Profile of the poultry system

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Profile of the poultry system and the socio-economic impact of native chickens as a potential development area in South Sulawesi, Indonesia

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ABSTRACT

Context. Native chicken farming has potential for development in several areas in Indonesia, because it is a very familiar practice and has specific community value. Both men and women have a role in raising native chickens. **Aims.** To construct a profile of the poultry system and determine the potential socio-economic impacts for meeting community needs as a basis for the development of future native chicken enterprises. **Methods.** The study was conducted in five areas in South Sulawesi, Indonesia, including Barru, Enrekang, Jeneponto, Maros, and Soppeng regencies. Interviews included 385 respondents (55.06% men and 44.94% women), most of whom were in the productive-age category (defined as 31–62 years of age) and were elementary school graduates. The number of family members was low, as was the number of chickens owned, being up to 25 chickens raised per year. **Key results.** Native chicken farming was determined to have a moderate socio-economic impact on communities, as the number of chickens owned was relatively low. Native chickens are used for consumption, income generation and savings, and as complements in religious and traditional ceremonies. The potential target markets for native chickens are diverse, including individual end consumers, restaurants, local markets, and inter-regional markets. The amount of income from selling chickens varies depending on the quantity sold and the price. The price of chicken will rise under certain conditions, such as during religious and traditional events. Technical production constraints to market development include inadequate housing, lack of sanitation, non-optimal disease management, and low use of vaccinations. The primary market constraint is that the rearing locations can be far from the city centre, and the number of chickens that can be produced for sale is low. **Conclusions.** Poultry management dynamics, such as feeding, housing, and sanitation, must be considered to expand native chicken production. It is essential to identify solutions for selling native chickens to significantly increase household income. Native chickens have a socio-economic impact, raising the family income, as complements in religious and traditional ceremonies, and affecting the social status of breeders. **Implications.** Information regarding the potential and prospects of native chicken farming from a socio-economic perspective can encourage communities to maintain and develop livestock enterprises to support the provision of animal protein for consumption and traditional uses, and to increase household incomes.

Keywords: economic impact, income generating, layer enterprises, management of poultry, native chickens, potential area, poultry profile, social impact.

Introduction

Indonesia's livestock subsector has a considerably large role in improving the quality of human resources because various products, such as eggs, meat, milk, cheese, and other products are nutritious sources of animal protein. The subsector also helps absorb labour and provides a source of community income. According to Sonaiya and Swan (2004), the sale of live chickens to increase income is the primary motivation for families to raise

chickens in developing countries. A popular commodity is chicken farming because chickens are easy to raise, do not require a large amount of land, and have a short production cycle, among other benefits.

Poultry that is commonly known as native chickens is often raised as a form of savings that can be sold anytime when a farmer needs cash, and as a source of animal protein. According to Padhi (2016), chickens have a significant role in rural economies and in developing countries in general. In developing countries, village poultry has an important nutritional, economic, and socio-cultural role (Hailemichael and Gebremedhin 2020). Native chickens also have unique advantages, such as commanding a higher price than for purebred chickens and potential for supporting Indonesian conservation and germplasm maintenance. Research by Manyelo *et al.* (2020) highlighted the significance of native chicken breeds for improving and maintaining livelihoods in Africa. Some areas in Indonesia use native chickens as complements in traditional and religious ceremonies. In addition to meat, eggs can also be used for consumption and hatching purposes, which aligns with the assertion of Moges *et al.* (2010) that the purposes of native chicken production include income generation, breeding, consumption, and as complements in traditional and religious ceremonies.

The existence of native chickens in Indonesia is quite good. This can be seen through the number of people in rural areas who mostly raise native chickens even though the number of chickens owned per household is relatively small. Pramudyati (2009) noted that the traditional system of rearing native chickens is conducted by most rural farmers, with an average rearing scale of three broodstock per breeder. Most Indonesian farmers own a small number of native chicken, averaging 30–40 heads (Sulastrawan *et al.* 2021), and the number of native chickens owned is small, at less than 10 heads for 57.7% of farmers (Triani *et al.* 2020). The distribution of native chicken populations in each district/city in East Java varies widely. The development of a native chicken industry is also supported because the animals are already adapted to the local environment and are an extremely important asset for breeders (Nataamijaya 2010). Its development is influenced by the characteristics of each region in terms of feed resource potential, socioeconomics, climate, and local government policies (Edi 2020).

In South Sulawesi, Indonesia, native chickens are commonly maintained; however, there is no centre for the development of native chickens, and rearing is spread across households in all regencies, involving most of the poor population. Nataamijaya (2010) asserted that native chickens are the backbone of the economy of the poor in rural areas. The poultry system is embedded in an extensive traditional pattern that has been going on for generations, involving household workers, such as husbands, wives, and even children. Poultry are reared around the house, and feeding is also minimal because the farmer gives the chickens the freedom to find their own food, which aligns with the finding of Das *et al.* (2008), in that chickens generally scavenge for food around the homestead area. This poultry pattern is referred to as family poultry (FAO 2014). Poor feed has an impact on egg quality, whereas some raw materials can be processed as a source of the nutrients required by laying hens. An *et al.* (2020) demonstrated that the egg laying performance and egg quality of laying hens can be improved by assessing the energy and amino acid levels in brown eggs, and Tamiru *et al.* (2020) argued that *Moringa Stenopetala* leaf flour is rich in antioxidants and can be used as a supplementary feed for poultry raised under heat stress.

Considering the potential for developing the native chicken industry in Indonesia, the prospects for some areas in South Sulawesi are considerable. In terms of demographics and geography, the study areas are very supportive, but associated locations are relatively far from the regency city centre, requiring additional arrangements for the transport and sale of native chickens. The areas for consideration in this study include Enrekang, Soppeng, Barru, Maros, and Jeneponto regencies. The five regions were chosen because they represent locations based in the western, eastern, northern, and southern regions of the city of Makassar, which is the provincial capital of South Sulawesi. Additional considerations include ease of access, the total population of laying hens, and the total residential population (Central Bureau of Statistics 2021).

Realising the enormous potential of the Indonesian native chicken enterprise to increase household income requires organisation into an intensive commercial business by improving housing and feeding methods and preventing disease. Successful native chicken farming is highly dependent on the breeders' abilities and capacities. The capacity of farmers is largely associated with their demographic profile, including age, sex, education level, and family size (Getiso *et al.* 2015, 2017; Shahjahan and Bhuiyan 2016; Fida *et al.* 2018). Livestock ownership indicates a social status; thus, breeders with many livestock in an area are considered to have a high social status. Laying hens have a high economic value because the price is higher than that of broiler chickens, providing opportunities for breeders to earn large incomes. Economically, the advantage of the layer enterprise compared with the broiler enterprise was illustrated in a study in Nigeria by Baruwa and Fabode (2019), where the gross margin for the farmers in layer enterprises was nearly seven times higher and the net present value (NPV) nearly 60% higher than those in broiler enterprises. One aspect of native chicken price is determined by the plumage colour, sex, comb type, and feather cover (Tadelle *et al.* 2003; Tůmová and Ledvinka 2009; Moula *et al.* 2011; de Koning *et al.* 2019). For residents in certain areas of Indonesia, laying hens are also used as complements in traditional and religious events (Moges *et al.* 2010). No previous study has explained the demographic profile of native chicken breeders and livestock ownership and the socio-economic impact in Indonesia in detail, particularly in South Sulawesi. The findings of this

study are expected to serve as a basis for improving native chicken productivity to establish a commercial business and increase rural household incomes. To do so, this study analyses the profile of the Indonesian poultry system and the potential socio-economic impact of native chicken production for development in South Sulawesi, Indonesia, to meet consumer needs for chickens in accordance with community preferences.

Materials and methods

Study area

This study was conducted from early September to late November 2021, covering five regions in South Sulawesi, including Barru, Enrekang, Jeneponto, Maros, and Soppeng regencies. The locations of the study areas are presented in Fig. 1. These regions were chosen on the basis of the results of a focus group discussion (FGD) that identified the five locations as areas that were quite far from the regency city centre where several individuals raised native chickens and had even become suppliers for other regencies.

Barru Regency located on the western coast of South Sulawesi, between the coordinates of 40°5′49″–40°47′35″S and 119°35′00″–119°49′16″E, with an area of 1174.72 km^2, approximately 100 km north of Makassar and 50 km south of Parepare, and with a coastline of 78 km. The population of Barru Regency is 174 989.

Enrekang Regency is located 236 km north of Makassar, with an area of 1786.01 km^2 between the coordinates of 3°14′36″–3°50′00″S and 119°40′53″–120°06′33″E and with a population of 197 800. The region has a varied topographic landscape with hills, mountains, valleys, and rivers at altitudes of 47–3293 m above sea level and it does not have a coastal area. The topography of the area is dominated by hills and mountains, taking up about 84.96% of the total area of Enrekang Regency, while the land area is only 15.04%.

Jeneponto Regency is located between 5°23′12″–5°42′1.2″S and 119°29′12″–119°56′44.9″E, with a population of 365 610. The area is 749.79 km^2 and is located at the western end of the South Sulawesi Province, and is about 90 km from Makassar.

Maros Regency is in the western part of South Sulawesi between 5°01′04″S and 119°34′35″E. The area is 1619.12 km^2, with a population of 356 195, and is directly adjacent to Makassar, but some areas are mountainous and difficult to access.

Soppeng Regency is located at 4°06′00″–4°32′00″S and between 119°47′18″–120°06′13″E. The area includes land and hills. The land area is 700 km^2 at an average altitude of 100–200 m above sea level. Meanwhile, the hill area is approximately 800 km^2 at an average altitude of 200 m above sea level. The area of Soppeng Regency is 1359.44 km^2 with a population of 227 208 (Central Bureau of Statistics, South Sulawesi 2020).

The subregencies of each regency were selected randomly, and included Palakka, Batu Bessi, and Tanete Riaja in Barru Regency; Enrekang and Maiwa in Enrekang Regency; Turatea and Bangkala in Jeneponto Regency; Tanralili, Tompobulu, Marusu, Simbang, Cenrana, and Mandai in Maros Regency; and Donri-Donri, Marioriwawo, Liliriaja, and Lalabata in Soppeng Regency.

Data collection

Data collection was conducted in the five regencies by employing a cross-sectional survey questionnaire as the research instrument. The questionnaire included open- and closed-ended questions, which were combined with the participatory rural appraisal method Tadelle *et al.* (2003) using key informants and FGD. Information was collected from farmers, extension and counselling officers, key informants, and members of livestock farmer collectives. Respondents were selected using the snowball sampling method because no records regarding the number of people raising native chickens were available, and they are spread out in several places; therefore, the sample number depended on information from previous informants. In total, 385 people were interviewed, including 64 respondents from Barru Regency, 80 from Enrekang Regency, 46 from Jeneponto Regency, 95 from Maros Regency, and 100 from Soppeng Regency.

Some of the questions about community perceptions of socio-economic impacts in the form of qualitative data were quantified using a Likert scale with a scale of 1–5, where 1 equals with 'strongly disagree', 2 equals with 'disagree', 3 equals with 'neutral', 4 equals with 'agree', and 5 equals with 'strongly agree'. The data collected in the questionnaire included demographic aspects of chicken farmers, utilisation, rearing constraints, and potential income.

Statistical analysis

To answer the two research objectives of profiling the poultry system, analyses included native chicken farmers' demographic profile, business scale per household, public perception of the socio-economic impacts of native chicken farming, and the constraints of raising native chickens. The second objective was investigating the socio-economic impact of native chicken farming examining the use of native chickens in the community, selling native chickens, and revenue potential from sales of live chickens. These considerations were analysed using descriptive statistics presented in percentage, average, and graph forms.

Results and discussion

Profile of the poultry system

Demographic profile of chicken farmers

Most of the 385 respondents were in the adult category (73.77%). More male (55.06%) than female (44.94%)

Fig. 1. Map of study areas in five regencies in South Sulawesi, Indonesia.

respondents were interviewed, and most of the respondents had an elementary school education level, which is the equivalent of 6 years. Finally, most respondents' households were one to three people (54.55%), and 42.60% of respondents' households had four to six people. (Table 1).

Raising native chickens is among the activities conducted by most households in rural areas, which is spread in various locations. Respondents who are also breeders in this study were dominated by men, in agreement with the findings of Fida *et al.* (2018), who demonstrated that native chicken farming activities are predominantly conducted by males, with an average of 56.3%. Notably, on the basis of interviews with respondents, females also have a significant role in the daily activities of rearing native chickens, particularly in

Table 1. Demographic profile of communities raising native chickens in South Sulawesi, Indonesia.

Category	Classification	Criterion	% Respondents (*n* = 385)
Age (years)	Young	15–30	14.55
	Adult	31–62	73.77
	Old	>63	11.69
Gender	Male	–	55.06
	Female	–	44.94
Education level	None	No formal education	11.00
	Elementary school	Acquired 6 years of education	32.00
	Junior high school	Acquired 9 years of education	25.00
	Senior high school	Acquired 12 years of education	23.00
	Diplomas, degrees	Acquired college or university education	9.00
Family size	Low	1–3	54.55
	Minimum	4–6	42.60
	High	7 and above	2.86

providing feed sourced from food scraps or organic waste, which is consistent with Mapiye *et al.* (2008), who found that females are responsible for the care of the poultry and for selling meat and eggs. The role of females in raising poultry was also reported by Tadelle *et al.* (2003).

The respondents engaged in native chicken raising were primarily in the productive age range of 31–62 years, as defined in this study, with 73.77% of the respondents being in this category. This has been supported by findings from other studies. For example, a study in the Bure Regency of Northwest Ethiopia showed an average age of 40.9 years (Moges *et al.* 2010), and a study in Bangladesh indicated an age range of 31–50 years (Shahjahan and Bhuiyan 2016). Getiso *et al.* (2017) showed an average age of 36.5 years. Fida *et al.* (2018) found the average age of farmers who raise native chickens to be 38 years, and Getiso *et al.* (2015) reported that the average age of chicken farmers was 37.8 ± 9.3 years.

The education level of most of the respondents was elementary school, or the equivalent of 6 years, followed by junior high school. This indicated that the education level of native chicken farmers remains low, in agreement with the findings of Ngongolo *et al.* (2021) that most chicken famers are primary school leavers or have acquired a standard level of seven years of education.

Business scale per household

The number of chickens raised by each household in the five regions investigated was primarily between 1 and 25 head. Barru, Enrekang, and Jeneponto regencies had almost the same average number of native chickens per each household (Fig. 2).

The relatively small average number of between 1 and 25 head is because households generally raise native chickens only for consumption, savings, and amusement. This is also related to the low average number of household members of between one and three people, indicating insufficient resources to raise many native chickens, as the number of chickens that can be raised is also determined by the number of family members who can look after the chickens, since most of the respondents raised their chicken by releasing them into the yard.

Public perceptions of the socio-economic impacts of native chickens

Of the total of 385 respondents interviewed, most (45.70%) indicated a moderate response regarding the contribution of native chickens and socio-economic impact and 38.99% indicated a high response; however, the number of native

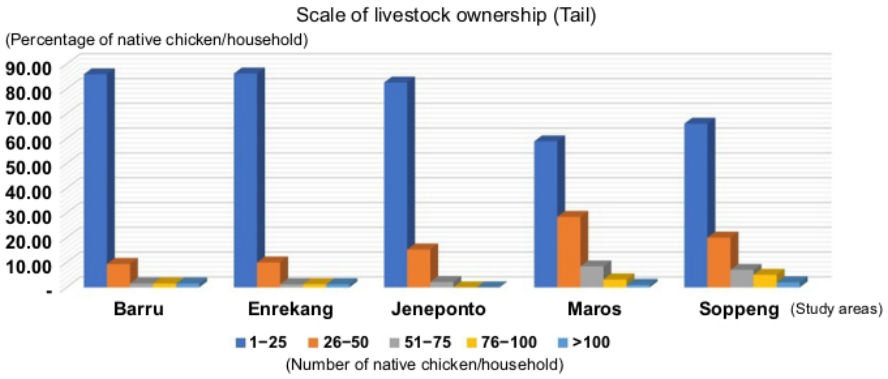

Fig. 2. Percentage of native chickens owned on the basis of ownership scale.

Table 2. Community responses to the socio-economic importance and native chicken production in South Sulawesi, Indonesia.

Category	Classification	Criterion	% Responses (n = 385)
Socio-economic importance (Likert score)	Very high	5	4.75
	High	4	34.24
	Moderate	3	45.70
	Low	2	10.34
	Very low	1	4.97
Native chicken production (number of chickens raised)	Very high	>100	1.30
	High	76–100	2.60
	Moderate	51–75	4.68
	Low	26–50	17.66
	Very low	1–25	73.77

Table 3. Constraints in raising native chicken.

Characteristic	Classification	Category	Frequency (n = 385)	% in each characteristic (n = 385)
Technical production	Housing	Intensive	21	5.45
		Semi-intensive	337	87.53
		Other	27	7.01
	Sanitation	Following sanitation	234	60.78
		Not following sanitation	151	39.22
	Diseases	Influenza	124	32.21
		Newcastle disease	123	31.95
		Other	138	35.84
	Vaccination	Following vaccination	104	27.01
		Not following vaccination	281	72.99
Market	Selling	1–5	241	62.60
		6–10	24	6.23
		>11	120	31.17

chickens owned was predominantly in the very low category, at 73.77% (Table 2).

Navigating the constraints of raising native chickens

The constraints in raising native chickens were divided into two categories. First, technical production constraints, including housing, sanitation, and disease. Most of the respondents (87.53%) raised native chickens in a semi-intensive way, putting the chickens in a coop in the afternoon and releasing them into the yard in the morning. The issue of coop sanitation was also cited by most respondents (60.78%). Diseases that attack native chickens, such as Newcastle disease (ND), influenza, and other diseases, were also cited. Most of the respondents (72.99%) had never vaccinated their chickens. Infectious disease is also a threat to native African chickens (Mpenda *et al.* 2019). Second, market constraints were noted, as only one to five chickens can be sold per month, on average (62.60%) (Table 3).

Overall, the constraints cited by chicken farmers were similar in all areas and referenced raising native chickens traditionally. As noted, these obstacles included housing, feeding, and disease management, congruent with Mujyambere *et al.* (2022), who noted that the obstacles to the development of indigenous chicken enterprises in eastern Africa are dominated by feeding, housing, and chicken health. Most of the farmers release chickens into their yards, but some raise their chickens by keeping them in the coop in the afternoon and releasing them into the yard in the morning (semi-intensive). Getiso *et al.* (2017) also found that most (63.9%) native poultry (rearing) systems are free-range or extensive and only some of them (36.1%) are semi-intensive. The function of the coop is to protect chickens from predators (Aklilu *et al.* 2013; Meseret 2016), inclement weather conditions or theft at night, aligning with Nayak *et al.* (2020) who noteed that all farmers provided night shelter for their chickens.

One potential approach advocated by Stadig *et al.* (2018) is the use of an automated positioning system for effectively monitoring chicken locations in a free-range area. In addition, it is essential to ensure adequate perching spaces, as this can lower predatory incidents; thus, availability of perches in outdoor areas has several benefits for chickens and such environmental complexities must be considered (Rodriguez-Aurrekoetxea *et al.* 2014). A drawback to the free-range method is that the quality of the feed consumed by chickens cannot be controlled because the chickens are given the freedom to find their own food around the yard. Therefore, dietary supplements must be considered even when free-range chickens are kept, as such supplements can improve chicken quality (Mutayoba *et al.* 2012). Tufarelli *et al.* (2018) demonstrated that free-range forage feeding has a role in the success of local poultry production. Prakash *et al.* (2020) determined that the nutrition required by free-range scavenging chickens differs depending on four different agroclimatic conditions (tropical, humid subtropical, cool-moderate, and semi-arid). Furthermore, chickens reared in cages will produce higher-quality eggs than do free-range chickens because farmers can control the type and quality of feed (Pires *et al.* 2021). Several studies have shown that egg quality will be the best in cages, followed by free-range, floor, organic, and aviary.

Several chicken farmers indicated that the diseases that often arise are caused by not maintaining the chicken

health and the cleanliness of coops, as well as weather fluctuations from the rainy season to the dry season or *vice versa*. Therefore, another important consideration is the appropriate use of coop litter. Pepper and Dunlop (2022) indicated that litter turning can reduce the occurrence of caked litter, lower production costs, and improve moisture-holding capacity, which is also related to risks of ammonia concentration, litter beetle control, and disease transmission. Diseases that arise in chickens include ND, influenza, calcareous stools, and other ailments that cause losses to farmers. ND was also found in a study by Shahjahan and Bhuiyan (2016) in a selected cluster area of Bangladesh, at a 65.82% rate. The obstacles faced by chicken farmers were also described by Mahoro *et al.* (2017), noting that the challenges faced by indigenous chicken enterprises include disease outbreaks, lack of investment capital, predators, feed shortages, thieves, market price fluctuations, low education about modern chicken rearing, and a lack of attention to chicken coops. Some native chicken farmers claimed that they rarely vaccinated their chickens, which conforms with the Islam *et al.* (2021) finding that farmers seldom vaccinate birds against any disease. Rather than preventive vaccination, the treatment given when chickens become ill is generally medicine for the disease they are suffering from, in the form of either traditional or chemical drugs, and farmers more often use traditional treatments that are based on local knowledge that has been passed down from generation to generation. Sick chickens are often separated from healthy chickens to be treated; however, some farmers do not treat sick chickens, just leaving them alone to heal or die. On average, dead chickens are buried, but some farmers also reported dumping dead chickens without special handling.

Consequently, to increase productivity and raise native chicken performance, the cleanliness and sanitation of the coop must be maintained so that it does not become a medium for the growth of disease sources. Coop systems should be improved, particularly those used in brooding, including maintaining an adequate temperature and a suitable coop area (Yuwanta *et al.* 2002). In addition, the population density of the cage must also be considered for growth performance; Mosca *et al.* (2015) showed that interaction, bird density, sex, and age significantly affect poultry bodyweight. Tendencies toward aggressive behaviour in brightly lit coops can lead to feather pecking and cannibalism (Groves 2021). Feeding must also be considered, particularly the quality of feed at the beginning of growth (starter phase). In addition, regularly administering vaccines to improve chicken immunity so as to avoid certain diseases is crucial, as one of the main problems faced by chicken farmers is disease outbreaks, particularly ND (98.2%) (Moges *et al.* 2010). Tadesse *et al.* (2005) reported that ND affects productivity and native chicken survival in the central highlands of Ethiopia and Ipara *et al.* (2019) argued that the governments must collaborate with development partners to develop innovative ways to disseminate information on ND.

The involvement of women in raising chickens cannot be ignored because the number of women who are involved in raising chickens is not small, being 44.94% (Table 1). This is because they generally have more time for household chores than do males. Muchadeyi *et al.* (2004) confirmed that women have a role in making decisions regarding chicken rearing, because women are exclusively responsible for caring for the poultry and selling the meat and eggs (Mapiye *et al.* 2008). Women have a substantial role in livestock production, sales, and food security and nutrition (Herrero *et al.* 2013). Indeed, Kumar *et al.* (2021) argued that women's empowerment is one way to improve the status of backyard poultry farming in India. The government must provide practical education to chicken farmers to improve poultry systems (Das *et al.* 2008). Policymakers must establish initiatives to train chicken farmers (especially females) about basic technical brooding, the provision of quality feed, and disease prevention. Wong *et al.* (2017) and Bagnol *et al.* (2013) concluded that the constraints faced in the livestock enterprises in resource-poor areas can be overcome by increasing the role of females and extension activities. In Indonesia, Sonaiya (2007) showed that household poultry raising, which is mostly conducted by people in rural areas (women, in particular), can increase family and national income, reducing poverty levels in rural areas. Andrew *et al.* (2019) asserted that chickens can increase household incomes and improve livelihoods when integrating education with technical training on good farming practices, feed formulation, medication, and shelter to improve productivity.

Socio-economic impact of native chickens

Uses of native chickens in the community

Most native chickens are used for consumption as sources of animal protein, for either household family members or guests. Native chickens are also used to increase family income by selling them to the market or to collectors. Native chickens are also used as complements in religious and traditional ceremonies (Fig. 3).

In this study, we observed that chicken production contributes socio-economically to local communities in areas that have the potential to develop the overall native chicken enterprise. Native chickens are raised in communities because they are considered to have both social and economic advantages, just as Das *et al.* (2008) demonstrated the significant role of chickens in socio-economic development in Bangladesh. The economic advantage is increased family income from both meat and egg production. The chickens owned by farmers can be sold anytime to finance family members' schooling or to meet other urgent financial needs. They can also be consumed by family members or guests. Lan Phuong *et al.* (2015) found poultry rearing and consumption to be linked to improved socio-cultural and economic factors. Ngongolo *et al.* (2021) noted that chicken production

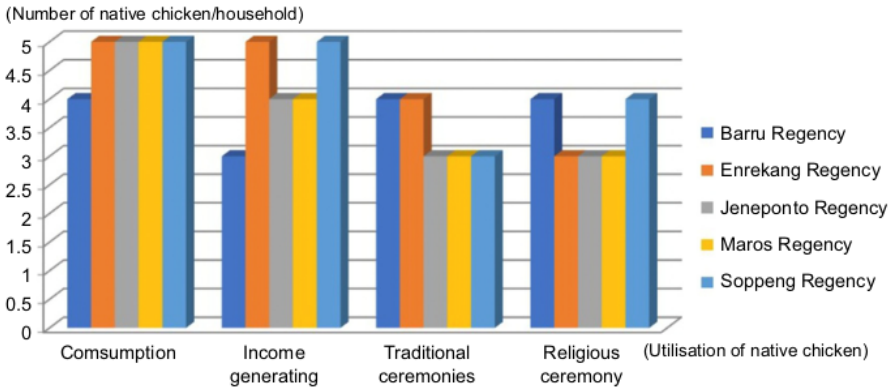

Fig. 3. Socio-economic impacts of native chickens for communities.

contributes as a source of protein, schoos fees, income generation, and employment. Native chicken also has specific value for the community as a complement to traditional ceremonies, such as the celebrations of a new house, the rice harvest, or family members' school graduation. Chickens are also used in religious events, such as Eid al-Fitr and Eid al-Adha, the observance of the birthday of Prophet Muhammad (Mawlid) and honouring the departure and return of family members from the pilgrimage. Similarly, Moges *et al.* (2010) and Okeno *et al.* (2012) showed chicken production purposes include selling for income, egg hatching for replacement, consumption, as complements in cultural and/or religious ceremonies, and for egg production. A study in Ethiopia showed the spiritual advantages of the sacrifice of indigenous chickens in cultural, social, and religious functions (Gondwe *et al.* 2005). Furthermore, Jugessur *et al.* (2006) determined that people raise chickens to generate income (50%), for home consumption (43%), for cultural reasons (4%), and simply for leisure and amusement (3%), and Tadelle *et al.* (2003) found that households keep birds for the purpose of reproduction, sale, and consumption, especially for their socio-religious function.

People who have a relatively large number of chickens compared with the surrounding community average are considered to have a higher social status. Native chickens have a high value for communities because traditional and religious ceremonies generally require native chickens, as they are seen by some people facilitating fortune, business, and making the ceremonies or celebrations performed more sacred than by using purebred chickens. This has an impact on people's preferences regarding the chickens used in such events. The criteria include the colour of the chickens' feathers, the colour of the hair on the chickens' legs, and the chickens' performance in terms of both the bodyweight and agility of movement.

The following are some notable statements from respondents:

'Native chicken has a distinctive taste, so it is more desirable for consumption than broiler chicken. In addition, it is more familiar to the community because it has been kept for generations both for consumption and for sale' [one respondent in each of Jeneponto Regency, respondent number 29, respondent age 45 years; and Enrekang Regency, respondent number 52, respondent age 40 years].

'Native chicken has its own value because it is used as a complement to traditional and religious parties. Mostly the native chicken used has a uniqueness in the feather colour, the colour of the hair on its leg. The price is relatively higher for chickens that meet the desired criteria as a complement to these traditional and religious events' [one respondent in each of Maros Regency, respondent number 18, respondent age 36 years; Jeneponto Regency, respondent number 5, respondent age 54 years; Soppeng Regency, respondent number 87, respondent age 43 years; and Barru Regency, respondent number 64, respondent age 60 years].

Sales and revenue potential of native chickens

The target market for native chickens differs in each regency. In Barru Regency, most of the respondents (81.25%; $n = 64$) stated that their chickens were sold to individuals who sought to buy them, such as neighbours and family members. As many as 73.00% of the respondents sold their chickens outside Barru Regency in the nearest regency, namely Enrekang, Jeneponto, and Soppeng. The respondents generally did not sell their chickens directly to restaurants, but in Barru and Maros regencies, chickens were sold directly to restaurants as well as through collectors, with a proportion of 50% to each. The local market tended to be used by respondents in Enrekang, Maros, and Soppeng regencies, while inter-regional markets (in other regencies) were mostly chosen by respondents in Barru and Maros regencies (Fig. 4). The most important factor to be considered in the development of native chicken enterprises is the sales aspect. In this study, each region sells chickens differently.

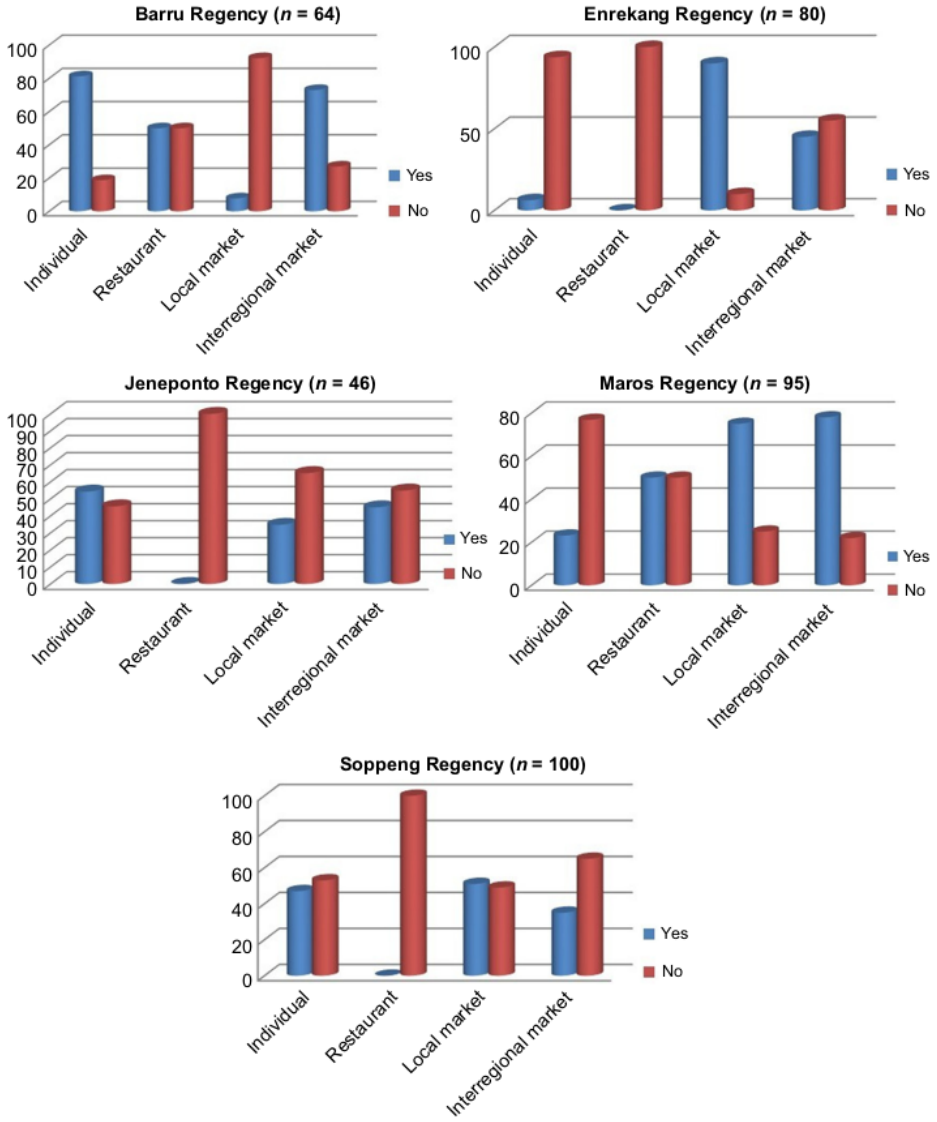

Fig. 4. Potential market area for live native chickens in Barru, Enrekang, Jeneponto, Maros, and Soppeng regencies. Note: Yes, have a potential market; No, do not have potential market; *x*-axis, kind of potential market for live native chickens in every regency; *y*-axis, percentage of answers stating that they have or do not have market potential.

In Barru Regency, most of the chickens are sold to neighbours and traders who come directly to the chicken farmers' house (individuals). In other areas, chickens are sold in the nearest regencies weekly by adjusting to the market day in the targeted regencies. Some sales are not directly conducted by farmers, but traders are tasked with taking native chickens to sell in the markets in other regencies. This has been a long-term arrangement that makes selling native chickens more organised. A relatively small number of chickens was sold in local markets because the price offered by buyers was quite low in comparison to the price of chickens sold (or sent via traders for sale) in other regencies.

In Enrekang Regency, farmers prefer to sell their chickens to local and inter-regional markets through collectors because the price offered is relatively higher than when selling directly to neighbours and family. In addition, the quantity of chickens that can be sold is large, and farmers do not need to sell them directly because traders facilitate the sale of chickens, incur

transportation costs, and even assume the risks that could occur during transportation from the farmer's location to the target market area. Das *et al.* (2008) explained that traders bear transportation and other costs during the process of collecting and moving live native chickens from villages to cities for sale.

Jeneponto and Maros regencies have almost the same circumstances, as the market potential is more focused on selling individual chickens to neighbours, families, and traders, but there are also those who take chickens directly to the local market or sell them in other areas, such as Takalar and Bantaeng regencies as the closest areas to Jeneponto Regency. The potential market in Maros Regency is somewhat different, as the chickens are sold to restaurants in addition to being sold at the local market and sent to Makassar (inter-regional market). This is due to the location of this area, which is directly adjacent to Makassar, making Maros a buffer zone in the provision of native chickens. This is also true for restaurants in both Maros Regency and Makassar. The position of Maros Regency, which is near an urban area, has market advantages. This shows that the location and availability of traders in an area also influences the variation in sales objectives for native chickens.

There is a difference between the price of native chicken on ordinary days and on religious holidays, such as Eid al-Fitr and Eid al-Adha, in addition to traditional ceremonies in some areas. The price can increase up to IDR25 000–30 000/head, i.e. increasing from IDR50 000–60 000/head to IDR75 000–80 000/head when there are religious and traditional ceremonies (Table 4). This causes farmers' income to increase during religious holidays and commemorations of traditional events.

The price of chicken increases because the demand also increases. Some people prefer to serve food prepared from native chicken rathern than from purebred chicken because some traditional foods with raw materials from chicken are more suitable if using native chicken. In addition, native chicken has a slightly different and distinctive taste that is preferred by consumers. At certain traditional events, chicken criteria are based on plumage colour, sex and age, comb type and feather cover. This is what affects the price of native chicken, tending to rise at that time.

Table 4. Price of live native chickens on ordinary days and on religious days/days of traditional ceremonies.

Day	Age	Price (IDR/head)
Ordinary days	4 days	8000.00
	1 month	15 000.00
	2 months	25 000.00
	5–6 months	50 000.00–60 000.00
Religious days/days of traditional ceremonies	5–6 months	75 000.00–80 000.00

Revenue from sales of live chickens

On the basis of the information obtained, the variation in average number and price of live native chickens and total income, it was noted that an average of 72 chickens were sold in Enrekang Regency every 3 months, followed by Maros Regency, with 70 chickens. The highest price received for native chicken was in Soppeng Regency, at IDR90 000/head. The lowest price was in Jeneponto and Maros regencies, at IDR60 000/head. The total income from native chicken sales in each region was IDR375 000/3 months in Barru Regency, IDR960 000/3 months in Jeneponto Regency, IDR4 200 000/3 months in Maros Regency, IDR4 590 000/3 months in Soppeng Regency, and the highest was IDR6 120 000/3 months in Enrekang Regency (Table 5).

As shown in Table 5, the amount of revenue obtained by chicken farmers in each regency varied widely, due to the difference in the number of chickens sold every 3 months and the price per head counted in this study. When the physical performance and attractiveness of a chicken is superior in terms of body size, eyes, and agility, the price tends to be high. Wunshi *et al.* (2012) asserted that bodyweight is among the economic traits that need to be improved on native chickens to advance economic performance. The price of chicken is also determined by the characteristics sought in accordance with the preferences and purposes of its use. For complementary purposes in religious events and traditional ceremonies, the attribute of the chicken that is an indicator of superiority is plumage colour. For example, if the chicken has a specific feather colour and a specific leg feather colour, the price will tend to be higher. Examples of these criteria include chickens with black, red, white, and red–yellow–brown (karame) feathers in Barru, Enrekang, Jeneponto, Maros, and Soppeng regencies. Moges *et al.* (2010) demonstrated that there are several main attributes that determine consumer preferences for traditional ceremonies, including plumage colours such as red and white. Abdelqader *et al.* (2007) also asserted that plumage colour is one of the indicators of chicken performance. This was echoed by Tadelle *et al.* (2003) who found that plumage colour, sex, comb type, feather cover, and the age of the bird are important considerations for socio-religious and traditional festivals. Moula *et al.* (2011) showed that some traditional ceremonies in the northern regions of Vietnam require chickens of colours, such as Ri chickens with yellow skin. With increased age, the colour of a laying hen shells will be lighter (Tůmová and Ledvinka 2009). Feathers are also determined by whether a chicken is kept in a cage, according to de Koning *et al.* (2019), who indicated better feather scores with a lower feather loss and decreased skin area results for chickens living outside of a coop than for those in a coop. Barnett *et al.* (1997) demonstrated that the presence of perches in a cage improved the quality of chicken bones and improved tail condition, whereas solid sides in a cage during hot weather will increase mortality.

Table 5. Public revenue from live native chicken sales every 3 months in 1 year in five regencies.

Variable	Barru Regency	Enrekang Regency	Jeneponto Regency	Maros Regency	Soppeng Regency
Average number of live chickens (head)	5	72	16	70	51
Price of a live native chicken (IDR/head)	75 000	85 000	60 000	60 000	90 000
Total income generated from sales of native chickens (IDR/3 months)	375 000	6 120 000	960 000	4 200 000	4 590 000

Conclusions and application

The demographic profile of the poultry system is one where the majority of breeders are adults of 'productive' age (31–62 years), dominated by men with a low level of education (elementary school). The number of poultry owned per household is typically in the range of 1–25 birds. Native chickens have a socio-economic impact, as they can be consumed, used as a means to increase family income and savings, and are used as complements in religious and traditional ceremonies. The more chickens a farmer owns in a community, the higher the farmer's social status tends to be. The amount of income generated depends on the number of chickens sold and the price per head. The price of chicken tends to increase during Eid al-Fitr, Eid al-Adha, and the observance of the birthday of Prophet Muhammad (Mawlid). Price difference is also determined by the special characteristics attached to native chickens, including feather colour; thus, buyer preferences can differ. Chicken productivity can be increased by improving coop management, the quality of feed, cleanliness and sanitation of coops, and by regular administration of vaccines to improve chickens' immunity and to avoid certain diseases.

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Data availability. The data that support this study cannot be publicly shared due to ethical and privacy reasons and may be shared upon reasonable request to the corresponding author if appropriate.

Conflicts of interest. The authors declare no conflicts of interest for this paper. The author states that there is no conflict of interest in regard to breeders, sellers of native chickens, policy makers and community leaders in each research location.

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Profile of the poultry system

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