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Research Article

How Sustainable Are Small Pig Farms in Assam? Assessing the Need for Study and Action

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ABSTRACT

Background: Assam, India's 16th largest state, has a population exceeding 31.2 million and a significant agricultural sector, including piggery. Recent data shows Assam's pig population surpassing 2.1 million, akin to countries like Ireland and Portugal. Small pig farms in Assam mostly rear these pigs. Small-scale pig farming in Assam is characterised by strong family involvement, with critical decisions made collectively within the family unit, highlighting its socio-economic importance. The study aims to assess the sustainability of these farms.

Methods: Using purposive sampling, the study examined 1200 small-scale pig farmers in Assam's selected agro-climatic zones. Data was collected through face-to-face interviews with structured questionnaires focused on pig numbers, housing, feed, farming preferences, and breed choices. Descriptive analysis was conducted to identify any distinct characteristics or uniformities among farmers across zones.

Results: The research explores small-scale pig farming practices across the diverse agro-climatic zones of Assam, shedding light on concentration trends and associated challenges. Indigenous breed preferences and the use of bamboo containment do reflect cultural traditions but raise biosecurity considerations and associated potential environmental implications. The variability in feed provision reflects environmental influences, while the involvement of families underscores the socio-cultural significance of pig farming, particularly regarding gender equity. The adoption of low-input rearing methods significantly influences economic factors. Overall, the study emphasizes the importance of identifying sustainability indicators and conducting a comprehensive assessment of sustainability within the small-scale pig farming sector.

Keywords: Piggery, Sustainability, Smallholder

1.1 Introduction

Assam, India's 16th largest state, is home to a population exceeding 31.2 million, ranking it 15th among all Indian states in terms of population as per the Directorate of Economics and Statistics, Government of Assam. Agriculture and its allied activities form the backbone of the state's economy, with over 56.5% of the primary workforce and 64.9% of marginal workers directly involved in this sector (H. Nath et al., 2022). Within the realm of agriculture, piggery emerges as a vital component. Recent data from India's livestock census underscore the significance of piggery in Assam. This data places Assam at the forefront nationally, with a pig population exceeding 2.1 million (Banik et al., 2020). This number is noteworthy, standing shoulder to shoulder-with pig populations in countries like Ireland and Portugal (Bellini, 2021).

The prevalence of pig farming in Assam is deeply ingrained in its cultural heritage, particularly among various indigenous tribes, for whom pig rearing is a traditional practice (Shyam et al., 2016). This cultural affinity towards pig farming has contributed significantly to the industry's growth and sustenance. Over recent years, there has been a noticeable surge in the demand for pork meat, further fuelling the momentum of pig farming in the state. Between 2012 and 2019, Assam witnessed a remarkable 28% increase in its pig population

(Department of Animal Husbandry, 2019). This surge in pig farming activity has propelled pork production to the forefront of the state's meat industry. According to statistics provided in Table 1, pork production in Assam has experienced substantial growth, escalating from 11.74 thousand MT in 2007-08 to 19.37 thousand MT in 2018. This steady rise in production reflects the growing demand for pork within the state and the increasing efficiency of pig farming practices.

YEAR	**Cattle**	**Buffalo**	**Goat**	**Sheep**	**Pig**	**Poultry**	**Total**	**Pork Share**
2007-08	4.35	0.41	6.81	0.18	11.74	6.39	29.88	39.3%
2008-09	5.19	0.37	6.51	0.17	12.01	6.44	30.69	39.1%
2009-10	5.13	0.31	7.56	0.18	13.25	5.13	31.56	42.0%
2010-11	4.12	0.1	9.41	0.23	14.91	5.06	33.83	44.1%
2011-12	4	0.07	9.07	0.22	14.7	6.08	34.14	43.1%
2012-13	3.53	0.08	10.91	0.37	14.61	7.13	36.63	39.9%
2013-14	3.74	0.08	7.56	0.18	15.96	6.17	33.69	47.4%
2014-15	3.45	0.06	14.02	1	16.53	7.53	42.59	38.8%
2015-16	3.16	0.1	14.56	1.47	17.38	8.02	44.69	38.9%
2016-17	3.32	0.14	14.14	1.64	18.72	9.39	47.35	39.5%
2017-18	3.2	0.1	14.6	1.53	19.37	8.69	47.49	40.8%

Table 1: Meat Production In Assam 2007-18

Source: Compiled from Integrated Sample Survey Reports, Department of Animal Husbandry

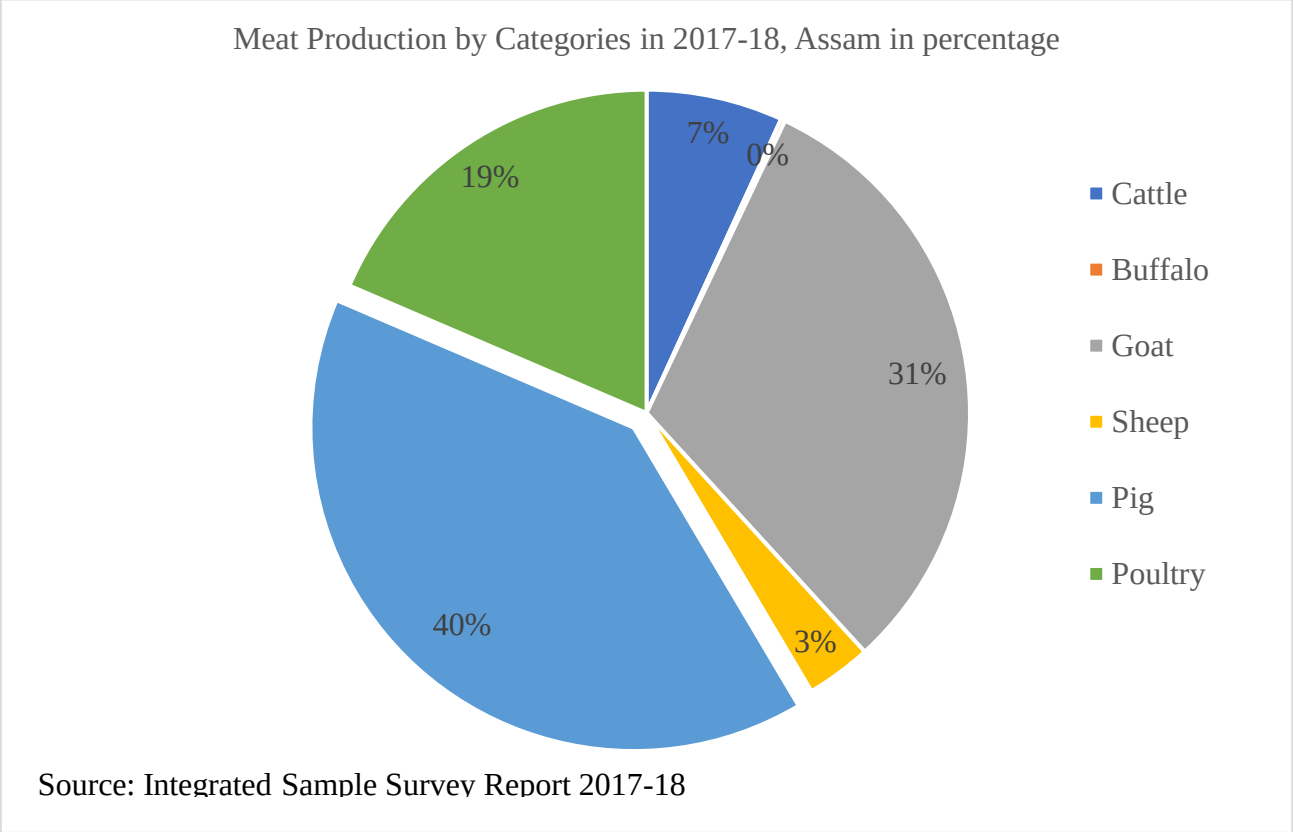


Figure 1 Meat Production by Categories in 2017-18, Assam in percentage.

Since India's independence and initiation of the Five-Year Plans, the state and central governments have consistently accorded special attention to Assam and its piggery sector. In 1971, Assam was chosen as one of the initial four centres for implementing the All India Coordinated Research Programme (AICRP) on piggery (Srikanth et al., 2023). The overarching aim of state and central government schemes has been to promote and emphasise small-scale piggery, a predominant practice in the region. This focus is evident through various schemes launched under entities like the State Institute of Rural Development (SIRD), the Integrated Rural Development Program (IRDP), and the National Rural Employment Program (NERP).

Even today, the central government's National Livestock Mission (NLM) includes a dedicated subsection on small-scale piggery in the Northeast region, of which Assam is an integral part. The prevalence of small-scale or smallholder pig farming in Assam mirrors practices in neighbouring countries to the east, such as China, Cambodia, Vietnam, and Thailand (Fang, 2022). These nations boast significant pig populations reared in small-scale or smallholder farms (Haldar et al., 2017). This trend aligns with the broader scale and size of agricultural activities across Asia and sub-Saharan Africa, as highlighted in a factsheet released by the Food and Agricultural Organization (FAO).

Smallholder or small-scale farmers in Assam typically prioritise family involvement, relying on family labour for pig rearing and utilising the proceeds for household consumption. Critical decisions regarding farm management are often made individually or collectively within the family unit (Wasudha et al., 2018). Consequently, small-scale pig rearing holds substantial socio-economic significance in the context of Assam. The objective of the study is to evaluate the necessity for assessing the sustainability of small-scale pig farms in Assam.

1.2 Research Methodology

Literature Review: In reviewing relevant literature to understand two key aspects—small pig farms of Assam and the concept of sustainability—the research adopted the pillar model of sustainability as its guiding framework (Purvis et al., 2019). The literature review aimed to glean insights into the unique characteristics of small pig farms in Assam, including their operational challenges, socio-economic significance, and cultural underpinnings. By grounding the research in the pillar model of sustainability, which emphasises the interconnectedness of these dimensions, the study aimed to comprehensively evaluate the need to assess the sustainability of small pig farms in Assam.

Study Area Delimitation: The research was limited to Assam's geographical area, which is renowned for its notable pig farming activity. More precisely, the study concentrated on four of Assam's six agroclimatic zones, encompassing almost 95% of the state's pig population (A. K. Das et al., 2018; H. K. Nath & Mandal, 2018). This focused strategy aimed to maintain relevance and specificity within the study's context.

Population and Sampling: The population under study comprises small pig farms in Assam, although determining the precise number poses challenges. Despite the lack of definitive figures, various news sources estimate the number of small pig farms in Assam to range between 800,000 to 1,000,000 pig farmers (M. Das, 2021). This wide range underscores the decentralised nature of the pig farming industry in Assam, where numerous small-scale farmers contribute to the sector's vibrancy and diversity.

Constructing a sampling frame was pivotal in the research on small pig farming in Assam. The sampling frame, carefully crafted from within the population of small pig farmers in the region, formed the basis for participant selection. A stratified purposive sampling technique was adopted, employing a strategic approach and utilising the diverse agroclimatic zones of Assam as distinct strata (Kothari, 2004; Leedy & Ormrod, 2016). This method categorised the population based on varying environmental conditions and agricultural landscapes, ensuring representation across different contexts. A total of 1200 farmers were surveyed, drawn from the sampled population, to provide insights into small pig farming practices, challenges, and perspectives within the unique setting of Assam. This meticulous sampling process aimed to capture a comprehensive understanding of small-scale pig farming dynamics, laying the groundwork for informed analysis and decision-making in the agricultural sector.

Field-Level Data Collection and Analysis: Data collection involved administering a meticulously prepared and validated questionnaire to capture a holistic understanding of various facets of small pig farming practices across environmental, social and economic parameters. Respondents contributed valuable insights into their pig-rearing practices and other pertinent variables crucial to the study's objectives. Following data collection, the gathered information underwent comprehensive analysis utilising the latest version of SPSS (Statistical Package for the Social Sciences). The analytical approach primarily comprised descriptive analysis, facilitating a thorough exploration of data characteristics and trends. Furthermore, to uphold the reliability of the findings, a test-retest validation procedure was executed to validate the statistical assumptions underlying the analysis (Allen et al., 2023). This rigorous validation ensured the statistical analysis's robustness and credibility, thereby enabling the extraction of meaningful insights and the formulation of valid conclusions concerning whether or not the assessment of sustainability is essential for small pig farms in Assam.

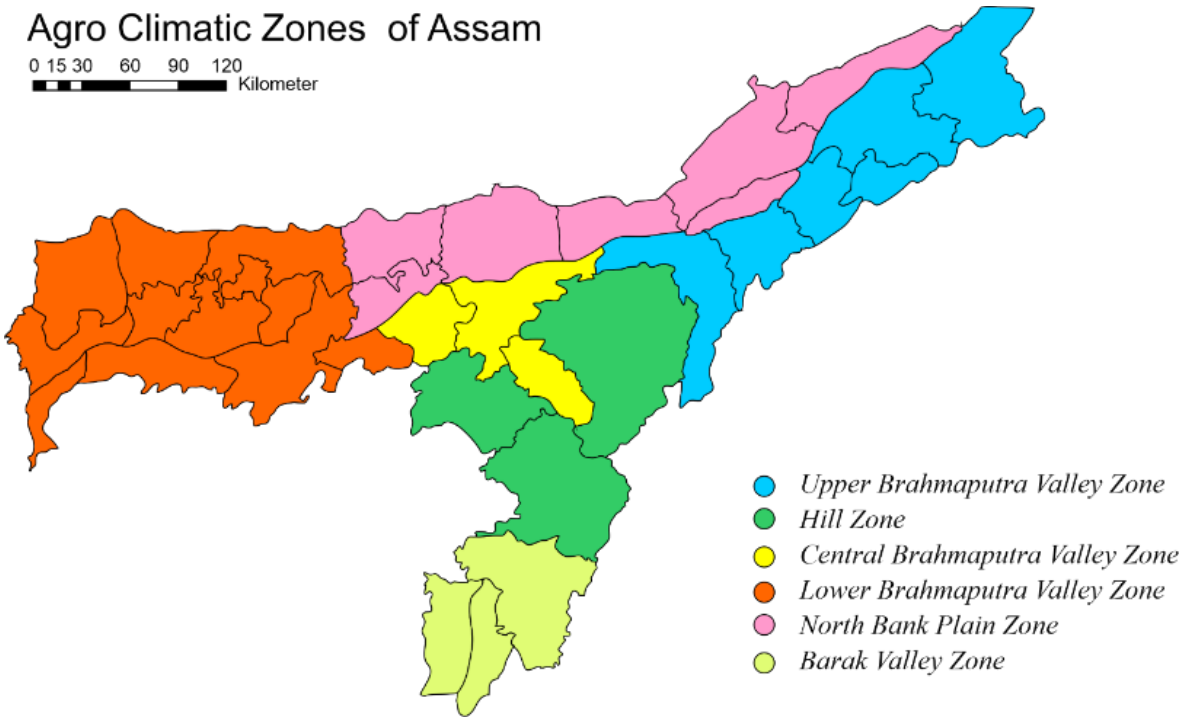


Figure 2 Agro-Climatic Zones of Assam

1.3 Results

1.3.1 Herd Size

The research findings indicated that, regardless of their agro-climatic zone, farmers maintained an average herd size of fewer than 2 pigs per farm. Across all surveyed farmers, the average herd size stood at 1.36 pigs, with those in the Hill Zone exhibiting a slightly higher average of 1.62 pigs per farm. Conversely, the lowest average herd size was noted in the Lower Brahmaputra Valley, where it was recorded at 1.17 pigs per farm. Table 2 presents the average herd size observed across the surveyed agro-climatic zones. Table 2 Average Pig Herd Size In Small-scale Pigs farms of Assam.

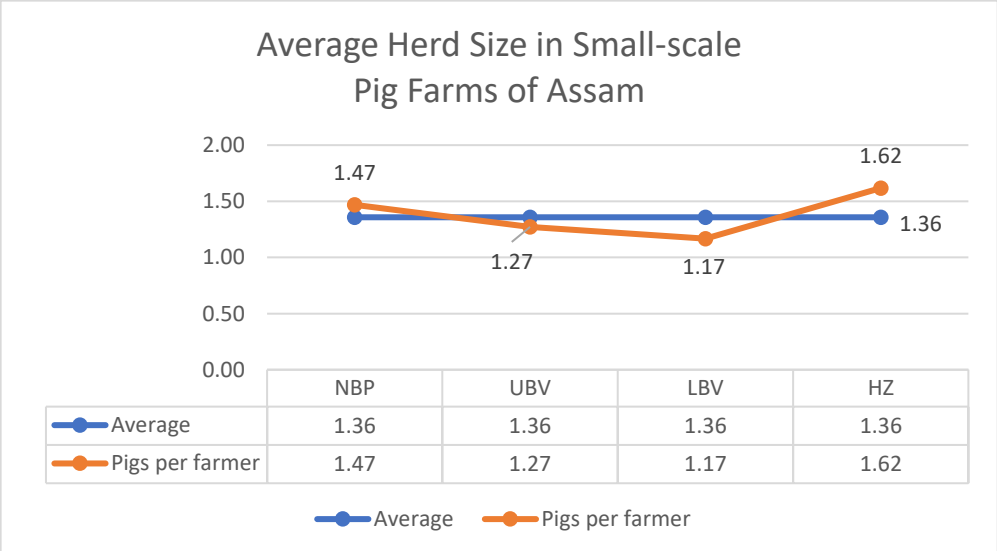


Figure 3 Average Pig Herd Size in Small-scale Pig Farms of Assam

1.3.2 Breed Preference

The study clearly revealed that small-scale pig farmers of Assam have an overwhelming preference for local or indigenous pigs. 95.46% of the pigs surveyed were either local, indigenous, or non-descript and only 4.54% of the pigs surveyed were of exotic variety. This data is quite significant in comparison to the state average of 21.83% for exotic breeds and 78.17% of indigenous breeds as recorded in the livestock census(Department of Animal Husbandry, Dairying & Fisheries, 2019).

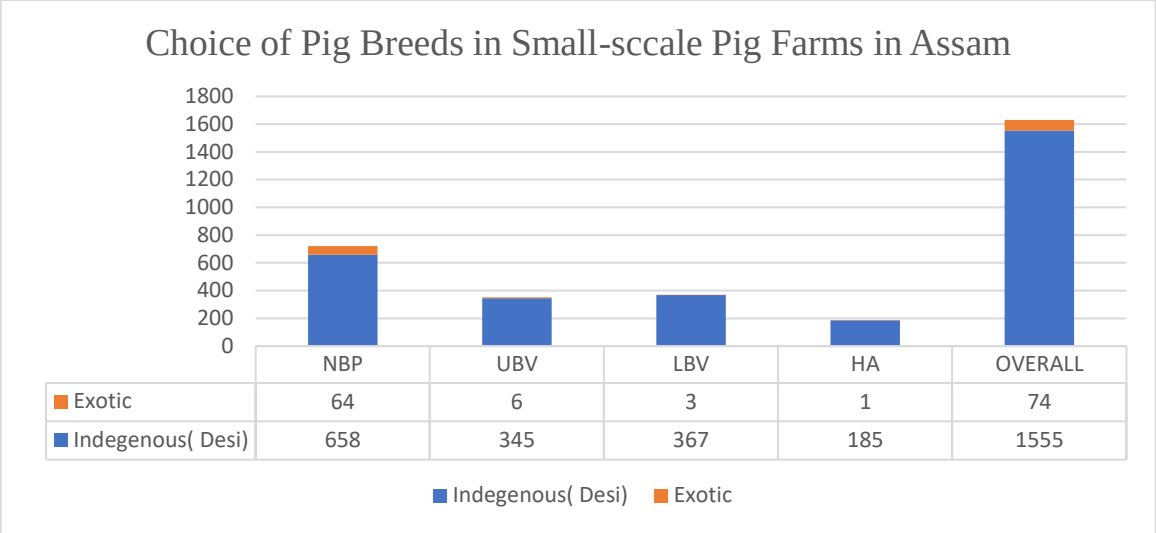


Figure 4 Choice of Pig Breeds in Small-scale Pig Farms of Assam

Picture 1 Local or Indigenous pigs Preference amongst small-scale pig farmers of Assam

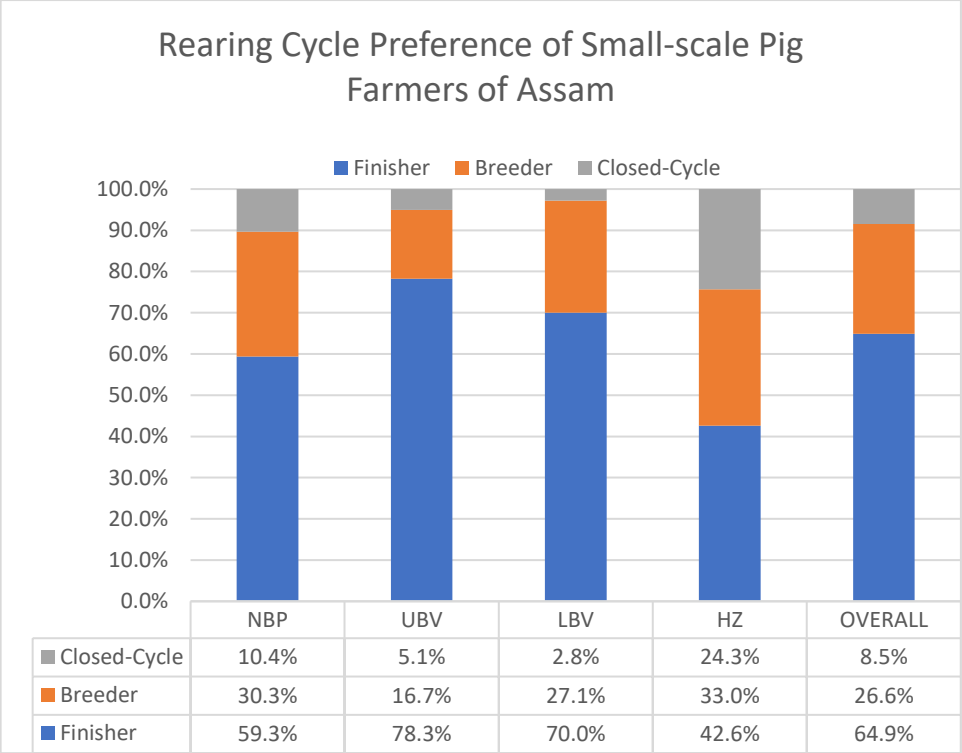
1.3.3 Rearing Cycle

Pig farming cycle can be distinguished in three main categories(Malak-Rawlikowska et al., 2021) –

(i) Breeding Farms: where farmers specialize in piglet production.
(ii) Finisher Farms: where farmers buy piglets and grow them for meat production.
(iii) Closed-cycle Farms: where farmers engage both in piglet production as well as engage in growing these piglets (either the whole lot or part of the stock) for meat purposes.

The study clearly showed that all these three types of rearing cycles are being practiced by small-scale pig farmers of Assam. Across the state, the preference lies in finishing the cycle with 64.9% of the farmers adopting this cycle. 26.6% of the farmers are engaged only in production of piglets whereas 8.5% of the farmers are engaged both in piglet production as well as finishing cycles i.e in a closed-cycle rearing.

The farmers located in the Hill Zone, have the least skewed preference with a slight skew towards finishing, where a skewness of 0.14 was observed. The farmers in the Upper Brahmaputra Valley showed the highest skewness towards a preference for finishing, where a skewness of 1.56 was observed. The overall skewness is towards Finishing, where are skewness of 0.99 was observed.



	NBP	UBV	LBV	HZ	OVERALL
Closed-Cycle	10.4%	5.1%	2.8%	24.3%	8.5%
Breeder	30.3%	16.7%	27.1%	33.0%	26.6%
Finisher	59.3%	78.3%	70.0%	42.6%	64.9%

Figure 5 Rearing Cycle Preference of Small-scale Pig Farmers of Assam

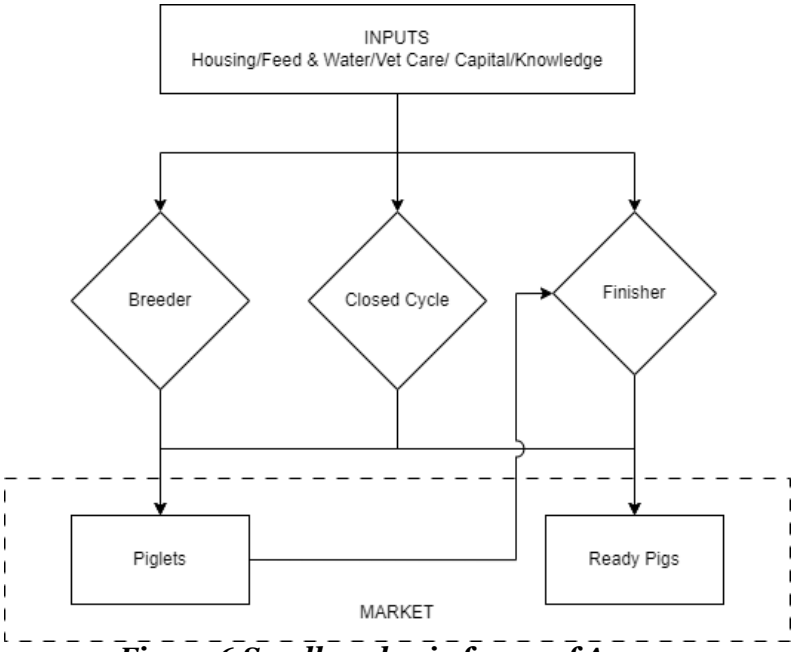
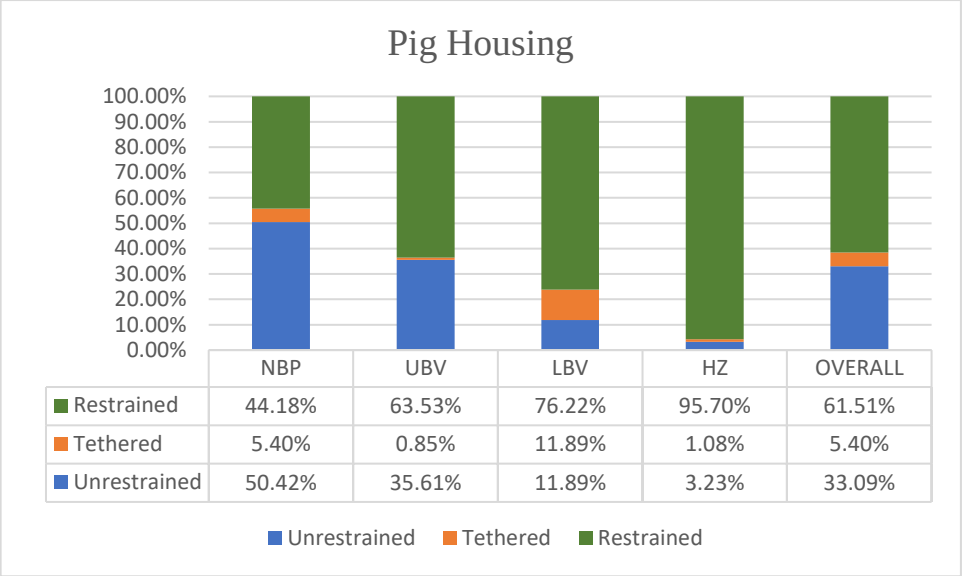


Figure 6 Small-scale pig farms of Assam

1.3.4 Pig Housing

It was observed that 1 in every 3 pigs across the small-scale pig farms of Assam was kept in an unrestrained manner when compiling the data for an overall assessment. Unrestrained rearing practice is most prevalent in North Brahmaputra Valley where 50.42% of the pigs were kept in an unrestrained manner. Restraining is most common in the Hill Zone, where only 3.23% of the pigs were found to be unrestrained, followed by 11.89% unrestrained pigs in Lower Brahmaputra Valley. During the data collection period, it was found out that some farmers have the habit of tethering the pigs either based on time of the day, or life cycle of the pig. However, to maintain uniformity, these were recorded as unrestrained.

Overall, it was found that only 15.4% of the pigs were tethered throughout their cycle. Tethering was most common in the Lower Brahmaputra Valley, where 21.89% of the pigs were kept tethered.



	NBP	UBV	LBV	HZ	OVERALL
Restrained	44.18%	63.53%	76.22%	95.70%	61.51%
Tethered	5.40%	0.85%	11.89%	1.08%	5.40%
Unrestrained	50.42%	35.61%	11.89%	3.23%	33.09%

Figure 7 Type of Pig Housing Amongst Small-scale Pig Farms in Assam

Picture 2 Bamboo Housing

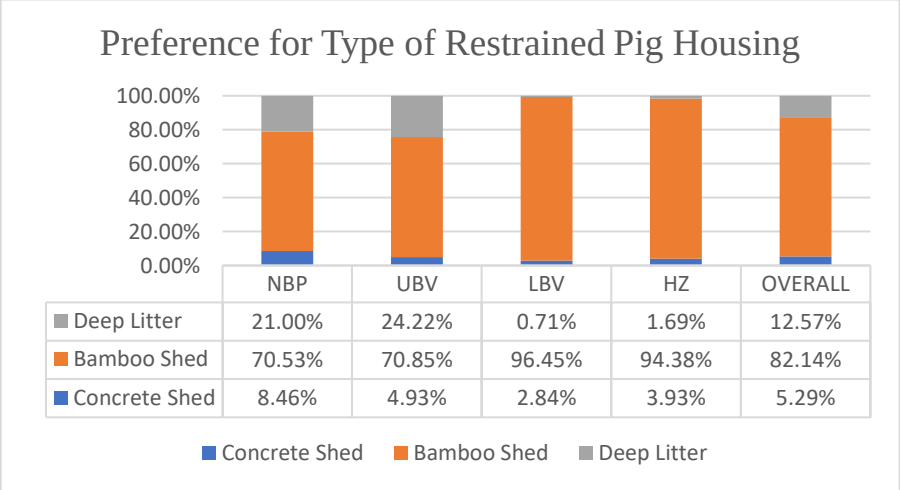
Picture 3 Pigs in a Deep Litter System in Dhemaji District

Picture 4 Tethering of Pigs to Trees or Bamboo Poles

Picture 5 Concrete Housing with Exotic breed in Lakhimpur

Restrained pig housing has been further segregated into three broad categories – Concrete housing, Bamboo and Wood housing and Natural or Deep Litter system of rearing. It was observed that the most preferred housing system are the ones that are made using bamboo or wood. Overall 82.14% of the houses surveyed were made of bamboo or wood. Only 5.29% of the pig houses surveyed were made of concrete with highest numbers in North Bank Plains with 8.46% of the houses made of concrete and lowest in Lower Brahmaputra Valley with only 2.84% of the pig houses made of concrete.

Natural or Deep Litter system of rearing is not popular in LBV or HZ areas. It is only prevalent in the NBP with 21% and UBV with 24.22% having natural system of rearing. One major observation during the survey was the manure management system, which was usually seen to be an open pit close to the farms.

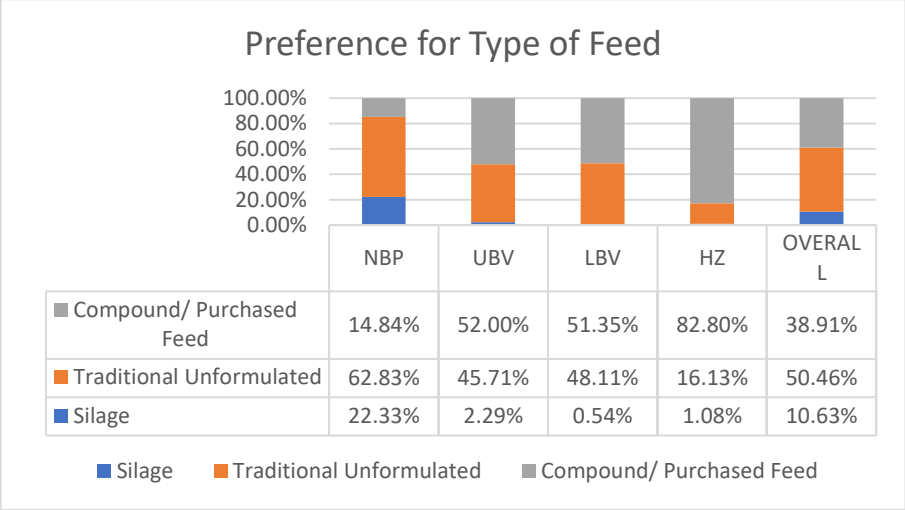


	NBP	UBV	LBV	HZ	OVERALL
Deep Litter	21.00%	24.22%	0.71%	1.69%	12.57%
Bamboo Shed	70.53%	70.85%	96.45%	94.38%	82.14%
Concrete Shed	8.46%	4.93%	2.84%	3.93%	5.29%

Figure 8 Type of Pig Housing in Small-scale Pig Farms of Assam

1.3.5 Pig Feed

To study the feeing system of pigs, feed was segregated intro three broad categories – Traditional unformulated, Purchased or Compound feed and Silage feed. It was observed the most common feed given to the pigs was traditional unformulated feed with 50.46% of the pigs fed on it. 38.91% of the feed provided to the pigs was purchased or compound feed. The small-scale pig farmers of the Hill Zone preferred providing purchased feed to their pigs with 82.80% of the pigs fed either on purchased or compound feed. Silage feeding is not a common practice and is prevalent only in the North Brahmaputra Plain areas with 22.33% of the pigs being fed silage feed. However, it was also observed that the NBP area has the least preference for purchased or compound feed, with only 14.84% of the pigs being fed on it.



	NBP	UBV	LBV	HZ	OVERALL
Compound/ Purchased Feed	14.84%	52.00%	51.35%	82.80%	38.91%
Traditional Unformulated	62.83%	45.71%	48.11%	16.13%	50.46%
Silage	22.33%	2.29%	0.54%	1.08%	10.63%

Figure 9 Type of Feed Provided to Pigs in Small-scale Pig Farms of Assam

1.4 Discussion

The study offers a comprehensive exploration of the small-scale pig farming sector across the diverse agro-climatic zones of Assam, shedding light on its intricate dynamics and implications. Notably, while pig farming is dispersed throughout the state, a significant concentration of pigs, approximately 95%, is observed in the LBV, UBV, NBP, and HZ zones, delineating patterns of distribution and agricultural activity.

Across these zones, a consistent trend emerges with farmers maintaining a modest average herd size of fewer than 2 pigs per farm, underscoring the prevalent scale of operations in the sector. This uniformity in herd size underscores the common challenges and practices experienced by small-scale pig farmers across Assam, irrespective of their geographical location.

A noteworthy aspect revealed by the study is the preference of farmers for indigenous breeds of pigs, reflecting a deep-rooted cultural affinity and an understanding of the local ecosystem. However, the practice of leaving pigs unrestrained, either partially or entirely, raises concerns, particularly in light of the reported outbreaks of ASF disease in the state. This underscores the urgency for adopting appropriate biosecurity measures and management practices to safeguard the sector's sustainability and resilience against potential threats.

Despite these challenges, the study highlights the innovative use of locally available materials, such as bamboo or wood, for restraining pigs, offering a cost-effective solution to mitigate risks associated with unrestricted roaming. Furthermore, the prevalence of low-cost housing solutions, predominantly constructed using bamboo or wood, underscores the resourcefulness and adaptability of small-scale pig farmers in Assam.

Interestingly, there exists notable heterogeneity among agro-climatic zones regarding feed provision practices, with farmers in hilly areas favouring purchased or compound feed, while those in the plains opt for unformulated or silage feed. This variation reflects the influence of local environmental factors and agricultural practices on farming decisions and resource utilization patterns.

Pig rearing emerges as a deeply ingrained family-oriented activity, with distinct gender roles delineating various aspects of farm management and decision-making processes. This socio-cultural dimension underscores the integral role of pig farming in shaping familial and community dynamics, thereby contributing to the social fabric of rural Assam.

Furthermore, the study identifies three distinct categories of farmers based on their preferred rearing cycle, reflecting diverse approaches to pig farming and highlighting the adaptability and versatility of small-scale

farmers in Assam. This close-cycle farming approach underscores the holistic engagement of farmers across different stages of pig production, maximizing resource efficiency and productivity.

1.5 Conclusion

This study offers a comprehensive insight into the complex dynamics of small-scale pig farming in Assam, addressing its economic, environmental, and social aspects. By delineating the interactions among these elements, the research establishes a foundation for a comprehensive evaluation of sustainability within the context of Assam's small pig farms. Given the unique nature of these farms characterized by decentralization and small herd sizes, it becomes essential to pinpoint relevant indicators for the study. The findings of this research will serve as a catalyst for further investigations aimed at fostering sustainable rearing practices in such farms, thereby contributing to a more promising future.

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