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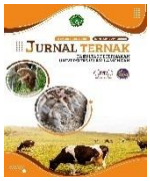

An Analysis of Regional Potency and Local Feed Resources to Develop Native Chicken in East Java Province

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ABSTRACT

This study aimed to depict the distribution of potential district/city in East Java Province to develop native chicken based on the analysis of regional potency and local feed resources. The result of this investigation provided basis for preliminary information and a general overview for the direction of native chicken development in East Java Province. The method used in this research were location quotient analysis (LQ), population growth analysis, and local feed potency using secondary data from the BPS-Statistic of East Java Province 2015-2019. The data were analyzed descriptively. The result showed that there were 12 districts (Trenggalek, Jember, Banyuwangi, Bondowoso, Situbondo, Probolinggo, Sidoarjo, Nganjuk, Ngawi, Bojonegoro, Bangkalan, and Sumenep) and one city (Probolinggo) in East Java Province that potentially developed native chicken. This determination was because those regions acted as the basis of native chicken based on location quotient analysis, positive population growth from 2015-2019, and abundant local feed resources.

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1. Introduction

Native chicken is an Indonesian-origin local chicken with a dual function; producing meat and eggs [1]. According to the Directorate General of Livestock and Animal Health [2], meat production of native chickens in East Java Province reached approximately 43,168 tons/year and became the second largest contributor to poultry meat after broiler chickens (277,654 tons/year). In addition, native chickens produced 21,341 tons of eggs/year and became the third-largest contributor of poultry eggs after laying hens (46 5,838 tons/year) and ducks (39,886 tons/year).

Native chickens have several advantages compared to other types of poultry, such as more adaptable to tropical environment under the East Java region, easier to care, and more expensive meat and eggs than commercial chickens. However, it also has shortcomings, such as slow growth rate, small body skeletons, and low egg production [3]. Winarti and Wiranti [4] stated that native chicken meat has a distinctive texture and taste, so that many people like it and had its market segment. Nevertheless, native chicken farming has several obstacles related to the lack of farmers' knowledge, genetics, and government policies.

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One of the supporting factors for the success of business development in a region is depicting the potential areas for determining the adjusted development to regional characteristics. According to Darsono *et al*. [5], the development of livestock business will be more effective if it is adapted to the technology, social, and economic conditions to support the development of livestock potential, the use of livestock, and the farmers' well-being. Sumanto and Juarini [6] explained that the livestock area potency analysis is a visualization of the evaluation of the livestock development potency to provide the necessary information and a general overview for conceptual and future-oriented planning.

Increasing productivity of native chicken can be made in several ways, including improvement in feed, genetic, and management aspects. Among others, feed is the dominant determining factor in the success of the native chicken business. The feed cost can reach around 70% of the total production cost of native chicken business [7]. One of the supports for the poultry business's independence is to utilize local feed ingredients [8]. The availability of local feed ingredients will be sustainable because most of the regions in Indonesia have the availability of feed ingredients that unutilized optimally [9]. At present, only 30-40% of agricultural and plantation waste is used as feed. The waste is in the development area and outside the livestock commodities area so that they need an alternative source of cheap local feed, such as utilizing agricultural waste as feed substitute [10]. In addition, Sadarman *et al*. [11] stated that it is necessary to explore alternative feed from agro-industrial by-products that are not yet commonly used for livestock development. Furthermore, Dewi [12] explained that the link between agricultural and livestock production areas became essential in developing livestock areas in terms of feed supply.

By looking at the role and potency of native chickens in East Java Province, it was necessary to identify the potency of local feed to support native chickens' productivity and to comprehend the regional potency related to wider development agribusiness, which is adjusted to the character of potential regions. The purpose of this study was to depict the regency/city with potency to develop native chicken in terms of regional analysis and local feed resources. The result of this investigation provided basis for preliminary information and a general overview for the direction native chickens development in East Java Province.

2. Method

2.1. Materials

The analyzed data were secondary data from the Livestock Service Office and the Central Bureau Statistics of East Java Province 2015-2020 [13-19].

2.2. Parameters

2.2.1. Profile of native chicken in East Java Province

Profile of native chicken farming was analyzed descriptively, including the development and distribution of native chicken populations.

2.2.2. Location quotient (LQ) analysis

LQ analysis was done according to Baharta *et al*. [20]:

$$LQi = \frac{Xi/Xt}{Yi/Yt}$$

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Xi: native chicken population in a district/city, Xt: total poultry population in a district/city, Yi: native chicken population in a province, and Yt: total poultry population in a province. Poultry population included broiler chicken, laying hens, native chicken, ducks, and quails. LQ value > 1, meaning that the district/city was a basis area of native chicken. The potency of native chicken in this area can be developed for the needs of this area and can fulfil the surrounding area. LQ value = 1, meaning that the district/city was a non-basis area of native chicken. The potency of native chicken in this area can be developed for the needs of this own area. LQ value < 1, meaning that the district/city was a non-basis area of native chicken. This area not potential for the development of native chicken.

2.2.3. Population growth analysis

Population growth analysis was carried out in accordance with Suparman [21]. This analysis was used to determine the population growth of native chicken in a certain area. The data used was the population of native chicken from 2015-2019. There were two criteria in this growth analysis, namely positive (+) and negative (-) growth. Growth (+) indicated that the commodity had the potency to be developed, while growth (-) indicated that it had less potential to be developed. The growth analysis formula is:

Population growth = (Tn-(Tn-1))/(Tn-1) x 100%

Tn: native chicken population at the year n and Tn-1: native chicken population at the year n-1

2.2.4. Potency of local feed resources

The potency of local feed resources can be analysed using the main agricultural product multiplied by the conversion value of by-products or waste and multiplied by their nutrient content [22]. The conversion value of agricultural by-products or waste was based on data from the literature. The potency of local feed resources was calculated using the following formula:

Feed ingredients potency (kg) = agricultural products (kg) x conversion value of by-products or waste

Crude protein potency (kg) = crude protein content (%) x dry matter content (%) x potency of feed ingredients (kg).

Metabolizable energy potency (kcal) = metabolizable energy content (kcal/kg) x dry matter content (%) x potency of feed ingredients (kg).

2.2.5. Carrying capacity

The carrying capacity of native chicken was analyzed with the approach of metabolizable energy and crude protein requirements. According to Sidadolog and Yuwanto [23], the balance of protein-energy and its concentration in the feed can be a biological limitation of feed consumption. Metabolizable energy and crude protein requirements of native chicken according to SNI No. 7783.3:2013 were 2500 kcal/kg and 16%, respectively. Feed consumption of native chicken was assumed to be 100 grams/day, so the requirements of metabolizable energy and crude protein within a year were as follow:

Metabolizable energy requirement (kcal/year)	= 2,500 kcal/kg x 0.1 kg/bird/day x 365 days
	= 91,250 kcal/bird/year
Crude protein requirement (kg/year)	= 16% x 0.1 kg/bird/day x 365 days
	= 5.84 kg/bird/year

Carrying capacity was calculated with the following formula:

Carrying capacity based on metabolizable energy requirement

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$$= \frac{\text{Metabolizable energy potency x 75\%}}{91{,}250}$$

Carrying capacity based on crude protein requirement

$$= \frac{\text{Crude protein potency x 75\%}}{5.84}$$

The 75% value was based on the total population of native chicken in East Java Province was 75% of local poultry (native chickens, ducks, Muscovy ducks, quails, and pigeons)[13]. Therefore, it was assumed that 25% of metabolizable energy and crude protein potency for other local poultries.

2.2.6. Development potency

Development potency was assessed by considering the following criteria:

1. LQ value (basis)
2. Growth value (positive)
3. Carrying capacity based on metabolizable energy requirement (positive)
4. Carrying capacity based on crude protein requirement (positive)

Development potency was calculated by combining criteria 3 and 4 with a ratio of 15625:1 (ratio of metabolizable energy and crude protein requirements).

2.3. Data analysis

The method used was descriptive-analytic. This method was done by collecting secondary data from related agencies and then analyzed into explainable information

3. Result and Discussion

3.1. Profile of native chickens farming in East Java Province

One of the Indonesian superior local poultry commodities is native chickens. The native chickens farming can support the preservation of genetic resources of Indonesian-origin animals. According to Nataamijaya [1], native chickens were highly valuable assets to form superior local chicken breeds and have been proven to adapt to the local environment. Winarti and Wiranti [4] explained that native chickens could grow well at a lower energy and protein level than commercial chickens so that native chickens can grow optimally with local feed ingredients that relatively had low quality. The development of native chickens and the distribution of their population in each district/city in East Java Province is shown in Figures 1 and 2.

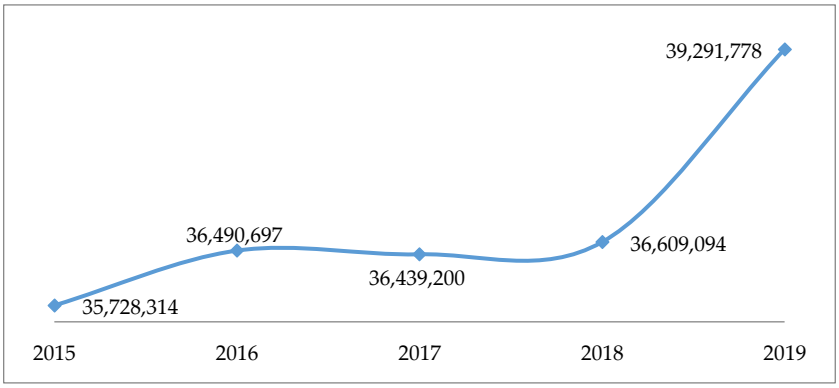

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Figure 1. The development of the native chickens' population in East Java Province
Source: Livestock Service Office of East Java Province [13]

Figure 1 showed that there was an increasing trend in the native chicken population in East Java Province. The native chicken population increased by 9.97% from 2015-2019, with an average increase of 1.99% each year. The highest increase occurred in 2018-2019, with 2,682,684 birds (7.33%). This result indicated that the native chickens had the potency to be developed in East Java Province. The livestock population is a general indicator that can be used as a parameter for livestock development [24].

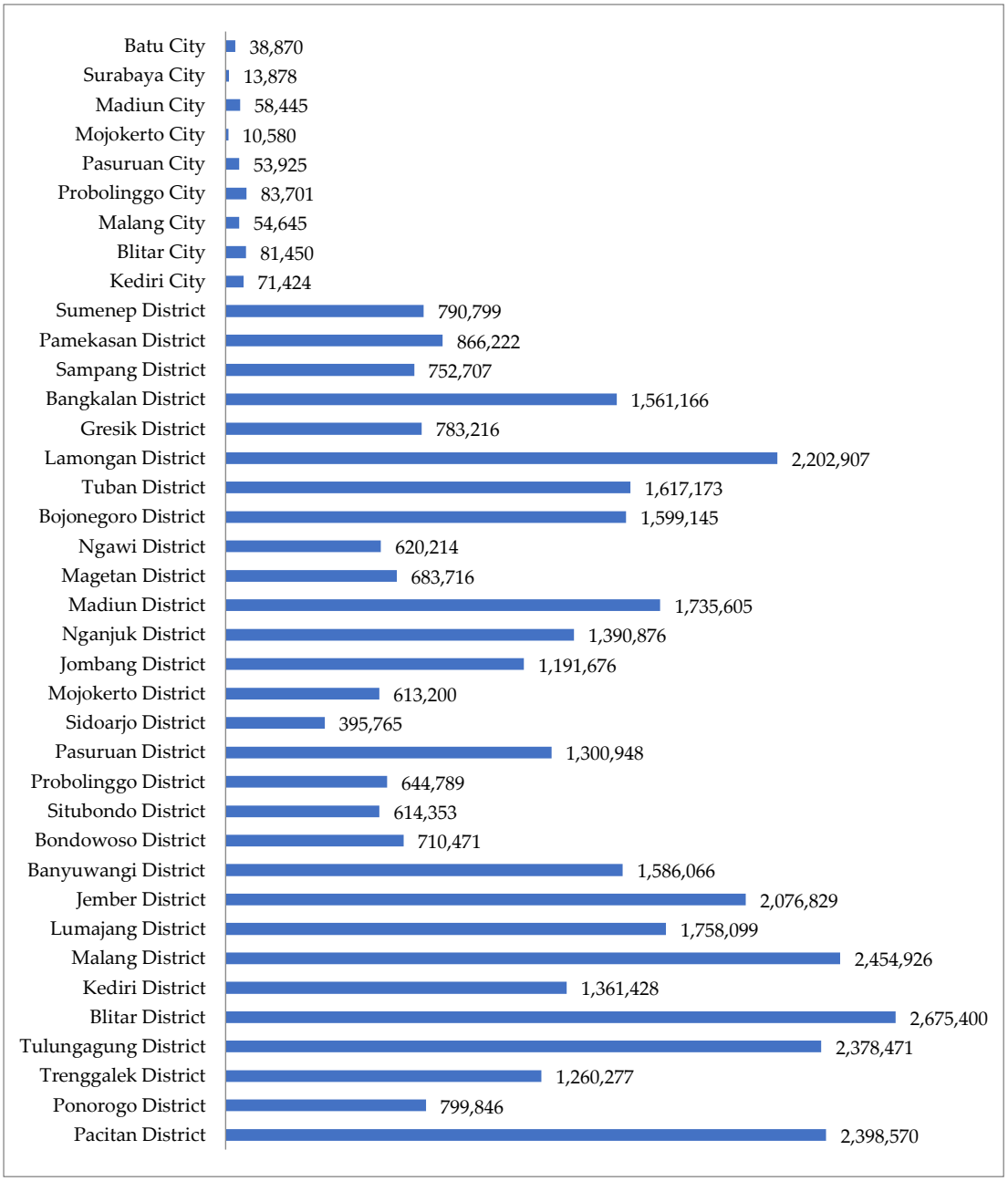

Figure 2. Distribution of the native chicken population in East Java Province
Source: BPS-Statistics of East Java Province [19]

As shown in Figure 2, the distribution of native chicken populations in each district/city varied widely. This result illustrated that the development of native chickens was influenced by the characteristics of each district/city. These characteristics can be in the form of feed resources potency, socio-economy, climate, and local government policies. The total population can describe the

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suitability of livestock commodities with the agroecological environment, population dynamics, community acceptance, and the success of reproductive management [24]. Matitaputty and Kuntoro [25] explained that the development of livestock areas must be adapted to the agroecosystem, spatial allocation of areas, and the use of superior or strategic types of livestock.

3.2. LQ analysis

LQ analysis is a method to map the potential base of native chickens in an area. This analysis can provide an overview of the potential areas for native chicken development from a perspective of the total population in an area relative to other areas. The result of the LQ analysis of native chickens in East Java Province is shown in Figure 3.

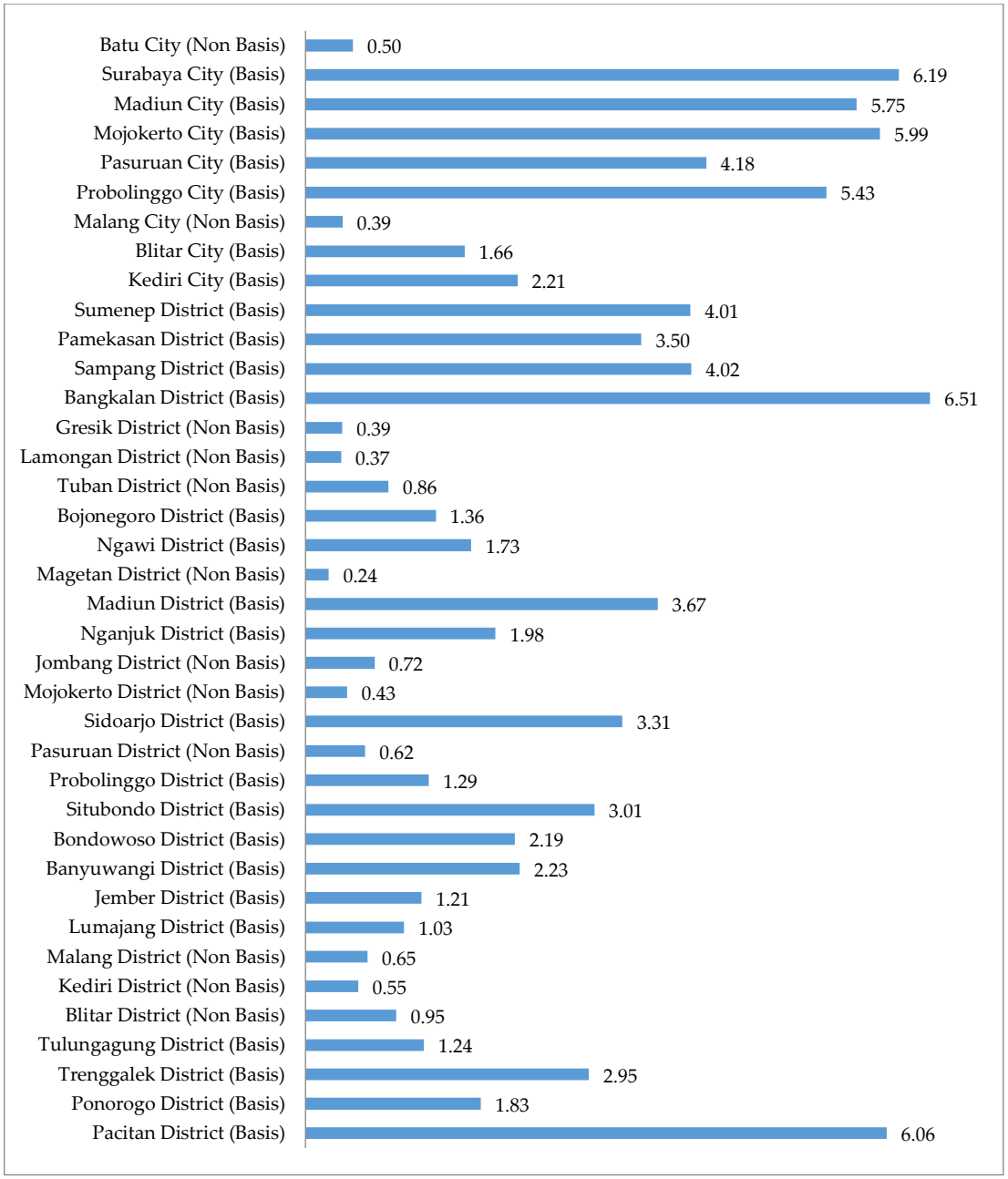

Figure 3. LQ analysis of native chickens in East Java Province
Source: Calculation results based on data from the BPS-Statistics of East Java Province [19]

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Table 1. Population growth analysis of native chickens in East Java Province 2015-2019

Area	Population growth				
	2015/2016	2016/2017	2017/2018	2018/2019	Average
Pacitan District	1.00	17.14	59.30	42.74	30.05
Ponorogo District	-1.65	-19.52	17.33	0.07	-0.94
Trenggalek District	4.79	3.58	4.87	21.87	8.78
Tulungagung District	-17.93	16.37	-33.71	-3.31	-9.65
Blitar District	5.00	-4.05	0.18	2.10	0.81
Kediri District	1.10	1.66	1.04	1.03	1.21
Malang District	2.80	2.14	2.07	1.58	2.15
Lumajang District	1.10	29.76	30.65	0.18	15.42
Jember District	1.50	1.71	37.93	-14.13	6.75
Banyuwangi District	25.52	-23.87	-2.01	47.00	11.66
Bondowoso District	13.51	5.67	4.76	2.34	6.57
Situbondo District	89.11	-57.76	-12.21	66.42	21.39
Probolinggo District	13.11	1.28	-14.89	17.08	4.14
Pasuruan District	0.36	0.64	-0.09	1.92	0.71
Sidoarjo District	6.84	4.26	2.28	0.97	3.59
Mojokerto District	0.71	-6.31	-4.84	-8.40	-4.71
Jombang District	-1.95	-7.00	-38.80	24.88	-5.72
Nganjuk District	0.00	0.01	0.12	13.39	3.38
Madiun District	3.45	3.58	3.07	3.00	3.27
Magetan District	-19.09	-0.02	0.68	15.31	-0.78
Ngawi District	7.23	-5.92	0.99	5.02	1.83
Bojonegoro District	0.83	1.04	1.20	1.29	1.09
Tuban District	15.99	0.04	4.04	2.04	5.53
Lamongan District	2.17	1.90	3.27	2.99	2.58
Gresik District	3.30	1.27	2.01	7.79	3.59
Bangkalan District	1.97	6.14	2.42	42.18	13.18
Sampang District	0.12	1.66	-1.57	-1.28	-0.27
Pamekasan District	1.60	3.12	0.05	0.04	1.20
Sumenep District	0.36	0.19	0.88	0.37	0.45
Kediri City	-15.80	-48.43	7.01	14.81	-10.60
Blitar City	4.78	3.93	28.95	0.97	9.66
Malang City	0.24	0.29	0.11	0.15	0.20
Probolinggo City	2.02	2.02	2.11	2.02	2.04
Pasuruan City	-0.92	0.46	10.43	11.74	5.43
Mojokerto City	-1.92	5.88	-11.85	-11.09	-4.75
Madiun City	3.09	-6.88	-4.00	-4.00	-2.95
Surabaya City	5.77	-19.74	-38.44	-0.81	-13.30
Batu City	-3.27	-7.77	-12.94	0.25	-5.93
East Java Province	2.13	-0.14	0.47	7.33	2.45

Source: Calculation results based on data from the BPS-Statistics of East Java Province [14-18]

Figure 3 showed that the majority (68.4%) of districts/cities in East Java Province were the basis of native chickens and only 12 districts/cities categorized into non-basis of native chickens. This result illustrated that the native chickens were one of the superior poultry in East Java Province. According to Suparman [21], the LQ index > 1 indicated that the area was the basis of livestock commodity. Susanto *et al*. [26] explained that the fundamental aspect for the development of an area

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based on agricultural commodities was to pay attention to the concentration and the degree of distribution of these commodities in the region.

The basis area with the highest LQ index of native chickens was found in Bangkalan District with 6.51, while the lowest one was Lumajang District with 1.03. The high LQ index illustrated that the area had higher potency for native chicken development. According to Baharta *et al*. [20], the basis area can function for exchange purposes and able to supply livestock in the area. In addition, Suparman [21] explained that the LQ analysis would obtain economic sectors with the potency to be distributed outside the surrounding area.

3.3. Population growth analysis

Population growth analysis is carried out to determine the growth rate of native chickens from an economic point of view each year. This analysis can describe the growth of native chickens in the district/city each year. The results of the population growth analysis are shown in Table 1. The average growth of the native chicken population in East Java Province during 2015-2019 was 2.45%. The distribution of population growth analysis in districts/cities showed that 27 (71.1%) districts/cities had a positive value. Whereas, 11 districts/cities (28.9%) had a negative value. This result indicated that most districts/cities in East Java Province had the potency to develop native chickens. Population growth (+) indicated that the commodity has the potency to be developed, while the negative value (-) indicated that the commodity has less potential to be developed [21].

Table 1 also showed that 19 districts/cities in East Java Province had a positive value of population growth from 2015 to 2019. This finding indicated that during those periods, the native chickens' population has always increased, and those areas were very potential for the development of native chickens.

3.4. Potency of local feed resources

The local feed is a feed ingredient from local resources with potency to be efficiently used as a supplement, part of concentrate, or main feed. The local feed can be in the form of crop residues, by-products crop, and by-product agroindustry [27]. Sinurat [28] explained that local feed ingredients that can be used to make native chickens' feed included rice bran, cassava and its by-products, coconut meal, tofu waste, palm oil waste, shrimp heads, and snails.

The use of agricultural by-products has several advantages, including high crude protein content at relatively low prices and some agricultural waste that can be used as feed additives. According to Kasapidou *et al*. [29], fruit and vegetable waste can improve the characteristics and palatability of the main feed because they contain antioxidants and coloring agents. The mannan content in palm kernel meal can be used as an antimicrobial agent against *Salmonella typhimurium* in chickens by reducing the incidence of *Salmonella typhimurium* and reducing the number of *Salmonella typhimurium* colonies in the cecum [30]. Nonetheless, the use of agricultural by-products for poultry feed also has several limitations, such as high antinutrient content, high crude fiber content [31], various nutrient content, seasonal dependent production, bulkiness properties, treatment requirements before usage, limited information on nutrient content, limited use by the cost per unit of amino acids, and more expensive energy than conventional feed ingredients. The processing and limitation of agricultural by-products for poultry feed can be seen in Table 2.

The local feed ingredients studied in this investigation were corn, agricultural by-products, and fruits recorded by BPS-Statistics of East Java Province. Corn has a multipurpose function, namely for food, feed, fuel, and fiber, and it was estimated that around 58% of domestic needs of corn were used for animal feed [32]. So that, in this study, corn was considered to have a conversion value of 58%. The data of local feed ingredients from agricultural by-products, estimated waste produced as local feed ingredients, and nutrient content for native chicken feed are shown in Table 3.

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Table 2. The processing and limitation of agricultural by-products for poultry feed

Feed ingredients	Treatment	Poultry type	Limit of use (%)	References
Corn	Without treatment	All	70	Bidura [33]
Rice bran	Without treatment	Laying hens	50	Sinurat [28]
Rice polishing	Without treatment	Laying hens	50	Sinurat [28]
Soybean hull	Fermentation (EM_4)	Broiler chickens	7.5	Auza and Badaruddin [34]
Soybean meal	Without treatment	Broiler chickens	32.5	Astuti [35]
		Laying hens	20	Syahruddin *et al*. [36]
Peanut meal	Without treatment	Native chicken	15	Bidura [33]
Sweet potato peel	Heating at 100-120 ^{0}C for 30 minutes	Broiler chickens	30	Widodo [37]
Cassava peel	Heating at 100-120 ^{0}C for 30 minutes	All	15	Widodo [37]
Tapioca waste	Fermentation (*Aspergillus niger*)	Native chicken	20	Widodo [37]
Palm kernel meal	Without treatment	Broiler chickens	40	Astuti [35]
Palm oil sludge	Without treatment	Laying hens	20	Sinurat [38]
Coconut meal	Without treatment	Broiler chickens, laying hens	40	Sinurat [28]
Coffee hull	Without treatment	Broiler chickens	14	Tatilu *et al*. [39]
Kapok meal	Fermentation (*Trichoderma harzianum*)	Laying hen	29.3	Syahruddin *et al*. [36]
Rubber meal	Fermentation (tapai yeast)	Broiler chickens	20	Inara [40]
Banana peel	Grinding	Broiler chickens	75	Hidayat *et al*. [41]

Table 3. Estimation of conversion value and nutrient contents of local feed ingredients in East Java Province

Agricultural product	Local feed	CV	DM (%)	CP (%)	ME (kcal/Kg)	References
Corn	Corn	58	84	8.5	3300	Panikkai *et al*. [32] Pratiwi [42]
Rice	Rice bran	8.5	86	11.9	2730	Astawan and Febrinda [43] Hartadi [44]
	Rice polishing	3	86	12	2887	Astawan dan Febrinda [43] Astuti [35]
Soybean	Soybean hull	7.3	94	16.2	2898	Auza and Badaruddin [34]
	Soybean meal	78.7	86	41.3	3421	Dei [45] Astuti [35]
Mung bean	Mung bean hull	10	88.5	13.5	2841	Surya [46]
Peanut	Peanut hull	2.3	88.6	9	2501	Zhao *et al*. [47] Lindemann *et al*. [48]
	Peanut meal	70	90	45.6	2664	Batal *et al*. [49] Zhao *et al*. [47]
Sweet potato	Sweet potato peel	16	85	6.7	1544	Nuraini *et al*. [50] Agustono *et al*. [27]
Cassava	Cassava peel	16	67.9	4.0	2135	Mirzah and Muis [51]
	Tapioca waste	11.4	85.9	2.9	2783	Kiramang [52]
Palm oil	Palm kernel meal	3	90	15.4	2446	Yanto and Febrina [53] Putri *et al*. [54]
	Palm oil sludge	15	90	15.5	1593	Sinurat [38]
Coconut	Coconut meal	30	92.9	20	3248	Stein *et al*. [55]
Cocoa	Cocoa hull	72.8	93.4	10.9	2999	Guntoro dan Yasa [56]
Coffee	Coffee hull	35	90	10.4	3356	Nuschati [57]
Kapok	Kapok meal	45	88.9	50.6	3712	Ma *et al*. [58]
Rubber	Rubber meal	56	94	26.7	2550	Inara [40]
Banana	Banana peel	35	68.9	7.0	2795	Ajila *et al*. [59], Dorisandi *et al*. [60], Hidayat *et al*. [41]

CV: conversion value, DM: dry matter, CP: crude protein, ME: metabolizable energy

Based on Table 3, a simple equation can be made by multiplying the conversion value of agricultural products with their nutritional content. Thus, a simple equation was obtained in order to calculate the potency of metabolizable energy and crude protein from agricultural products in an area as follow:

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$$\text{Metabolizable energy (kcal)} = (1{,}607.7 \times C) + (274.0 \times R) + (2{,}514.3 \times S) + (251.4 \times MB) + (1{,}729.3 \times P) + (197.9 \times SP) + (504.5 \times C) + (281.1 \times PO) + (1{,}485.0 \times K) + (1{,}342.3 \times R) + (905.2 \times Cc) + (1{,}057.1 \times Cf) + (2{,}039.2 \times Co) + (6.7 \times B) \quad (1)$$

$$\text{Crude protein (kg)} = (0.041 \times C) + (0.012 \times R) + (0.291 \times S) + (0.012 \times MB) + (0.289 \times P) + (0.009 \times SP) + (0.007 \times C) + (0.025 \times PO) + (0.202 \times K) + (0.141 \times R) + (0.056 \times Cc) + (0.033 \times Cf) + (0.074 \times Co) + (0.017 \times B) \quad (2)$$

C: corn, R: rice, S: soybean, MB: mung bean, P: peanut, SP: sweet potato, C: cassava, PO: palm oil, K: kapok, R: rubber, Cc: coconut, Cf: coffee, Co: cocoa, and B: banana.

Table 3 indicated that agricultural sector, not only produced food, but also potentially produced feed for native chickens (around 10-25%). According to Kasapidou *et al*. [29], approximately 30% of agricultural waste can be used for feed and can reduce by-product waste to create the integration of agriculture with livestock farming. Through this integration, the concept of zero waste can be created since the by-product of one component served as a resource for the other components. The use of agro-industrial by-products played a role in overcoming problems in environmental pollution [52].

The potency of metabolizable energy and crude protein from agricultural products in East Java Province can be calculated using Equation (1) and (2) above. The results of the analysis in Table 4 showed that the area that produced the highest metabolizable energy and crude protein was Tuban Districts with 1,073,735 million kcal/year and 39,457 tons/year, respectively, while the lowest one was Mojokerto Districts with 1,221 million kcal/year and 62.1 tons/year, respectively. The high potency of metabolizable energy and crude protein indicated that the area had a high agricultural production to produce high agricultural by-products which can also be used as animal feed ingredients.

3.5. Carrying capacity and development potency

The carrying capacity is the ability of an administrative area to accommodate animal feed requirements within a certain period. In poultry, the carrying capacity can be estimated using the requirement of metabolizable energy and crude protein. The balance of energy and protein is a determinant of chickens' performance because instinctively, chickens would stop eating if their metabolizable energy requirements are met [61]. Furthermore, Kiramang [52] stated that chickens will consume feed based on their energy requirements, if the energy requirements are met, the chickens will stop eating and will affect the consumption of protein and other nutrients.

Analysis of the distribution of the carrying capacity of native chickens based on the requirement of metabolizable energy and crude protein from the local feed in East Java Province can be seen in Table 4. The carrying capacity was based on the requirement of metabolizable energy and crude protein which were assumed to be 91,250 kcal/bird/year and 5.84 kg/bird/year, respectively. The result of the analysis in Table 4 showed that the carrying capacity with the metabolizable energy and crude protein approaches had a different value, which was higher when using the metabolizable energy approach.

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Table 4. Distribution of feed potency and carrying capacity in East Java Province

Area	Feed potency		Carrying capacity (birds)	
	ME (million kcal/year)	CP (ton/year)	Based on ME	Based on CP
Pacitan District	403,445.0	12,962.9	3,315,986.0	1,664,752.4
Ponorogo District	825,446.5	27,082.6	6,784,491.8	3,478,071.4
Trenggalek District	347,794.4	12,190.8	2,858,583.8	1,565,602.1
Tulungagung District	680,205.8	20,353.1	5,590,732.9	2,613,845.5
Blitar District	775,800.5	26,929.3	6,376,442.6	3,458,380.9
Kediri District	748,665.0	21,701.4	6,153,411.2	2,786,997.7
Malang District	778,652.9	28,658.8	6,399,886.8	3,680,498.5
Lumajang District	338,845.8	12,876.9	2,785,033.8	1,653,714.4
Jember District	1,004,502.1	38,175.6	8,256,181.6	4,902,683.0
Banyuwangi District	624,477.5	31,854.1	5,132,692.1	4,090,852.4
Bondowoso District	345,044.9	10,229.4	2,835,985.8	1,313,709.5
Situbondo District	446,707.6	12,557.7	3,671,569.0	1,612,722.1
Probolinggo District	418,561.3	12,583.6	3,440,229.9	1,616,046.7
Pasuruan District	569,593.5	20,846.4	4,681,590.3	2,677,188.5
Sidoarjo District	72,721.5	3,601.1	597,710.8	462,476.1
Mojokerto District	330,818.4	11,805.1	2,719,055.5	1,516,062.4
Jombang District	481,418.5	16,672.3	3,956,864.0	2,141,139.4
Nganjuk District	600,628.0	22,178.0	4,936,668.5	2,848,195.8
Madiun District	244,185.4	10,736.1	2,007,003.0	1,378,778.6
Magetan District	303,031.9	12,167.8	2,490,673.5	1,562,642.4
Ngawi District	627,152.7	25,115.4	5,154,679.9	3,225,432.2
Bojonegoro District	694,961.1	32,649.9	5,712,008.9	4,193,051.7
Tuban District	1,073,735.6	39,457.3	8,825,223.8	5,067,286.3
Lamongan District	814,867.0	33,539.4	6,697,537.2	4,307,282.8
Gresik District	296,168.6	10,340.4	2,434,262.3	1,327,963.3
Bangkalan District	371,414.1	18,921.3	3,052,719.0	2,429,958.4
Sampang District	386,817.8	25,650.8	3,179,324.7	3,294,196.5
Pamekasan District	196,026.9	6,404.1	1,611,179.6	822,442.4
Sumenep District	771,908.7	24,057.3	6,344,455.1	3,089,556.0
Kediri City	12,860.1	443.9	105,699.5	57,011.5
Blitar City	16,058.7	456.0	131,989.1	58,557.8
Malang City	6,266.6	217.2	51,506.4	27,892.3
Probolinggo City	42,466.7	1,127.8	349,041.7	144,842.1
Pasuruan City	3,059.1	1,544.4	25,143.1	18,549.1
Mojokerto City	1,221.1	62.1	10,036.5	7,969.8
Madiun City	2,848.8	160.6	23,414.5	20,629.8
Surabaya City	4,116.2	158.4	33,831.9	20,336.1
Batu City	4,310.4	155.4	35,427.6	19,962.5
East Java Province	15,666,806,6	585,224.7	128,768,273.8	75,157,280.7

Source: calculation results

ME: metabolizable energy, CP: crude protein

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Table 5. The distribution of development potency of native chickens in East Java Province

Area	LQ	PGA	DP (birds)		DC	DP (birds)
			ME	CP		
Pacitan District	Basis	+	917,416	-733,818	Non-potential	-
Ponorogo District	Basis	-	5,984,646	2,678,225	Non-potential	-
Trenggalek District	Basis	+	1,598,307	305,325	Potential	305,325
Tulungagung District	Basis	-	3,212,262	235,375	Non-potential	-
Blitar District	Non-basis	+	3,701,043	782,981	Non-potential	-
Kediri District	Non-basis	+	4,791,983	1,425,570	Non-potential	-
Malang District	Non-basis	+	3,944,961	1,225,573	Non-potential	-
Lumajang District	Basis	+	1,026,935	-104,385	Non-potential	-
Jember District	Basis	+	6,179,353	2,825,854	Potential	2,825,854
Banyuwangi District	Basis	+	3,546,626	2,504,786	Potential	2,504,786
Bondowoso District	Basis	+	2,125,515	603,239	Potential	603,239
Situbondo District	Basis	+	3,057,216	998,369	Potential	998,369
Probolinggo District	Basis	+	2,795,441	971,258	Potential	971,258
Pasuruan District	Non-basis	+	3,380,642	1,376,241	Non-potential	-
Sidoarjo District	Basis	+	201,946	66,711	Potential	66,711
Mojokerto District	Non-basis	-	2,105,856	902,862	Non-potential	-
Jombang District	Non-basis	-	2,765,188	949,463	Non-potential	-
Nganjuk District	Basis	+	3,545,792	1,457,320	Potential	1,457,320
Madiun District	Basis	+	271,398	-356,826	Non-potential	-
Magetan District	Non-basis	-	1,806,958	878,926	Non-potential	-
Ngawi District	Basis	+	4,534,466	2,605,218	Potential	2,605,218
Bojonegoro District	Basis	+	4,112,864	2,593,907	Potential	2,593,907
Tuban District	Non-basis	+	7,208,051	3,450,113	Non-potential	-
Lamongan District	Non-basis	+	4,494,630	2,104,376	Non-potential	-
Gresik District	Non-basis	+	1,651,046	544,747	Non-potential	-
Bangkalan District	Basis	+	1,491,553	868,792	Potential	868,792
Sampang District	Basis	-	2,426,618	2,541,490	Non-potential	-
Pamekasan District	Basis	+	744,958	-43,780	Non-potential	-
Sumenep District	Basis	+	5,553,656	2,298,757	Potential	2,298,757
Kediri City	Basis	-	34,276	-14,412	Non-potential	-
Blitar City	Basis	+	50,539	-22,892	Non-potential	-
Malang City	Non-basis	+	-3,139	-26,753	Non-potential	-
Probolinggo City	Basis	+	265,341	61,141	Potential	61,141
Pasuruan City	Basis	+	-28,782	-35,376	Non-potential	-
Mojokerto City	Basis	-	-543	-2,610	Non-potential	-
Madiun City	Basis	-	-35,030	-37,815	Non-potential	-
Surabaya City	Basis	-	19,954	6,458	Non-potential	-
Batu City	Non-basis	-	-3,442	-18,908	Non-potential	-

Source: Calculation results

LQ: location quotient, PGA: population growth analysis, DP: development potency, ME: metabolizable energy, CP: crude protein, DC: development criteria

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The results of the development potency analysis in Table 5 showed that there were 12 districts and one city with potency for the development of native chickens. Those areas were Trenggalek, Jember, Banyuwangi, Bondowoso, Situbondo, Probolinggo, Sidoarjo, Nganjuk, Ngawi, Bojonegoro, Bangkalan, and Sumenep Districts, as well as Probolinggo City. This determination was based on several criteria; the area being the basis of native chickens based on LQ analysis, population growth has always been positive during 2015-2019, the potency of local feed resources was abundant, which exceeded the requirements for existing native chickens (Table 4). The difference between the requirements and potency of local feed resources in those 13 districts/cities converted into metabolizable energy and crude protein was around 6,368,341 million kcal/year and 245,242 tons/year, respectively. Therefore, the potency for native chicken development was around 18,160,677 birds.

The results of the analysis in Table 5 also showed that the area with the greatest development potency was Jember District with 2,825,854 birds, while the lowest one was Probolinggo City with 61,141 birds. This result probably because by the feed potency in Jember District was very abundant, supported by a huge area for agriculture. Probolinggo City has a small carrying capacity because the agricultural land was minimal. Subsequently, the feed produced from agricultural waste was also limited.

4. Conclusions

Based on the analysis of location quotient, population growth, and local feed potency, there are 12 districts and one city in East Java Province that had the potency to develop native chicken. The districts are Trenggalek, Jember, Banyuwangi, Bondowoso, Situbondo, Probolinggo, Sidoarjo, Nganjuk, Ngawi, Bojonegoro, Bangkalan, and Sumenep. The potential city to develop native chicken is Probolinggo. This determination is based on several criteria including the area being the basis of native chicken predicated on location quotient analysis, the population growth of native chicken has always been positive from 2015 to 2019, and the local feed resources are abundant. The difference between the feed demand and the feed potency in those 13 areas when converted into metabolizable energy and crude protein contents is around 6,368,341 million kcal/year and 245,242 tons/year, respectively. Thus, the potency for the development of native chicken is around 18,160,677 birds.

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