# Vision 2050


## NATIONAL RESEARCH CENTRE ON PIG

**INDIAN COUNCIL OF AGRICULTURAL RESEARCH**

**Rani, Guwahati – 781 131, Assam**


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# Message from Hon`ble AM

# Foreword from Hon`ble DG, ICAR

# Preface

**Dilip Kumar Sarma**
**Director**

# Preamble

Pig rearing is one of the most important occupations of rural society especially among the tribal masses of India. It has largely remained under nomadic system of rearing with the weaker sections of the society both as a source of income and a choice of meat for consumption. Cost of inputs and returns are not a serious concern in this low or zero input pig rearing system. Pig is one of the most efficient food converting animals among domesticated livestock and can play an important role in improving the socio-economic status of the weaker sections of the society, particularly in the North-Eastern Region of the country. Bulk of the pig population in India is indigenous type with low growth rate and productivity. The share of pork to the total meat production has been almost static for last 15 years at about 10%. Average meat yield of pigs in India is about 40kg/animal, which is about 55% less than the corresponding value of world average. Over 70% of the pigs kept in India are crossed with exotic breeds, but with a large amount of inbreeding because of non-systematic breeding and selection. The bulk of the pig population remains indigenous with low growth rate and productivity. In nutshell, the pig rearing is still unorganized venture that requires science and technology driven support to make it a vibrant enterprise. The various stakeholders require promotion at various levels such as technology, entrepreneurship development, and financial support to drive a mark for Indian pig farming a place at global level. Further the shrinking resources in terms of land availability, water as well as threats from the changing environment being conducive for emergence of new diseases are gradually expected to limit the capacity for pork production optimization. If the country does not take suitable step now to develop and execute scientific strategies to address the issues of bridging the gap between need and availability of pork, other countries, taking the advantage of globalisation, shall make inroads to a sector that is so inextricably linked with the economic condition of rural poor in the country. It is assessed that the pig farming has immense potential to ensure nutritional and economic security for the weaker sections of the society. Hence, a road map in the form of Vision 2050 is prepared, keeping in long terms interests to provide sustainable and inclusive growth and ensure nutritional security through technology driven pig rearing in the coming four decades time.

# Contents

# Scenario of Piggery sector

Pig production, among other species has a high potential to contribute to high economic gain. This is because of two folds: First the pigs have high fecundity, high feed conversion efficiency, early maturing, short generation interval and relatively small space requirement. Secondly, they are multipurpose animals providing about 40% of meat in the world market, and by-products like pig dung as manure and bristle for brush industry. It is produced under a variety of production systems ranging from simple backyard pigs, pigs living on garbage belts to family operated farms or large scale integrated pig industries with sophisticated bio-safety measures.

**Pig population in India**

Pig is widely distributed in all the eco-regions of the country and is an important occupation of the rural society especially the tribal masses. People of certain ethnic groups prefer to keep pigs, especially black ones, for festivals and ceremonial purposes. Pigs are concentrated in the North-Eastern Region where almost 40% of the country's total pig population exists. As per the latest livestock census, the pig population is 11.13 million and is presently showing a decline trend (BAHS, 2012). The pigs constitute 1.47% of world pig population and our piggery sector is gaining slow but steady momentum during the past years. Majority of our pig population is held by marginal and small farmers. Further, the average pig population per thousand human populations is about 11.5. Among Indian states, Uttar Pradesh has the maximum number of pigs with about 17% of the total pigs followed by Assam (~12%), West Bengal (~10%) and Jharkhand (~8%). The distribution of land and pig holdings in India is presented in table 2.

**Table 1: Pig and pork production in India and world (2009)**

| Item | Production | | India's share (%) | Decadal Growth rate (1999-2009) | |
|---|---|---|---|---|---|
| | India | World | | India | World |
| Pig (million) | 13.84 | 941.78 | 1.47 | 3.40 | 5.00 |
| Pork( MT) | 0.48 | 106.33 | 0.45 | 3.40 | 15.45 |

Source FAOSTAT website

**Table 2: Distribution of land and pig holdings in India**

| Landless | Marginal | Small | Medium | Large | overall |
|---|---|---|---|---|---|
| (<0.002 ha) | (0.002–1.0 ha) | (1.0–2.0 ha) | (2.0–4.0 ha) | (>4.0 ha) | |
| Distribution of pig population (%) | | | | | |
| 7.7 | 49.9 | 20.4 | 13.9 | 8.1 | 100 |
| Size of pig holdings (no/100 households) | | | | | |
| 1 | 4 | 6 | 6 | 6 | 4 |

*Source: Govt. of India, National Sample Survey Organization. Land and livestock holdings.*

The pork production in India is growing steadily in a slow pace and the share of pork in total meat production of the country remained static over a decade.

According to ICMR recommendation, out of 60 gm daily protein requirement; 20gm should be from animal protein source. Considering a modest figure of 20% of total population consuming pork in the country today, and out of 20gm daily animal protein, assuming 10 gm from pork source; the total pork requirement is around 0.88 million ton (20% of 1210 million human population *i.e.* 242 X 0.010 kg X 365 days). Against this, the country as per FAOSTAT figure (2009), produced 0.48 million ton of pork. Thus the present shortfall is 0.40 million ton or 45.45%. If the deficiency is not met through appropriate technological interventions, the gap is to be widened to such an extent that the country might be forced to import pork in days to come to meet the demand.

**SWOT analysis of piggery sector:**

**Strength**

13.11 million (2011) pigs is strength to meet the animal protein deficiency experienced in the country. Ability of the pig to survive and produce under adverse husbandry practices is strength particularly for the weaker, tribal and landless population of the country. Increased demand for pork and pork products like sausage, bacon etc. is the strength for economic upliftment of the pig growers. Pig by-products, namely bristle and inedible offal are strength to support allied industries. Both commercialization and organic pork production are considered strengths to give a meat revolution to the country and thereby provide employment to a large section of the rural poor.

India still has around 250 million people below poverty line who go to bed hungry. Most of this population is again in the tribal belts of the country where the people are non-vegetarian in their dietary habit. Pork consumption being popular among these populations, improved pig husbandry programmes has been observed to be an important area in the poverty alleviation programme of the Government.

**Weakness**

Absence of sufficient number of breeder farmers throughout the country is a weakness for which sufficient numbers of quality pigs are not available for the fattener farmers as well as to the markets. Religious taboo attached with pork consumption is also a weakness for which marketing of pork has to be confined to a selective group. Tendency of the pig grower to raise pig to marketable age on zero to negligible inputs is another weakness. Preference of the consumers for pork from the local pig is another weakness for promotion of improved pig with lean meat quality. Lack of adequate support from the development and financial bodies to establish pork based industries is hindering the growth of pig to the desired extent. In the absence of supportive industries in and around the areas where pigs are grown, by-product utilization suffers a setback for which economic return is less.

**Opportunities**

Pigs being a live source of insurance particularly for the weaker section of the community, there is a tremendous opportunities to use pig as a medium of poverty reduction in the country.

Since region like North East in the country where around 50% of country's pork is consumed by way of procuring live pigs from other parts to the tune of around 1.0 lakh pig heads per annum, a very good opportunity exists for opening up employment generation for rural youth in this sector. Self employment to at least 200 youths in the region would be ensured giving a target of production of 500 weaner pigs by each one of them per annum to produce marketable pigs of 1.00 lakh number. Each one of them could in turn, employ at least 10 pig-man to support the production i.e. 10 X 200 = 2000 numbers of unskilled persons employment. In addition to this, weaner pig purchasers (fattener farmer) get benefited through the enhanced income from the improved pigs they receive from the piglet producers. Self employment to another set of pork product processor and workers is yet another opportunities through pig husbandry not to mention about Self Help group (SHG) personnel to be engaged in service delivery like A.I, Vaccination *etc.*

Since pig is a prolific breeder, achieving the targeted growth of 10% in meat sector is another opportunity through pigs.

Considering a figure of about 5 million adult pigs are slaughtered per year and each pig yielding 250grams of fiber, the quantity of fiber availability will be to the tune of 1.25 million tones. At the current market rate (as surveyed in December, 2012) of around Rs800/kg of fiber, the total value of produce) will be Rs100crore. Since, in the North Eastern region of the country alone, where around 50% of country's pork is consumed by way of procuring live pigs from other parts to the tune of around 1.0 lakh pig heads per annum and immense opportunity exists for employment generation for rural youth in the piggery sector. The awareness and growth of end users is an opportunity for the development of fiber based brush making industries.

**Threats**

High cost and more than 60% deficiency in concentrate feed sources are threat to the pig industry which compete human for grains. Non availability of sewage disposal and by product utilization facility particularly in areas where pig concentration and slaughter is maximum is another threat from public health point of view for which general public might offer negative views for the growth of pig industry.

# National Research Centre on Pig

National Research Centre on Pig was established by the Indian Council of Agricultural Research on the recommendation of mid-term appraisal committee constituted by ICAR in 1990 after reviewing the work of the All India Coordinated Research Project (AICRP) on Pig. The institute was established in Guwahati, Assam located in North-eastern part of India where 40% of country's pig population is distributed. Following the clearance for the site and also the approval of the EFC, a plot of land measuring 17 acres was taken over in the year 2002. The foundation stone of the Institute was laid by the then Director General of ICAR, Dr. Panjab Singh on 4th September 2002. The pig farm of the Institute has been started functioning since August, 2007 and currently maintaining two exotic (Hampshire and Duroc), two indigenous (Ghungroo and Niang- Megha) pig breeds and their crosses. The office cum Laboratory building was inaugurated on 20th May 2008 by Dr.Mangala Rai, then Director General of ICAR.

**The institute has the following mandates**

**Mandates**

- To undertake basic, strategic and applied research in the areas of pig production and health including product/by-product processing, value addition through quality control measures and transfer of the evolved technologies to the client groups.
- To act as a repository of information on pig production and health for regional, national and global policy planning and implementation.

Presently the institute is engaged in basic, applied and strategic research on pigs besides driving towards overall development in the piggery sector of the country. In addition, the institute coordinates 10 All India Coordinated Research Projects on Pig (AICRP on Pig), 4 Mega Seed Projects on Pig spread across the country and has administrative control over a Krishi Vigyan Kendra (KVK) located in the Goalpara district of Assam, with separate mandates and activities converging with the objective of developing and transfer of technologies for promoting sustainable agriculture and animal husbandry.

**All India Coordinated Research Projects on Pig centres:**

- Assam Agricultural University, Khanapara, Guwahati
- Birsa Agricultural University, Kanke, Ranchi
- Kerala veterinary and Animal Science University, Mannuthy
- Tamilnadu Veterinary Animal Science University, Kattupakkam
- Sri Venkateswara Veterinary University, Tirupati
- Indian Veterinary Research Institute, Izatnagar
- ICAR Research Complex for Goa, Old Goa.

- Central Agricultural University, Aizawl
- Nagaland University, Medziphema.

**Mega Seed Projects on Pig centres;**

- Assam Agricultural University, Khanapara, Guwahati
- Birsa Agricultural University, Kanke, Ranchi
- State Veterinary and Animal Husbandry Department, Govt. of Mizoram, Aizawl
- ICAR RC for NEH, Medziphema

# NRC on Pig 2050

The National Research Centre on Pig is committed to bring in excellence in all the frontier areas of research on pig production, health and product development and productivity enhancement to increase socio-economic status of the pig rearers of the country through the medium of pig rearing. The NRC stands up to play pivotal role in addressing the national goals, policy development and international commitments of the country to improve nutritional security, productivity, profitability, human resource development, animal welfare and promote sustainable and environment friendly piggery subsector. The institute will strive hard with the focused efforts to place a strong mark of Indian pig in the global map.

**Vision**

To bring in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through the medium of pig husbandry.

**Mission**

Performance appraisal and genetic cataloguing of indigenous pigs, development of improved pig variety together with production, health, product processing and pig based integrated farming system technologies to facilitate the pig rearers of the country achieving household food, nutritional and economic security.

**Focus**

The institute will focus through various programmes to achieve vision envisaged though well structured research, teaching and extension programmes.

- Genetic improvement of indigenous pigs through selective and crossbreeding including identification of new traits, genome wide association studies and finally genomic selection
- Improvement of physiological and reproductive efficiency of pig production
- Address the issues related to feed shortage and improvement of nutrient utilization for enhancing pig production
- Development of pig health management protocols
- Post harvest management and value addition of pork
- Promote environment friendly and climate resilient pig farming
- Institute-stakeholder linkage and skill developments for improved pig seed production at various levels of pig production.

- Develop a database for strategic planning and policy support at national and international level including development of networks.
- Programs to induce and sustain economic transition and nutritional security among the pig rearers through development of novel products and technologies, their transfer and refinement

# Harnessing Science

Pig rearing is one of the most important occupations of rural society especially the tribal masses of India. The pig is one of the most efficient food converting animals among domesticated livestock, and can play an important role in improving the socio-economic status of the weaker sections of the society, particularly in the North-Eastern Region (NER) of the country, which has a significant pig population (about 40%). Considering the relevance of the pig for the NE region, ICAR/Government of India approved the establishment of a National Research Centre (NRC) on Pig at Guwahati, Assam for conducting basic, applied and strategic research and boosting the pig husbandry in the region with a mandate over the entire country.

There is an imperative need to grow more food animals in the region and pig may be considered as the animal of choice due to its high prolificacy, early attainment of slaughter/ market weight, efficient feed conversion rate, relatively less susceptibility to diseases and preference of the local population to pork and pork products. Though the consumption of pork is the highest in the NER, the production and processing scenario of meat in the region is underdeveloped.

The major problem faced by small holder pig farmers in the country is the lack of critical inputs to transform the existing low or zero input system to a vibrant technology driven successful enterprise. It was realized that a small scale economic technology intervention in the form of superior germplasm and package of practices is required to improve income and viability of the enterprise. The institute conducted a survey based project for documenting various pig husbandry practices (procurement of animals, management, housing and health care) for the eight NE states and later on the pork production and quality scenario in the Assam to have first hand information. Based on the surveys, research conducted and anticipated requirements for technology driven piggery development in coming four decades, the Vision 2050 and Expenditure Finance Committee memorandum s for 12$^{th}$ five year plan documents are prepared.

## Enhancing production through cutting edge research in physiology, reproduction, nutrition, health, genetics and breeding

One of the key factors in determining the productivity of the pigs is its genetic makeup. Therefore, for production of superior germplasm one of the strategies will be to undertake genetic improvement of indigenous pigs through conventional and molecular methods, keeping in line with advancement of science. The superior germplasm developed will require necessary support in terms of nutrition,

physiological, health and farm management research. The various components of the production enhancement strategy will include:

- Characterization, evaluation and conservation of indigenous pigs. The institute presently maintains two indigenous breeds of pigs (Niang-Megha and Ghungroo) and three exotic breeds (Hampshire, Large white Yorkshire and Duroc) of pigs. Niang-Megha and Gunghroo has been recognized as separate breed of pigs and efforts for documentation of other indigenous germplasm available in India needs to be taken up.
- Development of suitable cross breed of pig (such as Ghungroo x Hampshire) and fixation of optimal level of exotic inheritance for maximizing performance (production, reproduction and carcass characteristics) and adaptation under farm and field conditions.
- Development and expansion of database on pedigree and performance data for taking up genome wide association studies using bioinformatic tools.
- Molecular screening of indigenous pigs for presence of adverse characteristics such as Pale, Soft and Exudative (PSE) meat in the pig herds.
- Application of techniques such genomics, proteomics, gene mining for generation of basic functional genomic data and identification of various trait associations.
- Identification of candidate markers for selected productive and reproductive traits genomic selection.

**Physiological and Reproductive management**

- The institute has developed artificial inseminations (AI) protocol along with a suitable semen extender and so far about 13000 AI born piglets were produced including 8700 piglets in farmers' house and 4500 piglets in institutional farm. The efforts for further spread of AI to continue at field level in collaboration with various stake holders for rapid multiplication of superior swine germplasm.
- Optimization of milk production in sows to support increased litter number including enhancement of mammary gland immunity.
- Understanding hormonal and nutritional regulation of fatty acid synthesis and desaturation in pigs for improving fatty acid composition manipulation and alteration of body fat content.
- Physiogenomics, functional genomics and systems biology research including nutrient/hormone-gene interaction analysis.
- Development of good management practices including promotion of pig based integrated farming system
- Development of comfort housing for pigs, keeping in view of impending climate change.
- Research on environment friendly pig farming including documentation of gas emissions, reduction of carbon foot prints and climate resilient agriculture to ensure long term human and animal welfare.

**Feeding management for improving quality, quantity and bioavailability of nutrients**

- Nutritional analysis of locally available unconventional feed resources including research on impact of industrialization, environmental pollutants in quality and quantity of feed.
- Development of balanced ration for various categories of pigs using locally available feed resources to reduce feed cost. This includes identification of novel feed resources.
- Formulation of economic rations for application in the field conditions and resource based feeding
- Development of rapid feed evaluation techniques including in vitro methods, amelioration for anti-nutritional factors, identification and manipulation of gut microbiota in pigs and improving gut immunity.
- Assessment of use of xenobiotics, probiotics, minerals, vitamins and evaluation of Genetically Modified (GM) feed resources.
- Feed processing and resource management planning for lean periods and during natural disasters such as flood etc.
- Improving linkages with crop production research to improve nutritive value and mitigation of anti-nutritional factors in the pig feed components.
- Enhancement of nutrient utilization and bioavailability of nutrients including improving ability to digest increased dietary fibre, reduction of mineral/nutrient content in the excreta.

**Pig health management**

- Development of pig health management, biosecurity protocols and models for prediction of disease incidence with respect to season/climatic changes
- Research on existing and emerging swine pathogens including those with zoonotic importance.
- Linkages with National and International institutions for vaccine development against major swine pathogens.
- Research on non infectious diseases and immunity to improve production performance.
- Regulatory measure development for control of trans-boundary diseases.
- Awareness creation among the stakeholders to contain infectious diseases.

## Post-harvest management, product development and value addition

Once a healthy pig attains an optimal age or body weight for slaughter, the concern is to ensure production of wholesome meat and value addition of pork. The efforts directed towards this goal will also include development and implementation of quality production parameters on par with global standards to facilitate fresh pork or product export. The pig slaughter byproduct utilization is also an area which is yet to be tapped. The major emphasis may include the complete pork production to consumption chain research for domestic and export market tapping.

- Development and expansion of data on quality characteristics, drug and other residues in pork sold in India.
- Development and popularization of pig slaughter and processing facility suited to field conditions with minimum operational costs, off-floor operations, hygienic display and storage facilities to facilitate clean pork production.
- Refinement and development of different value added pork products
- Development of standards and improvement of nutritive/functional value of pork
- Reduction of post harvest losses and promote hygienic farm to fork chain continuity though technology support and stakeholder involvement
- Technologies for improving shelf life of pork products.
- Efficient utilization of slaughter by-products for development of novel products

## Human resource development and promoting piggery based entrepreneurship

The updation of knowledge and skill of researchers, field veterinarians, farm personnel and most importantly farmers is expected to be a continuous process. The institute will organize short and long term trainings, workshops, symposia, seminars etc for improving quality of human resources. Specific steps to create awareness and improve entreprenuership will also be taken up in a systematic manner. This will not only ensure employment generation, but is also expected to create more and more clients for developed technologies. Therefore, emphasis will be to strenghten institute -stakeholder linkage for improved pig production and promotion of entrepreneurship. One of the strategies towards this goal will be the creation of pig villages, production support in terms of piglet supply, good management practices, providing training for production of pork products and market linkages for the produce. Knowledge management and protection of intellectual property will be of concern while commercializing the technologies. The institute will facilitate stakeholder meeting at various stages to promote entrepreneurship including the interface meetings with policy makers. Further, taking advantage of advancement in information technology, the dissemination of information will also be planned though mobile networks and other forms of print and electronic media.

# Strategy and Framework

The National Research Centre on Pig will adopt the following strategies to accomplish the targets envisioned, and to enhance efficiency research, pig production, product development and promotion in the country (see annexure 1).

1. **Achieving 30% growth rate in the piggery sector**

It is envisaged that the piggery sector will be dominated by crossbred and improved variety of pigs to the level of 95% by next 35-40 years. The population of indigenous pigs will be about 5%, maintained mainly under various *in situ* conservation programmes.

**Institute's Role:**

- Large scale application of AI technology in pig production and horizontal spread of superior germplasm
- Development of effective production package and delivery for sustaining and improving pig production.
- Further strengthening and expansion of existing public-private networks
- Development of market channels
- Development and delivery of disease forecast, early detection and control modules
- Skill upgradation programme/Human Resource Development
- Promoting climate resilient pig farming.

2. **Achieving a minimum of 32 piglets/sow/year**
    - Development of suitable variety of pig
    - Development of optimal package of practices including improved nutrition and health coverage for supporting increased litter number
    - Physiological capacity building for improved lactation support for piglets

3. **Conservation of indigenous pig germplasm**

Different strains of indigenous pigs from Indian States will be collected, documented and conserved *in-situ* and *ex-situ*. Necessary steps will be taken to accord distinct breed status, wherever possible.

4. **Development of technologies related to animal breeding and propagation of improved breeds of pigs**
    - Improved breeds of the pig will be propagated throughout the country for generating high income and growth among farming community.

- Development of capabilities and implementation of velogenetics through incorporation of molecular techniques like marker assisted introgression (MAI), marker assisted selection (MAS) and genomic selection (GS).
- Standardization of high throughput genomic approaches such as microarray, SNP and genotyping for improving pig breeding programme.
- Development of breeding pyramid and herd maintenance plan for pig farms
- Identification of new traits for improving pig production and health
- Studies on genome wide associations for various traits in pigs
- Development of capabilities for collection, maintenance of database and analysis of large volume pedigree and performance data of pigs

**5. Developing novel feeds and technologies for high animal performance**

- Integration of already available pig feed technological options for supporting increased production.
- Development of novel feed technologies and feed additives, supplements and other alternatives for replacement of substances such as growth promoting antibiotics for increased animal performance.
- Development of novel feed components for substituting naturally grown grain and other feed resources
- Preparation of inventory of feed resources
- Biotechnological intervention for enhancing nutritive value, nutrient assimilation and utilization of agro-industrial by-products as pig feed
- Studies on role of gut microbiome and application of metagenomics

**6. Development of early disease diagnosis, prevention and decision support systems**

- Developing pen side disease diagnosis systems
- Region wise mapping and forecasting of pig diseases including their impact on production
- Development of disease resistant pigs
- Development and delivery of effective marker vaccines and DIVA tests for economically important diseases.
- Development of technologies for combating emerging swine pathogens
- Development and strengthening of bio-safety protocols for implementation at field level
- Addressing issues related to development of antibiotic resistance and presence of residues
- Continuing Veterinary Education (CVE) programme for skill development and improving knowledge related to modern health management practices for field veterinarians.
- Documentation and validation of time tested indigenous technical knowledge (ITK) on pig disease control/treatment

- Development of strategies for the control of transboundary diseases
- Development of models for risk management and impact assessment along the pig production chains
- Development of strong immune belt across the international borders in collaboration with line agencies/department.
- Good emergency management practices for early detection, reporting and counter epizootic measures.
- Development of novel technologies for improving gut and lacteal immunity for reducing neonatal piglet mortality

**7. Development of novel production technologies**

- Development of embryo sexing and cloning techniques for efficient evaluation of genotypes
- Development of transgenic pig
- Application of pig as model for biomedical research
- Application of advanced technologies for pig production research (proteomics, epigenomics etc).
- Application of nanotechnology in pig production and health
- Application of nutrigenomics for precision/personalized nutrition

**8. Development of advanced technologies for optimising physiology and reproduction in pigs**

- Identification of mechanisms regulating porcine physiology and reproduction
- Identification and functional/chemical characterization of novel/candidate substances influencing physiology and reproduction
- Studies on animal adaptation and development of markers for quantification of stress
- Refinement of technologies for cryopreservation of boar semen
- Development of techniques for detection of estrus and diagnosis of pregnancy at field level
- Establishment of nucleus stock breeding farm and frozen semen banks for A.I programmes
- Development of techniques and *ex-situ* conservation of valuable pig genetic resources through cryopreservation of oocytes from genetically superior females.

**9. Development of post harvest management technologies**

- Technologies for minimizing post harvest losses and increasing shelf life
- Development of HACCP/GMP protocols for pork production to minimize post harvest losses for all producer levels
- Development of suitable standard operating procedures confirming to international standards such as sanitary/phytosanitary/codex alimentarious
- Refinement/development of a standard grading procedure and grading of pork and its products at par with international standards.

- Individual postmortem animal identification and carcass labeling
- Technologies for tracing origin/source of meat/animal before and after processing
- Development of technologies for detection and prevention of adulteration in processed pork products.

**10. Value addition and development of novel pork products**

- Research on quality control parameters/sanitary measures and getting the local bodies adhere to the sanitary regulations so devised.
- Pork quality assessment under different stages of processing.
- Value addition to different pork products and development of shelf stable pork products through MAP & Retort processing
- Development of novel pork products
- Technologies for enhancement of nutritive and functional value of pork

**11. Development of broiler pig**

- Development of a crossbred line of pig strain with incorporation of genetic components from small size pig.
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**12. Promotion of pig based integrated farming system and environment friendly pig farming**

In order to provide technological support to small land holders who are desirous of practicing mixed farming for multiple livelihood options, following strategies shall be followed to promote pig based integrated farming:

- Development of low cost pig housing systems using locally available materials.
- Documentation and monitoring of environmental impact of pig farming
- Development of technologies for better waste management and manure nutrient recycling
- Nutrient Management Planning (NMP) for modification of manure composition depending upon soil chemistry

**13. Development of pig by-products and promotion of pig based entrepreneurship**

- Development of novel applications/products of pig and pig byproducts
- Characterization of pig by products and development of technologies for its utilization.
- Knowledge management and technology commercialization to promote pig based entrepreneurship in collaboration with banking, business houses and research institutes
- Training support for various kind of stakeholders (farmers, entrepreneurs, personnel from line departments etc)

**14. Linking of Indian pig production system with global network**

- Development of pig village networks for transfer of technology and feed back for its refinement.
- Development and propagation of community based cooperative pig farming.
- Application of Information Communication Technology (ICT) for percolation of technologies from farm to field
- Development and support kisan call centres.
- Development of links with National and International organizations like ILRI, OIE etc,.
- Strengthening of collaboration and cooperation with various National departments and R&D in various countries.

**15. Development of centre of excellence in pig production**

- Promotion and development of NRC on Pig as a leader in pig production, product processing and research among the SAARC/SE Asian countries
- Making a mark of Indian pig globally in terms of research, production and product export.

# Epilogue

National Research Centre on Pig, Guwahati, Assam is dedicated to bring in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through the medium of pig husbandry.

The institute envisions developing critical innovative research in pig production, product processing, policy support and targeted technology delivery mechanisms for rapid growth of the piggery sub-sector and making India a dominant player among the pig producing nations of the world. The cutting edge research activities in various frontier areas at the Institute would be directed towards augmenting overall nutritional and economic security of pig farmer, transforming it to an organized venture for enhanced income, generate employment opportunities and act as engine for driving socio-economic progress among the citizens of the country and environmental sustainability of pig production system in the country. It is further envisioned to transform the NRC on pig to a world class institution involved in high quality, high impact research, making it a model leader institution in all areas of pig and allied research and production support with a potential game changer among the stake holders of pig farming.

The institute will remain committed to facilitate the pig rearers of the country in achieving household food, nutritional and economic security through research, extension and overall human resource development.

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# Annexure 1: Strategic framework

| Goal | Activity/Approach | Performance indicator |
|---|---|---|
| **Technology development for superior germplasm production and management** | • Development of capabilities and implementation of velogenetics through incorporation of molecular techniques like marker assisted introgression (MAI), marker assisted selection (MAS) and genomic selection (GS)<br>• Development of breeding pyramid and herd maintenance plan for pig farms<br>• Identification of new traits for improving pig production and health<br>• Studies on genome wide associations for various traits in pigs<br>• Development of capabilities for collection, maintenance of database and analysis of large volume pedigree and performance data of pigs | • Improved breeds of the pig will be propagated throughout the country for generating high income and growth among farming community.<br>• Advanced technologies for animal selection and breeding<br>• Database containing phenotypic and genotypic for wide spread applications and future planning. |
| **Promoting high growth rate in the piggery sector and sustainable pig production** | • Large scale application of AI technology in pig production.<br>• Development of effective production package and delivery for sustaining and improving pig production.<br>• Development of novel feed technologies and feed additives, supplements and other alternatives for replacement of substances such as growth promoting antibiotics for increased animal performance.<br>• Biotechnological intervention for enhancing nutritive value, nutrient | • Spread of superior germplasm<br>• Production package and delivery for sustaining and improving pig production<br>• Novel feed technologies and feed additives, supplements and feed components, inventory of feed resources<br>• Better utilization of industry byproducts<br>• Increased pig population in the country leading to improved nutritional and |

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| | assimilation and utilization of agro-industrial by-products as pig feed<br>• Integration of already available pig feed technological options for supporting increased production.<br>• Promoting climate resilient pig farming/<br>• Development of market channels<br>• Development and delivery of disease forecast and climate change modules for early warning<br>• Development of suitable variety of pig<br>• Development of optimal package of practices including improved nutrition for supporting increased litter number<br>• Physiological capacity building for improved lactation support for piglets<br><br>• Further strengthening and expansion of existing public-private networks | economic security<br>• Improved income of pig rearers in the country<br>• Suitable variety of pig along with package of practices for improved nutrition supporting increased litter number<br>• Skill upgradation programme/Human Resource Development |
| **Development of early disease diagnosis, prevention and decision support systems** | • Developing rapid pig disease diagnosis systems<br>• Region wise mapping and forecasting of pig diseases including their impact on production<br>• Development of disease resistant/tolerant pigs<br>• Development and delivery of effective marker vaccines and DIVA tests<br>• Development of technologies for combating emerging swine pathogens and control of transboundary | • Pen side diagnostic systems for rapid disease detection.<br>• Effective ontrol and eradication of pig diseases.<br>• Disease resistant/tolerant pigs<br>• Creation of strong immune belt across the international borders in collaboration with line agencies/ department<br>• Documentation and control of epizootic and zoonotic diseases |

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| | diseases<br>• Development and strengthening of bio-safety protocols for implementation at field level<br>• Continuing Veterinary Education (CVE) programme for skill development and improving knowledge related to modern health management practices for field veterinarians.<br>• Development of models for risk management and impact assessment along the pig production chains | • Knowledge upgradation among field veterinarians |
| **Development of cutting edge and futuristic technologies** | • Development of embryo sexing and cloning techniques for efficient evaluation of genotypes<br>• Development of transgenic pig<br>• Application of pig as model for biomedical research<br>• Application of advanced technologies for pig production research (proteomics, epigenomics etc).<br>• Application of nanotechnology in pig production and health<br>• Application of nutrigenomics for precision/personalised nutrition<br>• Development of novel technologies for improving gut and lacteal immunity for reducing neonatal piglet mortality | • Swine based models for biomedical research<br>• Precision nutrition for performance/ genotype based practices for optimal production<br>• Reduction of piglet mortality and increased production of quality pig germplasm due to advanced health management |
| **Development of advanced** | • Identification of mechanisms regulating | • Generation of data for understanding porcine |

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| **technologies for optimizing physiology and reproduction in pigs** | porcine physiology and reproduction<br>• Identification and functional/chemical characterization of novel/candidate substances influencing physiology and reproduction<br>• Studies on animal adaptation and development of markers for quantification of stress<br>• Refinement of technologies for cryopreservation of boar semen<br>• Development of techniques for detection of heat and diagnosis of pregnancy at field level<br>• Establishment of Nucleus stock Breeding Farm and frozen semen banks for A.I programmes<br>• Development of techniques and *ex-situ* conservation of valuable pig genetic resources through cryopreservation of oocytes from genetically superior females. | physiology and its interaction networks.<br>• Markers for quantification of stress<br>• Kit for rapid detection of heat and diagnosis of pregnancy at field levels<br>• Propagation of superior germplasm |

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| **Development of post harvest management and value addition of pork** | • Technologies for minimizing post harvest losses and increasing shelf life<br>• Development of HACCP/GMP protocols for pork production to minimize post harvest losses for all producer levels<br>• Development of suitable standard operating procedures confirming to international standards such as sanitary/phytosanitary/codex alimentarious<br>• Development of suitable standard grading procedure for pig carcasses to facilitate export of pork.<br>• Development of a standard grading of pork and its products at par with international standards.<br>• Individual postmortem animal identification and carcass labeling<br>• Technologies for tracing origin/source of meat/animal before and after processing<br>• Development of technologies for detection and prevention of adulteration in processed pork products.<br>• Research on quality control parameters/sanitary measures and getting the local bodies adhere to the sanitary regulations so devised.<br>• Pork quality assessment under different stages of | • Technologies for minimizing post harvest losses and increasing shelf life<br>• Development framework of export markets<br>• Technology for back tracing origin of meat<br>• Spread of pork based products over a wide area<br>• Clean and wholesome pork production<br>• Novel pork products<br>• Development/refinement of technologies for pork product production and processing |

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| | processing.<br>• Value addition to different pork products and development of shelf stable pork products through MAP and retort processing<br>• Development of novel pork products and smart packaging technologies for pork and pork products. | |
| **Promotion of pig based integrated farming system and environment friendly pig** | • In order to provide technological support to small land holders who are desirous of practicing mixed farming for multiple livelihood options, | • Optimal utilization of resources and waste materials of pig farming<br>• A step towards reduced chemical fertilizer use |

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| **farming** | following strategies shall be followed to promote pig based integrated farming:<br>• Development of low cost pig housing systems using locally available materials.<br>• Documentation and monitoring of environmental impact of pig farming<br>• Development of technologies for better waste management and manure nutrient recycling<br>• Nutrient Management Planning (NMP) for modification of manure composition depending upon soil chemistry | and organic agriculture<br>• Reduction of emissions and carbon footprints related to pig farming |
| **Development of pig by-products, knowledge management and promotion of pig based entrepreneurship** | • Development of novel applications/products of pig and pig byproducts<br>• Characterization of pig by products and development of technologies for its utilization.<br>• Knowledge management and technology commercialization to promote pig based entrepreneurship in collaboration with banking, business houses and research institutes<br>• Training support for various kind of stakeholders (farmers, entrepreneurs, personnel from line departments etc) | • Characterization of pig by products such as hair/bristle fibers and development of technologies for its utilization.<br>• Human resource development at various stages of pig production and farming community, stakeholders and entrepreneurs<br>• Promotion of pig based entrepreneurship and technology development<br>• Increased income among pig rearers and others related with pig based industries<br>• Improved livelihood security among poor and socially backward communities |
| **Integrating Indian pig research and production system globally** | • Development of pig village networks for transfer of technology and feed back for its refinement<br>• Application of Information | Improved outreach of research institute to the field level<br><br>A mark for Indian pig in |

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| **by emerging as centre of excellence** | Communication Technology (ICT) in percolation of technologies from farm to field<br>• Development and support kisan call centres<br>• Development of links with international organizations like ILRI, OIE etc<br>• Promotion and development of NRC on Pig as a leader in pig production and research among the SAARC/South-East Asian countries | terms of research, production, and product export globally<br><br>High impact and quality research and visible transformation |

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