Original Research Article

Piggery Value Chain Mapping in Bengaluru: A Comprehensive Analysis of Rearing Systems

Abstract

The study explores the structure and mapping of the piggery value chain in Bengaluru, focusing on pig farmers comprising breeders and fattening farmers from both rural and urban districts. The research delineates distinct rearing systems, breeding practices, feeding strategies, and health care protocols observed among the respondents. Breeders predominantly employ intensive rearing systems to optimize breeding outcomes, contrasting with fattening farmers who favor semi-intensive methods to balance care with natural behaviors. Variations in housing preferences, feeding practices, and health care routines reflect tailored approaches aligned with specific farming objectives. The study's value chain mapping visually illustrates the sequential stages from input supply to consumption, highlighting the roles and interactions of stakeholders in Bengaluru's piggery sector. These findings contribute insights into enhancing productivity, promoting animal welfare, and fostering sustainable practices within the local pig farming industry, crucial for future research and development initiatives.

Keywords: Piggery Value Chain, Rearing systems, Piggery Breeders, Piggery Fattening Farmers

Introduction:

Livestock plays a crucial role in India's agricultural sector, serving as a cornerstone of its landscape. Its multifaceted contributions span various critical dimensions. Livestock significantly bolster food and nutritional security by supplying nutrient-rich products. Moreover, it serves as a vital source of employment and income, providing a buffer against crop failures. Additionally, livestock provides essential draft power and valuable manure, thereby enriching agricultural practices and reinforcing the agricultural value chain.

Pork is the most consumed meat globally. However, in India, consumption of pork is limited to few regions of the country. In India, as per 20th Livestock census, the total Pig population is 9.06 million. Pigs stand out in terms of their potential to provide rapid economic returns to farmers due to inherent traits such as high fecundity, efficient feed conversion, early maturity, and a short generation interval. Notably, pig farming demands relatively modest investments in infrastructure and equipment. This sector holds immense promise for ensuring both nutritional and economic security for vulnerable sections of society (Akriti *et al.* 2023).

As per the 20th Livestock Census, the distribution of the pig population across districts in Karnataka highlights Kalaburagi district with the highest percentage share at 13.66 per cent, followed by Bengaluru Urban (8.66 %), Belagavi (6.73 %), Bidar (6.43 %), Yadgir (6.33 %), Bagalkot (6.32 %), Vijayapura (6.01 %), and Raichur (5.06 %). The remaining districts collectively contribute less than 5 per cent each to the state's total pig population. Notably, Uttara Kannada district holds the lowest position with only 0.37 per cent of the state's pig population. This distribution pattern underscores varying concentrations of pig farming activities across Karnataka's districts, with certain regions holding considerably larger shares compared to others.

Pig farming in India, particularly in Bengaluru, has experienced notable changes in recent years. Traditionally associated with lower social status and predominantly practiced by marginalized communities, perceptions have shifted significantly. Today, commercial pig farming is no longer confined to lower-income groups but is increasingly recognized for its economic potential. The present study undertaken to assess structure and mapping of piggery value chain in Bengaluru.

Methodology:

The study was carried out using multi-stage random sampling technique, to draw the samples from the study area. The first stage, constituted with selection of villages from Bangalore Rural district and Bengaluru Urban district. Further, in the second stage, list of piggery farms in the selected region were prepared with the help of local farmers and veterinarians of the district. Total sample size of 35 pig farmers i.e., 5 pig breeders and 30 pig

fattening farmers were selected randomly for the study. Different marketing channels for the disposal of piglets, live animals and pork were examined by selecting a sample of size of 10 traders, 5 processors, 30 retailers and 120 consumers from the study area for value chain mapping. The collected data pertained to the 2022-23.

Value Chain Mapping

Porter's seminal work (1985) on the value chain, which identifies it as a pivotal tool for assessing competitive advantage and enhancing operational efficiency, this study adapts the concept to analyze the piggery value chain in Bengaluru. The value chain framework delineates the sequence of activities involved in transforming inputs into outputs, encompassing design, production, marketing, distribution, and disposal. In this context, the methodology reframes Porter's model to examine both primary and support activities within the piggery sector similarly, Qui *et al*. (2020), used Porter's model to map pig value chain in Vietnam in their study. Primary activities include inbound logistics (procurement of piglets and feed), operations (breeding andx fattening processes), outbound logistics (transportation to markets), and marketing and sales (promotion and distribution). Support activities encompass firm infrastructure (organizational structure and management), human resource management (training and workforce development), technology development (adoption of innovative practices), and procurement (sourcing of materials and services). By applying this adapted value chain framework, the study aims to uncover critical insights into the operational dynamics, competitive strengths, and areas for enhancement within Bengaluru's piggery industry.

Descriptive statistics

For the study, descriptive statistics such as mean and percentages were used for analyzing the data pertaining to the study.

Results and discussion:

1.0. Rearing System Preferences:

The type of rearing system followed by both piggery fattening farmers and Piggery Breeders presented in Table 1. There are usually three types of rearing system, Intensive, Semi Intensive and Extensive.

1.1. Piggery Fatteners: All fatteners practicing semi-intensive rearing system. This choice implies a balanced approach, allowing pigs a moderate level of care while retaining some freedom and natural behaviours. The semi-intensive method typically involves adequate shelter This choice aligns with welfare-based approaches in pig farming. The semi-intensive system allows for moderate intervention, providing pigs with a balance between controlled care and freedom, promoting behavioural enrichment and social interaction among pigs. Scientifically, this system supports pigs' natural behaviours, potentially reducing stress and enhancing their overall well-being. Similarly, Plavan *et al.* (2020) in their study shown the similar system of pig rearing and Machebe *et al.* (2009) in their finding underscores the diversity in pig farming practices, with the semi-intensive system being identified as the more widespread approach in tropical regions.

1.2. Piggery Breeders: Conversely, all breeder favours an intensive rearing system. This choice emphasizes controlled environments, stringent monitoring, and precise management crucial for successful breeding operations.

Table 1: Type of housing system followed by sample piggery units

Variables	Piggery Fatteners (n=30)		Piggery Breeders (n=5)		Overall (n=35)	
	No.	%	No.	%	No.	%
Rearing System						
-Intensive		-	5	100.00	5	14.29
- Semi-intensive	30	100.00		-	30	85.71
- Extensive		-		-	0	0.00
Floor						
- Kutcha	12	40.00	-	-	12	34.29
- Pacca	18	60.00	5	100.00	23	65.71
Type of roof						
- Flat	7	23.33	2	40	9	25.71
- Slope	23	76.67	3	60	26	74.29
- No roof	-	-	-	-	-	-
Roof material						
- RCC		-	2	40.00	2	5.71
- Tin	6	20.00	-	-	6	17.14
- Thatched	12	40.00	-	-	12	34.29
- Asbestos	12	40.00	3	60.00	15	42.86
Material used in walls						
- Brick with lime/cement mortar	24	80.00	5	100.00	29	82.86

- Brick with mud mortar	6	20.00	-	-	6	17.14
- Iron mesh	-	-	-	-	0	0.00
Manger facility						
- Yes	26	86.67	5	100.00	31	88.57
- No	4	13.33	-	-	4	11.43
Ventilation						
- Low	4	13.33	-	-	4	11.43
- Optimum	26	86.67	5	100.00	31	88.57
Bedding material provided						
- Yes		-	3	60.00	3	8.57
- No	30	100.00	2	40.00	32	91.43
Light in the farm						
- Low	6	20.00		-	6	17.14
- Optimum	24	80.00	5	100.00	29	82.86
Drainage System						
- Efficient	14	46.67	5	100	19	54.29
- Non-efficient	16	53.33		-	16	45.71

The intensive system often involves meticulous attention to temperature, feeding, hygiene, and genetic selection to ensure optimal conditions for breeding pigs. The breeders' preference reflects a specialized approach tailored to achieve specific breeding objectives and maximize reproductive success.

1.3. Flooring and roofing preferences: While both groups lean towards pucca flooring, breeders exhibit a slightly stronger preference (65.71 %) compared to fatteners. Similarly, although both prefer sloped roofs, breeders demonstrate a more pronounced inclination (74.29 %) toward this roofing type.

1.4. Wall materials and facility management: The use of lime/cement mortar brick walls is prevalent among both fatteners and breeders, indicating a shared preference for sturdy construction. Moreover, an overwhelming majority of respondents (82.86 %) provide manger facilities, ensuring efficient feeding management for the pigs.

1.5. Ventilation, lighting, and drainage systems: Breeders display a higher adoption of optimum ventilation compared to fatteners. Intriguingly, while none of the fatteners use bedding material, some breeders incorporate it, implying differing priorities or farming philosophies. Optimal lighting is widely implemented by both groups and breeders tend to emphasize more efficient drainage systems (100 %) compared to fatteners (46.67 %). These

distinct housing system preferences underscore the tailored approaches of piggery fatteners and breeders. Fatteners prioritize a balanced semi-intensive model with specific flooring preferences, while breeders prioritize intensive care, specialized materials, and advanced management practices, tailored to the unique requirements of breeding pigs.

2.0. Breeding practices and piglets supply

The breeding practices observed among pig farmers in the study area reveal a clear and consistent approach across various variables. Firstly, all breeders exclusively engage in the breeding of descript swine, with a notable absence of non-descript or crossbred swine breeding. this points to a concentrated effort in maintaining a specific breed, possibly due to its suitability for local conditions or market demand.

Table 2: Breeding practices followed in study area (n=5)

Variable	No.	Per cent
Breed of swine		
-Descript	5	100.00
- Non-descript	-	-
- Crossbred	-	-
Service of sow		
- Natural service	4	80.00
- Artificial insemination	1	20.00
Heat detection	5	100.00
Castration	5	100.00
Farrowing's per sow		
- Twice	5	100.00
- More than twice		-
Litter size		
- 4-6	-	-
- 6-9	5	100.00
Time of weaning		
- In 1 month	5	100.00
- In 1-2 months	-	-
- Not practiced	-	-

Source: Author's calculation

When it comes to the service of sow, a majority prefer natural service, while a significant minority opt for artificial insemination. This indicates a balance between traditional, natural breeding methods and the adoption of advanced reproductive technologies, possibly for improving breeding efficiency. Similarly, Deka et al. (2007) reported that natural service was

the exclusive breeding method among pig producers in surveyed districts of Assam, with no instances of Artificial Insemination (AI).

The commitment to effective reproductive management is evident in the universal use of heat detection methods among all breeders. This awareness of the sow's estrus cycle is crucial for successful breeding and optimizing reproductive outcomes.

Castration is a standard practice, with all breeders practicing it. This reflects a uniform approach to managing swine herds, considering castration as a means to control undesirable behaviors and enhance meat quality.

In terms of litter size, there is a unanimous preference for larger litters, with all breeders reporting a litter size of 6-9 piglets. This aligns with economic considerations, as larger litters contribute to increased productivity.

The weaning process is uniformly conducted within one month after farrowing, with no breeders extending the weaning period beyond one month. This commitment to early weaning practices aligns with the broader goal of maximizing productivity and ensuring the overall health and performance of the swine herd.

In the study area, Yorkshire, Duroc, and Angamali emerged as the predominant swine breeds, indicating their prominence and widespread supply in the region. Majority farmers rare Descript and cross breed in fattening farms so they come to body weight of 80-100 Kg in 8 months period. Similarly, Sharma *et al.* (2015) reported that prevalent practices among pig farmers in Tripura state. The majority of farmers focused on rearing descript breeds.

3.0. Feeding practices followed by respondents of study area

The feeding practices observed among respondents in the study area is presented in Table 4, particularly between piggery fatteners and piggery breeders, present distinct patterns and preferences in how pigs are nourished. notably, the absence of stall feeding among piggery fatteners contrasts sharply with its prevalence among piggery breeders (100 %), suggesting a clear divergence in preferred feeding methods. this hints at differing approaches to managing the animals, with breeders favoring controlled feeding environments while fatteners potentially rely more on alternative practices.

scavenging feeding emerges as a prominent strategy among piggery fatteners, encompassing sources such as kitchen, hostel, and hotel waste. This utilization of organic waste

as supplementary feed showcases an innovative approach to cost-effective feeding. However, it raises considerations regarding nutritional adequacy and potential health risks associated with the quality of scavenged food. Similarly, Nanda *et al.* (2018) reported that varied feeding practices were evident, with stall feeding prevalent in breeders farms and scavenging feeding in fattening.

Table 3: Feeding practices followed by respondents of study area (n=35)

Variables	Piggery fatteners (n=30)		Piggery breeders (n=5)		Overall (n=35)	
	No.	%	No.	%	No.	%
Feeding of Animal						
- Stall feeding	-	-	5	100	5	14.286
- Scavenging feeding	23	76.67	-	-	23	65.714
- Mixed (stall + Scavenge)	8	26.67	-	-	8	22.857
Process of procuring						
- Direct procuring	30	100.00	5	100	35	100.000
- Presence of middleman	-	-	-	-	-	-
Quantity of feed provided						
- Measured	30	100.00	5	100	35	100.00
- Not measured	-	-	-	-	-	-
Additional feeding						
- Mill by products	30	100.00	-	-	30	85.72
- Mixture of all	-	-	-	-	-	-
- Others (Vegetables, etc.)	-	-	-	-	-	-
Frequency of feeding						
- Once	-	-	-	-	-	-
- Twice	30	100.00	5	100.00	35	100.00

Source: Author's calculation

Conversely, piggery breeders seem to prioritize direct procurement of feed, with a higher percentage opting for this method. this reflects a more controlled and deliberate sourcing of feed materials, potentially ensuring higher quality and reliability in their animals' diet. the

absence of middlemen in procurement further underscores the breeders' preference for direct sourcing, reducing dependencies and potential cost escalations.

When examining the quantity of feed provided, a striking difference emerges between the groups. While both generally measure the feed quantities, Piggery Fatteners exhibit a trend toward exclusively measured feeding, suggesting a more regulated and controlled approach to portioning feed. In contrast, piggery breeders, while also measuring, display a comparatively lower percentage, indicating potentially more flexible feeding practices.

The reliance on mill by-products as additional feed is notably high among piggery fatteners but absent among breeders. This preference might stem from the fatteners' aim to enhance growth rates efficiently. However, the absence of mixed feeding or other sources among respondents implies a lesser reliance on diverse feed components, potentially indicating a focus on specific feed types for optimized results.

Both groups unanimously adopt a twice-daily feeding frequency, indicating a standard practice within the study area. However, the consideration of concentrates from kitchen, hostel, or hotel waste in the scavenging feed adds a layer of complexity, demanding attention to nutritional balance and hygiene to mitigate health risks in pigs.

In essence, this diversity in feeding practices, procurement methods, and feed sources highlights the nuanced approaches adopted by piggery fatteners and piggery breeders. Understanding these variations becomes crucial for effective livestock management, emphasizing the need for balanced nutrition, health considerations, and optimal feeding strategies for the pigs' overall welfare and growth.

4.0. Health care practices:

The health care practices observed among respondents in the study area are presented in Table 4, specifically among piggery fatteners and piggery breeders, exhibit notable variations and trends. These practices are pivotal in maintaining the well-being and health of the pigs within these operations.

The majority of piggery breeders adhere to a regular deworming schedule, whereas among piggery fatteners, it's slightly lower but still significant at per cent. However, a substantial proportion of respondents, 28.57 per cent overall, follow an irregular deworming

schedule, with 33.33 per cent of piggery fatteners and none among the breeders. Notably, a small percentage (5.71 %) overall never engage in deworming practices, with 6.67 per cent among piggery fatteners and none among the breeders adopting this approach.

Regarding vaccination practices, a stark contrast emerges between the two groups. All Piggery Breeders ensure vaccination for their pigs, while only 26.67 per cent of piggery fatteners do so. The majority (62.86%) of respondents overall do not engage in vaccination practices, with 73.33 per cent among piggery fatteners.

Table 4: Health care practices followed in study area

Variables	Piggery Fatteners (n=30)		Piggery Breeders (n=5)		Overall (n=35)	
	No.	%	No.	%	No.	%
Deworming						
- Regular	18	60.00	5	100.00	23	65.71
- Irregular	10	33.33	-	-	10	28.57
- Never	2	6.67	-	-	2	5.71
Vaccination						
- Yes	8	26.67	5	100.00	13	37.14
- No	22	73.33	-	-	-	-
Iron Inj./Tab						
- Yes	6	20.00	5	100.00	11	31.43
- No	24	80.00	-	-	-	-
Veterinary aid available						
- Satisfactory	12	40.00	4	80.00	16	45.71
- Poor	18	60.00	1	20.00	19	54.29
Cleaning of pig sty						
- Daily	3	10.00	3	60.00	6	17.14
- Alternate day	12	40.00	2	40.00	14	40.00
- Weekly	15	50.00	-	-	15	42.86

Source: Author's calculation

A similar trend appears in the administration of iron injections or tablets. All piggery breeders undertake this practice, whereas only 20 per cent of piggery fatteners do so. The majority (68.57 %) of respondents overall do not administer iron injections or tablets, with 80 per cent among piggery fatteners and none among the breeders employing this method.

The availability and quality of veterinary aid also differ significantly between the two groups. Among piggery breeders, 80 per cent report satisfactory veterinary aid availability, contrasting with 40 per cent among piggery fatteners. However, a higher proportion of piggery fatteners (60 %) report poor veterinary aid availability compared to 20% among piggery breeders. Overall, almost half of the respondents (48.57 %) express concerns about inadequate veterinary aid.

Cleaning frequency of pig sties varies considerably. While 60 per cent of piggery breeders clean their sties daily, only 10 per cent of piggery fatteners do so. Conversely, 50 per cent of piggery fatteners clean weekly compared to none among the breeders. The majority of respondents (40 %) overall opt for weekly cleaning, emphasizing a diverse range of cleaning practices among the surveyed population.

These variations in health care practices highlight the diverse approaches to pig care within the study area as shown in Table 4, with disparities between piggery fatteners and piggery breeders. Vaccination, deworming, iron supplementation, access to veterinary aid, and cleaning schedules significantly differ between these two groups, underscoring the importance of tailored health care strategies for improved pig health and productivity.

Similar study was earlier reported by Majunder *et al*. (2020), on the socio-economic profile and swine management practices of piggery farmers in Telangana. The prevalent rearing methods included semi-intensive, extensive, and intensive systems. Swill feeding, particularly direct procurement consisting of hostel and hotel waste, was widely practiced. Non-descript swine were the most common, with natural service being the predominant breeding practice. Farmers routinely castrated boars for non-breeding purposes. Deworming practices were irregular, and vaccination was not prevalent in rural areas.

5.0. Piggery value chain

The Value Chain Map, depicted as Fig. 1, visually represents the trajectory of a product from its origin with producers to its ultimate destination among consumers. It encapsulates diverse stages, delineating the flow of operations through vertical linkages from top to bottom. These stages encompass pivotal functions of the chain, prominently listed on the left side of the diagram. These key functions encompass input supply, production, marketing, processing, and consumption.

The vertical progression within the map delineates the actors or entities accountable for executing these specific functions throughout the chain's continuum. This visual representation aids in comprehending the interplay between different stages and entities involved in the value chain, elucidating the sequence of activities from the product's creation to its utilization by end consumers.

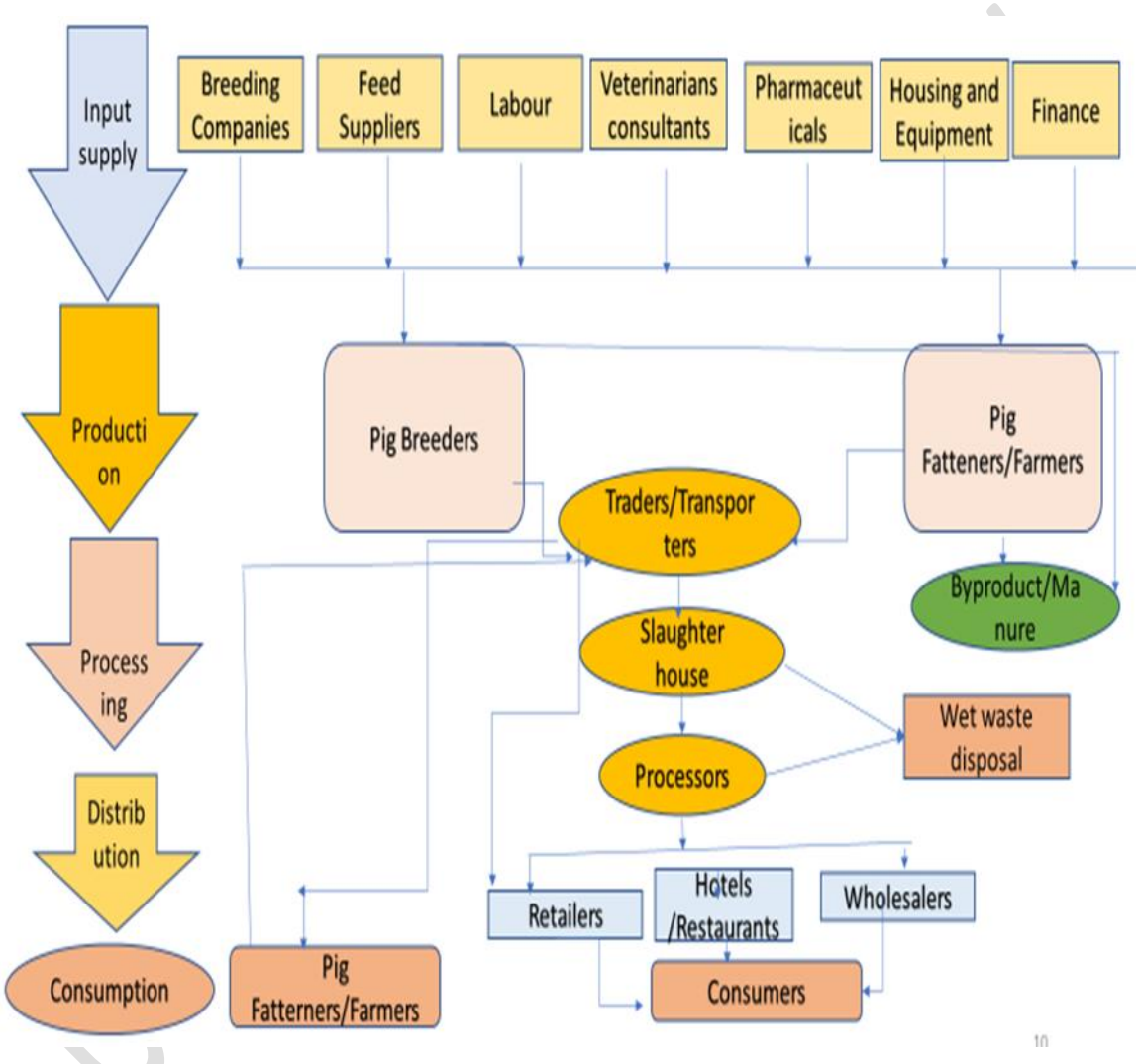

Fig 1: Value chain of modern piggery enterprise in Bengaluru

Conclusion

This study underscores the need for targeted interventions in Bengaluru's piggery sector, focusing on the distinct needs of breeders and fattening farmers in rearing, feeding, and healthcare practices. By understanding and accommodating these variations, policymakers and

stakeholders can develop customized strategies to improve efficiency and profitability within the value chain. Furthermore, the findings highlight opportunities to enhance animal welfare standards and promote sustainable practices through better housing, improved feeding regimes, and robust healthcare protocols. These efforts not only enhance pork quality but also align with consumer preferences for ethically sourced products and bolster the sector's resilience against environmental and economic challenges. The study's value chain mapping provides a crucial tool for stakeholders to identify inefficiencies and optimize logistics, market access, and processing facilities, thereby enhancing overall profitability and competitiveness in Bengaluru's piggery industry and beyond.

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