the market access" narrative must be upgraded by a development paradigm which pays due regards to livelihood services rendered by livestock, encompassing both monetary and non-monetary services. To be effective, if resources be directed to ensure that a comprehensive and new livelihood-livestock (swine sector) development statement emerges, then future policies, the program, and project, by clinging to new pattern, will attempt for building on several livelihood (pig related) services provisioned by livestock, i.e., that livestock development including swine sector will be pro-poor and inclusive. Secondly, for being effective, the policies, the program, and project must be designed with the inclusive and the participatory process which includes conversation and example of evidence for addressing institutional dimensions. This means that

resources must be invested towards making plan and implementing it for identifying/experimenting with new delivery mechanism and towards embracing the incentives which the poor livestock (pig) keepers have to respond to newer rule and regulation, as required for policy implementation. Thirdly, there is a need for better coordination among the livestock (pig) related policies at the state, the regional, and the national levels. This will avoid the duplication of efforts and wastage of already constrained resources, and, simultaneously, it will be ensured that the policy and program – at every level and in and out of the livestock (swine sector) domain – are not contradictory, the one thing that only can warrant a livelihood-enhancing and inclusive livestock sector (swine sub-sector) development.

10 Conclusion

The contribution of pigs towards the livelihoods of smallholder farmers around the world is well understood in spite of its complex nature. Nowadays, pigs have become an essential asset for resource-poor farmers, both those who are directly involved in agricultural farm production and also for non-farm rural poor households particularly who are dependent on affordable nutrition source. Livestock dependence is remarkably high across rural India especially in those parts having various degrees of vulnerability. The food and non-food products of livestock have been in the mainstay of rural small holders' livelihood and will continue to be the same if proper planning, policy back-up, and implementation of pro-poor livestock development projects/programs are stressed upon by the National Government. The genetic improvement of pig for increasing productivity will ensure the stocking of less number of animals for obtaining similar or more production. Fortification of breeding services and management in pig will be helpful in increasing the reach of these services to the large number of small-scale producers. Maintaining a value chain from the farm to fork through efficient and appropriate product processing, and effective marketing of the produce will be required for flourishing the livestock sector primarily owned by the small holders. Further, the subsistence-to-sustenance transition in case of pig rearing with its gradual increasing contribution to national economy should be strictly looked into with efficient and effective value chain management and opening up pro-producer marketing avenues that can warrant an inclusive and livelihood-enhancing (not only securing) small-scale pig production.

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