Which Households Raise Livestock in Urban and Peri-Urban Areas of Eight Developing Asian Countries?

Ushimaru, Sayaka
Iwata, Rintaro
Amrullah, Eka Rastiyanto
Utami, Arini W.
Ishida, Akira

(Citation)
Agriculture,14(3):443

(Issue Date)
2024-03

(Resource Type)
journal article

(Version)
Version of Record

agriculture

Article

Which Households Raise Livestock in Urban and Peri-Urban Areas of Eight Developing Asian Countries?

Sayaka Ushimaru [1], Rintaro Iwata [2], Eka Rastiyanto Amrullah [3], Arini W. Utami [4] and Akira Ishida [2,*]

[1] Faculty of Agriculture, Kobe University, Kobe 657-8501, Japan; 2046091a@stu.kobe-u.ac.jp
[2] Graduate School of Agricultural Science, Kobe University, Kobe 657-8501, Japan; rin_jolly@icloud.com
[3] Agricultural Instruments Standardization Agency, Ministry of Agriculture, Jakarta 12550, Indonesia; ekarastiyanto@pertanian.go.id
[4] Faculty of Agriculture, Gadjah Mada University, Yogyakarta 55281, Indonesia; ariniwu@ugm.ac.id
* Correspondence: akira_ishida@people.kobe-u.ac.jp; Tel.: +81-78-803-5844

Abstract: In many developing countries, ensuring a stable and affordable supply of safe and nutritious food for urban dwellers, especially impoverished households, has become an urgent policy issue due to growing urban populations. Since urban and peri-urban agriculture (UPA) has emerged as a potential solution, research interest in UPA has increased. However, most studies have been conducted in specific African towns, and analyses in Asian countries are scarce. In addition, further research must be performed on urban and peri-urban livestock farming (UPLF), which may provide animal-based protein to the urban population. Therefore, this study aims to clarify who raises livestock in the urban and peri-urban areas of eight developing Asian countries using raw data from the Demographic and Health Survey (DHS). The aggregation results reveal that at least 10% of households keep livestock, with more than 30% of households in four of the eight Asian countries practicing UPLF. Poultry is the most common type of livestock, and the number of animals per household is usually limited. Logistic regression analysis reveals that poorer families are more likely to raise livestock, suggesting UPLF can enhance food and nutritional security for low-income households.

Keywords: urban and peri-urban livestock; Bangladesh; Cambodia; India; Myanmar; Nepal; Pakistan; Philippines; East Timor; Demographic and Health Survey

Citation: Ushimaru, S.; Iwata, R.; Amrullah, E.R.; Utami, A.W.; Ishida, A. Which Households Raise Livestock in Urban and Peri-Urban Areas of Eight Developing Asian Countries?. *Agriculture* **2024**, *14*, 443. https://doi.org/10.3390/agriculture14030443

Received: 26 January 2024
Revised: 2 March 2024
Accepted: 4 March 2024
Published: 8 March 2024

1. Introduction

The world population is predicted to reach 9.7 billion by 2050 [1], with approximately 68 percent of the people residing in urban and peri-urban areas in 2050, compared to 55 percent in 2018 and 30 percent in 1950 [2]. The data indicates that the urban population is rapidly increasing along with population growth and concentration in urban areas. In addition, the population of slums or slum-like areas, where low-income households are concentrated, is expected to grow by an additional 2 billion people by 2050, from 1.1 billion in 2020 to more than 3 billion in total [3]. Given the rapid growth of the urban population, primary food producers are located in rural areas, rendering large-scale food production in densely populated cities challenging. Consequently, urban residents are more likely to depend on purchasing food instead of producing it themselves. However, little attention has been paid to the effects of urban growth on food security [4].

Urban poor households in developing countries are more prone to food insecurity than those of non-poor families [5–7] and are also more vulnerable to shocks such as reduced income, unemployment [8,9], and social instability [9]. In addition, as can be inferred from Engel's law, which states that income level is inversely related to the ratio of food expenditure to household expenditure, Engel's coefficient is reported to be higher for the urban poor [10,11], and higher food prices have a significant negative impact on food nutrition security [9,11–13]. As noted by Crush and Frayne [14], the issue of urban food security is becoming an increasingly pressing development challenge, and the complex

nature of urban food systems requires urgent attention from researchers, policymakers, international donors, and multilateral agencies. In response to this situation, along with strengthening the food supply chain from rural and overseas food production areas to cities, there has been growing interest in urban and peri-urban agriculture (UPA), which is defined as the production of food and other outputs in urban and peri-urban areas by Food and Agriculture Organization (FAO) [15], since FAO started actively promoting UPA in the late 1990s [15]. Therefore, since the 2000s, mainly the 2010s, there has been a growing interest in UPA among international donors, organizations, local governments, and researchers, leading to increased research on natural and social sciences [16].

Previous studies have demonstrated that although UPA is typically practiced in small vacant spaces and is considered a supplementary source of income or food for consumption, it has positively impacted households' food access [17], food and nutritional intake [18–23], increased or diversified income [20,21,24], reduced vulnerability and increased resilience to shocks [25], empowered women through economic independence [26–28], accumulated social capital [18,29,30], and suppressed the rise of ground surface temperatures [31]. However, research on UPA is nascent, and most discussions are based on small-sample surveys in a specific area of an African country. Further research is needed to determine UPA's potential positive effects on urban dwellers' well-being using raw data from extensive sample surveys. Moreover, because home or community gardens are the most common form of UPA, and agricultural censuses typically do not include urban dwellers (FAO), it is unclear how widespread UPA is in developing countries. In addition, most studies have focused on the production of staple crops, vegetables, and fruits, whereas few have been conducted on livestock production in urban and peri-urban areas [16]. Graefe et al. [16] reported that only 2% of all studies on UPA address urban and peri-urban livestock farming (UPLF). Animal protein intake is lower in developing countries than requirements [32]. Therefore, it is crucial to understand the status of UPLF implementation in developing countries urban and peri-urban areas to improve urban dwellers' nutritional security. In addition, Graefe et al.'s [16] literature review, spanning from 1988 to 2017, found that only 9% of the total literature focused on Asia, with a predominant emphasis on China and India, leaving other Asian countries underexplored.

Therefore, the main objective of this study is to clarify the characteristics of households engaged in UPLF in developing Asian countries, with a specific focus on understanding the economic status of urban and peri-urban households involved in UPLF. This study is novel in that it covers eight developing Asian countries and analyzes their UPLF.

The paper is structured in the following way. Section 2 outlines the DHS, the statistical method used, and the dependent and independent variables employed for our logistic regression. In Section 3, we present the results of the logistic regression estimation, and in Section 4, we provide a discussion based on the analysis results. Finally, in Section 5, we summarize the paper and present the limitations of this study.

2. Materials and Methods

2.1. Description of Demographic and Health Survey Data

This study used raw household data from the Demographic and Health Survey (DHS) in South and Southeast Asian countries, including Bangladesh, Cambodia, East Timor (Timor Leste), India, Myanmar, Nepal, Pakistan, and the Philippines. Sri Lanka, Vietnam, and Indonesia were excluded from the analysis due to the unavailability of raw data, lack of recent surveys, and missing information on some variables. The United States Agency for International Development (USAID) established the DHS in 1984. It is a well-known and reliable large-scale sampling survey used to analyze women's and children's health, sanitation, and empowerment in public health, medical science, and social science research. Detailed information on the sampling methodology is available from the survey reports of each country, and raw data can be downloaded from the DHS program homepage [33]. For the survey in each country, the number of sampling units was determined for each administrative unit, such as division or province, according to the population ratio, using

the sampling units from the population census conducted by the national statistical offices in each country. From each sampling unit randomly selected, the same number of households (30 households in Bangladesh [34], Cambodia [35], Myanmar [36], and Nepal [37], 29 or 22 households in the Philippines [38], 28 households in Pakistan [39], 26 households in Timor-Leste [40] and 22 households in India [41]) was randomly selected and interviewed in person by trained interviewers using a questionnaire with some common questions in each country. As this study aims to examine raising livestock in urban and peri-urban areas, only information collected from households in these areas was considered. Table 1 illustrates the year(s) in which the survey was conducted in each country, the number of samples obtained from each country that contained all the information required for analysis, and the Gross Domestic Product (GDP) per capita in current US dollars for the surveyed year.

Table 1. List of Asian countries used for the analysis.

Country	DHS Surveyed Year	Number of Households Used for the Analysis	GDP Per Capita (Current US $)
Bangladesh	2017–2018	7044	1815.6 (2017)
Cambodia	2021/22	6919	1625.2 (2021)
East Timor	2016	3065	1349.5 (2016)
India	2019–2021	156,280	2050.2 (2019)
Myanmar	2015–2016	3182	1159.3 (2015)
Nepal	2022	7195	1336.5 (2022)
Pakistan	2017–2018	6087	1567.6 (2017)
Philippines	2022	11,573	3498.5 (2022)

Note: The number of DHS households used in the analysis was obtained from the authors' calculations. Data on the GDP per capita for each country obtained from the World Bank (https://data.worldbank.org/indicator/NY.GDP.PCAP.CD, accessed on 15 December 2023) was presented to provide a reference for the economic level of each country.

The DHS collects information on livestock ownership in all surveyed countries by asking, "Does this household own any livestock, herds, other farm animals, or poultry?" In addition, the number of animals kept for major species was collected (no information on the number of animals was available in India). However, when the number of poultry (primary animals raised in urban and peri-urban areas) exceeds 95, the DHS records the number as 95+, rendering it challenging to obtain accurate information on the exact number of poultry kept and accurately estimate tropical livestock units for each country. Therefore, this study used logistic regression to estimate odds ratios with livestock-holding status as the binary dependent variable (with livestock = 1, without = 0). Based on explanatory variables used in previous studies regarding urban and peri-urban agriculture, we used explanatory variables such as the gender of the household's head (male = 1, female = 0), age categories for the household's head (10/the 20s, 30s, 40s, 50+), household economic status categories (10 levels, see the next paragraph for a more detailed explanation), the number of household members (person), farmland ownership (with = 1, without = 0), capital city residency (living in capital = 1, living in other cities = 0), travel times to the center of the nearest city (minute), and annual rainfall in the primary sampling unit where a respondent lives (mm). The last two variables were obtained from geographic datasets and others from the primary survey datasets of DHS. The weight-adjusted mean and standard deviation of the explanatory variables are shown in Table 2.

To measure the economic status of households in developing countries where obtaining detailed information on household income within a limited survey time is difficult, the DHS encourages using a method commonly employed by international organizations and researchers in large-sample surveys. This method utilizes categorical principal component analysis based on polychoric correlation to analyze survey data on the materials of walls, roofs, and floors; the living environment, including water supply and toilet facilities; the type of cooking fuel; and the ownership of durable consumer goods [42]. The households surveyed were divided into ten strata based on their economic status using the first principal component score, which was included in the DHS datasets. These strata were then used as categorical variables in the analysis.

Table 2. Descriptive statistics of explanatory variables.

Explanatory Variables	Bangladesh		Cambodia		India		Myanmar	
	Mean	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**
Sex of household's head (dummy variable)								
Woman	0.132		0.320		0.171		0.267	
Man	0.868		0.680		0.829		0.733	
Age of household's head (dummy variable)								
10s or 20s	0.133		0.095		0.054		0.053	
30s	0.286		0.267		0.184		0.142	
40s	0.258		0.209		0.253		0.238	
50s	0.163		0.212		0.231		0.267	
60s and above	0.159		0.217		0.277		0.300	
Economic conditions (dummy variable)								
1st quintile (poorest)	0.100		0.100		0.100		0.100	
2nd quintile	0.100		0.100		0.100		0.100	
3rd quintile	0.100		0.100		0.100		0.100	
4th quintile	0.100		0.100		0.100		0.100	
5th quintile	0.100		0.100		0.100		0.100	
6th quintile	0.100		0.100		0.100		0.100	
7th quintile	0.100		0.100		0.100		0.100	
8th quintile	0.100		0.100		0.100		0.100	
9th quintile	0.100		0.100		0.100		0.100	
10th quintile (richest)	0.100		0.100		0.100		0.100	
Number of family members (persons)	4.180	1.788	4.083	1.905	4.189	2.021	4.256	2.242
Land possession (dummy variable)								
Yes	0.389		0.320		0.132		0.095	
No	0.611		0.680		0.868		0.905	
Living in capital 2 (dummy variable)								
Yes	0.469		0.357		0.040		0.030	
No	0.531		0.643		0.960		0.970	
Travel times (minutes)	4.496	8.692	28.586	46.055	4.717	11.888	10.468	21.554
Annual rainfall (mm) (dummy variable)								
Below 1000					0.264		0.190	
1000–1999	0.201		0.932		0.592		0.234	
2000–2999	0.638		0.048		0.044		0.452	
3000–3999	0.130		0.019		0.064		0.059	
4000–	0.031				0.036		0.065	

Table 2. *Cont.*

Explanatory Variables	Nepal		Pakistan		Philippines		East Timor	
	Mean	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**
Sex of household's head (dummy variable)								
Woman	0.331		0.116		0.290		0.116	
Man	0.669		0.884		0.710		0.884	
Age of household's head (dummy variable)								
10s or 20s	0.143		0.068		0.079		0.068	
30s	0.234		0.225		0.184		0.225	
40s	0.215		0.271		0.233		0.271	
50s	0.203		0.221		0.229		0.221	
60s and above	0.206		0.216		0.275		0.216	
Economic conditions (dummy variable)								
1st quintile (poorest)	0.100		0.100		0.100		0.100	
2nd quintile	0.100		0.100		0.100		0.100	
3rd quintile	0.100		0.100		0.100		0.100	
4th quintile	0.100		0.100		0.100		0.100	
5th quintile	0.100		0.100		0.100		0.100	
6th quintile	0.100		0.100		0.100		0.100	
7th quintile	0.100		0.100		0.100		0.100	
8th quintile	0.100		0.100		0.100		0.100	
9th quintile	0.100		0.100		0.100		0.100	
10th quintile (richest)	0.100		0.100		0.100		0.100	
Number of family members (persons)	3.918	1.944	6.294	3.250	4.124	2.128	6.294	3.250
Land possession (dummy variable)								
Yes	0.586		0.106		0.081		0.106	
No	0.414		0.894		0.919		0.894	
Living in capital (dummy variable)								
Yes	0.266		0.334		0.266		0.334	
No	0.734		0.666		0.734		0.666	
Travel times (minutes)	38.465	61.183	7.478	21.291	8.172	27.950	7.478	21.291
Annual rainfall (mm) (dummy variable)								
Below 1000	0.005		0.898		0.016		0.898	
1000–1999	0.612		0.101		0.254		0.101	
2000–2999	0.338		0.002		0.649		0.002	
3000–3999	0.045				0.078			
4000–					0.004			

Dummy variables are binary variables that take the value of 1 if applicable and 0 if not applicable. Standard deviations are presented for continuous variables only. For Myanmar, 1 is defined as living in Yangon, the former capital city with a large population, and 0 as living in any other city.

2.2. Statistical Analysis

For estimating parameters, the following mathematical formula of the logistic regression was used:

$$P(Y = 1|X) = \frac{\exp(X'\beta)}{1 + \exp(X'\beta)} \quad (1)$$

$$ln\left(\frac{P(Y = 1|X)}{1 - P(Y = 1|X)}\right) = ln\left(\frac{P(Y = 1|X)}{P(Y = 0|X)}\right) = X'\beta \quad (2)$$

where Y is a binary dependent variable (that is, engagement in UPLF), cap X is vector of independent variables, and β a vector of unknown parameters to be estimated by the maximum likelihood logistic regression. We used the SVY command of Stata MP18.0 (StataCorpLLC, College Station, TX, USA) to calculate more accurate estimates during the

estimation process, as the number of survey subjects in the DHS is determined by stratified two-stage random sampling.

3. Results

3.1. Prevalence of Rearing Livestock

Table 3 shows the percentages of households involved in livestock production in various Asian countries. The rates were 59.9%, 57.1%, 31.0%, and 30.0% in East Timor, Nepal, Bangladesh, and Cambodia, respectively. The Philippines had a rate of 15.6%, Pakistan 13.5%, Myanmar 13.6%, and India 10.4%. These percentages indicate that animal husbandry is common in some households in the urban and peri-urban areas of developing Asian countries. In East Timor and Nepal, where livestock ownership was higher than in other countries, most families owned pigs and goats, respectively. However, in different countries (except India, which has no data on the number of livestock), most households owned poultry, the second most common type of livestock in East Timor and Nepal. This clearly shows that many families in urban and peri-urban areas of Asia prefer to keep poultry instead of cattle or other large livestock due to several plausible reasons. Poultry is more accessible than large livestock. Chicks are relatively inexpensive and proliferate, making them a more cost-effective option. Moreover, urban areas have limited space due to high population density, and poultry requires less space than cattle or other large livestock.

Table 3. Percentage of urban households that own livestock and their major livestock types.

Country	Percentage of Households with Livestock to Total Households (%)	Percentage of Households with Specific Livestock to Total Households (%)
Bangladesh	31.0	Poultry (25.7), Goat/sheep (6.7)
Cambodia	30.0	Poultry (27.7), Cow/bull (10.0)
East Timor	59.9	Swine (48.0), Poultry (22.9)
India	10.4	Not available
Myanmar	13.6	Poultry (8.7), Swine (5.1)
Nepal	57.1	Goat (39.1), Poultry (30.0)
Pakistan	13.5	Poultry (7.5), Goat (5.9)
Philippines	15.6	Poultry (15.2), Goat (2.4)

Note: The table was created using the results obtained from the weight-adjusted crosstabs using Stata's svy and tabulate commands.

Here, we show the distribution of the most commonly kept livestock in the urban and peri-urban areas of each country (detailed figures are not shown in Table 3 due to space limitations). Among the five countries where poultry was the primary livestock in urban and peri-urban areas, namely Bangladesh, Cambodia, Myanmar, Pakistan, and the Philippines, out of households rearing poultry, 93.4% of households in Pakistan, 81.7% in Bangladesh, 68.6% in Myanmar, 67.5% in the Philippines, and 63.3% in Cambodia had ten or fewer units of poultry in their households. On the contrary, the proportion of households with more than 50 units of poultry was 0.2% in Pakistan and Bangladesh, 3.0% in Myanmar, 3.6% in the Philippines, and 9.0% in Cambodia. In Nepal, 63.3% of households owning goats had a maximum of five goats, and 3.1% kept more than twenty goats. In East Timor, 90.7% of households with pigs had five or fewer pigs, and 0.4% kept more than twenty pigs. This suggests that most homes in developing Asian countries have limited livestock.

3.2. Estimation Results

Table 4 presents the results of the logistic regression estimation. The odds ratios for many explanatory variables were significant in all countries, indicating good estimation results. While the odds ratios for male heads of households were significantly higher than those for female leaders in Cambodia, India, Myanmar, and the Philippines, they were considerably lower than those for female heads in Bangladesh and Nepal. The odds ratio for the head of household in their 30s was significant in five out of the eight countries and

for those in their 40s and above in seven countries. The simple average of the odds ratios of eight countries for the head of the household was 1.43 for 30s, 1.96 for 40s, 2.12 for 50s, and 2.17 for 60s and above, indicating that the probability of rearing livestock increases with the age of the head of the household. Almost all the deciles had positive and significant odds ratios for household economic status. In addition, the odds ratios for household economic status decreased with higher economic rates in almost all countries. This finding indicates that households with higher levels of economic deprivation are more likely to retain livestock, suggesting a negative correlation between economic status and livestock ownership. The number of household members and farmland ownership in all countries had significant odds ratios above one. The odds ratio for the capital city was significantly lower than those for non-capital cities in the other seven countries. By contrast, the odds ratio for the time required to reach the nearest city center was significantly greater than in Bangladesh, India, Nepal, Pakistan, and the Philippines. The odds ratios of households living in areas with high annual precipitation were considerably lower than in Bangladesh and Pakistan and significantly higher than in Cambodia and Nepal. In India, the odds ratios ranged from substantially more than one to less than one. Myanmar, the Philippines, and East Timor did not show significant odds ratios.

Table 4. Estimation results by logistic regression.

	Bangladesh			**Cambodia**			**India**			**Myanmar**		
	AOR [1]	**t Value** [2]		**AOR**	**t Value**		**AOR**	**t Value**		**AOR**	**t Value**	
Sex of household's head												
Woman	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Man	0.76	−2.32	*	1.52	5.07	**	1.24	6.33	**	1.89	3.74	**
Age of household's head												
10s or 20s	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
30s	1.31	1.98	*	1.50	2.31	*	1.12	1.87		1.73	1.97	*
40s	1.71	3.57	**	1.46	2.38	*	1.36	5.13	**	2.41	3.04	**
50s	2.04	4.38	**	1.84	3.76	**	1.62	7.67	**	1.85	2.05	*
60s and above	2.24	5.46	**	1.30	1.58		1.53	6.76	**	2.16	2.54	*
Economic conditions												
1st quintile (poorest)	42.98	13.68	**	19.18	9.39	**	24.43	36.07	**	22.96	8.33	**
2nd quintile	19.60	11.59	**	17.19	9.65	**	12.08	28.93	**	13.77	6.79	**
3rd quintile	13.93	9.94	**	14.08	9.13	**	8.92	25.70	**	10.17	5.53	**
4th quintile	7.19	7.59	**	16.50	9.42	**	6.85	22.24	**	5.77	4.49	**
5th quintile	5.49	6.66	**	9.77	8.12	**	5.73	20.07	**	6.00	5.17	**
6th quintile	5.43	6.99	**	8.48	6.61	**	4.24	16.28	**	2.65	2.29	*
7th quintile	4.25	6.30	**	6.80	6.09	**	3.23	13.07	**	4.14	3.49	**
8th quintile	2.56	3.90	**	6.32	6.19	**	2.53	10.16	**	0.92	−0.17	
9th quintile	1.57	1.84		3.92	4.58	**	1.56	4.90	**	1.00	0.00	
10th quintile (richest)	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Number of family members (persons)	1.32	11.86	**	1.23	10.08	**	1.23	34.29	**	1.21	6.08	**
Land possession												
Yes	2.69	11.29	**	3.40	13.98	**	4.20	44.22	**	5.45	8.55	**
No	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Living in capital [3]												
Yes	0.43	−4.86	**	0.32	−5.15	**	0.14	−12.98	**	0.91	−0.33	
No	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Travel times (minutes)	1.05	3.35	**	1.00	0.62		1.01	8.26	**	1.00	0.39	
Annual rainfall (mm)												
Below 1000							1.00	Ref.		1.00	Ref.	
1000–1999	1.00	Ref.		1.00	Ref.		0.79	−5.58	**	1.51	1.15	
2000–2999	0.59	−3.43	**	1.53	1.63		1.36	3.80	**	0.63	−1.58	
3000–3999	0.34	−4.92	**	0.31	−3.83	**	1.14	1.23		0.55	−1.26	
4000–	0.21	−5.50	**				0.28	−6.74	**	0.88	−0.39	
Constant	0.02	−13.20	**	0.01	−14.41	**	0.00	−50.87	**	0.00	−12.44	**

Table 4. *Cont.*

	Nepal			Pakistan			Philippines			East Timor		
	AOR	**t Value**		**AOR**	**t Value**		**AOR**	**t Value**		**AOR**	**t Value**	
Sex of household's head												
Woman	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Man	0.83	−2.48	*	1.24	0.80		1.80	5.84	**	1.20	1.08	
Age of household's head												
10s or 20s	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
30s	1.67	4.36	**	0.98	−0.05		1.30	1.64		1.79	3.52	**
40s	2.83	8.91	**	1.51	1.80		1.88	3.80	**	2.51	5.28	**
50s	3.27	8.68	**	1.57	1.72		2.13	4.77	**	2.65	4.11	**
60s and above	2.70	7.38	**	2.05	2.77	**	2.00	4.16	**	3.34	5.82	**
Economic conditions												
1st quintile (poorest)	27.91	9.78	**	11.62	6.54	**	3.52	6.80	**	1.72	2.74	**
2nd quintile	29.66	12.20	**	5.74	4.53	**	3.28	7.39	**	1.41	1.69	
3rd quintile	27.54	11.69	**	5.11	4.47	**	2.37	4.64	**	1.80	2.48	*
4th quintile	23.87	12.46	**	2.39	2.26	*	1.84	3.22	**	1.84	2.76	**
5th quintile	15.42	10.26	**	2.41	2.23	*	1.42	1.68		2.60	4.35	**
6th quintile	10.18	9.02	**	2.01	1.75		1.53	2.29	*	1.71	2.40	*
7th quintile	8.79	8.71	**	1.71	1.39		1.59	2.12	*	1.37	1.61	
8th quintile	4.63	6.66	**	0.97	−0.06		1.45	1.78		1.60	2.11	*
9th quintile	3.48	5.36	**	1.62	1.47		1.26	1.16		1.44	1.88	
10th quintile (richest)	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Number of family members (persons)	1.39	11.59	**	1.11	5.61	**	1.13	8.14	**	1.13	5.38	**
Land possession												
Yes	2.86	11.62	**	3.66	5.83	**	3.92	13.20	**	4.35	9.63	**
No	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Living in capital												
Yes	0.58	−2.24	*	0.69	−2.47	*	0.10	−9.63	**	0.53	−2.02	*
No	1.00	Ref.		1.00	Ref.		1.00	Ref.		1.00	Ref.	
Travel times (minutes)	1.01	3.78	**	1.01	2.22	*	1.01	4.53	**	1.00	1.19	
Annual rainfall (mm)												
Below 1000							1.00	Ref.				
1000–1999	1.00	Ref.		1.00	Ref.		1.76	0.63		1.00	Ref.	
2000–2999	25.36	3.87	**	1.74	1.52		1.45	0.42		0.88	−0.45	
3000–3999	41.78	4.24	**	0.46	−6.04	**	1.28	0.28		1.06	0.19	
4000–	18.95	2.99	**				2.07	0.81				
Constant	0.00	−8.44	**	0.01	−10.53	**	0.01	−4.56	**	0.21	−4.17	**

[1] AOR means adjusted odds ratio. [2] ** and * denote significance at one and five percent, respectively. [3] For Myanmar, 1 is defined as living in Yangon, the former capital city with a large population, and 0 as living in any other city.

Figure 1 shows the relationship between household economic status and the predicted probability of livestock rearing. A lower economic rate was consistently associated with a higher likelihood of livestock ownership across all eight countries. In East Timor, Nepal, and Cambodia, which had the lowest GDP per capita among the eight countries, the predicted probability remained relatively high from the first to the fourth quintile. This suggests that many middle- and lower-middle-class households in these countries maintain their livestock. In contrast, in Bangladesh, India, Myanmar, Pakistan, and the Philippines, the percentage of households with livestock consistently declined from the poorest to the middle-fourth quintile.

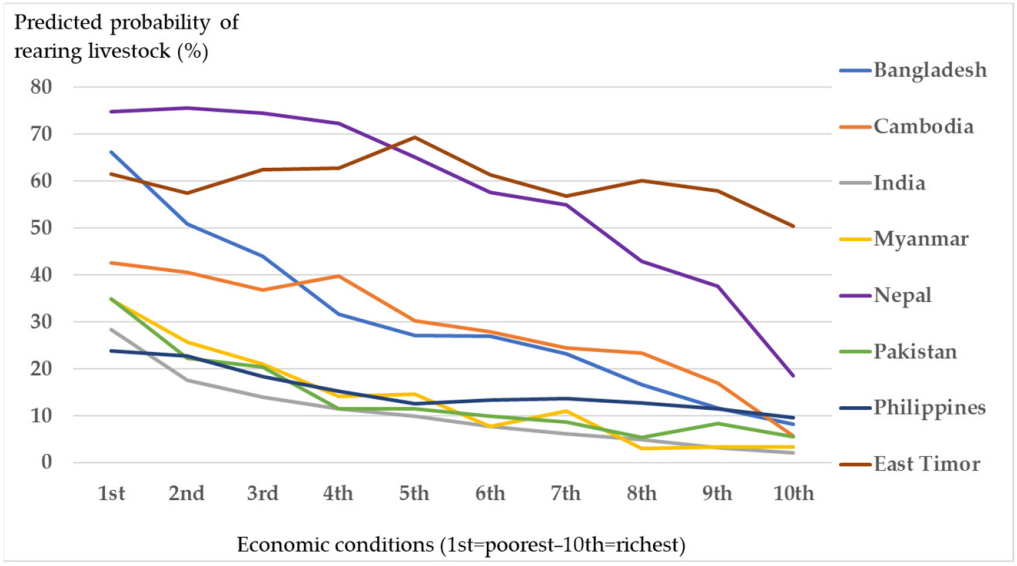

Figure 1. Predicted probability of raising livestock by economic conditions.

4. Discussion

4.1. Characteristics of Households Rearing Livestock

In half of the countries studied, male-headed households had greater livestock ownership. This may be because men are often responsible for slaughtering livestock. However, in two countries, female-headed families were more likely to own livestock. In two other countries, there was no significant relationship between livestock rearing and the sex of the household's head. Previous studies on the relationship between the sex of the household's head and UPA have mixed results. Maxwell [23] and Yamashita and Ishida [43] found that the sex of the household's head was not associated with UPA implementation in Kampala, Uganda, and the urban slums of Bangladesh, respectively. Although Mwakiwa [44] noted that female-headed households practiced UPA to cope with their vulnerability to food insecurity, Mwakiwa et al. [45] found that male-headed families were likelier to continue community gardening in Zimbabwe. In some Asian countries, older people may be the head of the household, even if only formally. Therefore, it is impossible to draw definitive conclusions about the effect of the sex of the household's head on UPLF implementation based solely on this analysis. Women often manage small livestock, such as poultry, in Africa and Asia. Therefore, it is necessary to consider whether UPLF should be chosen as a survival strategy based on the employment status of men in the family, as well as the employment status of women and their burden of housework and childcare, rather than the sex of the household's head.

The older the household's head, the higher the percentage of households with livestock. Given the suggestion that the likelihood of UPA in densely populated urban areas is higher with more extended residence [23,43], it can be noted that the older the age of the household's head and the longer the duration of their residence, the more likely the household has been using the available space and land for some time. In addition, given a previous study [43] stating that families with more social capital are more likely to implement UPA, it is possible that households with older heads have lived in the area longer, formed better human networks in the residential area, and are more likely to implement UPLF while avoiding conflicts with neighbors.

In each country studied, the larger the number of household members, the more UPLF was implemented, consistent with previous studies [23,43,45,46] showing that households with more family labor or members are likely to practice UPA or continue community gardening. There are two possible reasons for this. First, the larger the number of household members, the easier it is to manage livestock. Second, the larger the number of household

members, the more food is needed, which may be a reason to keep livestock to reduce food costs.

In the two countries, farmland households were more likely to have livestock. In capital cities, which are generally more densely populated and where land is used for administrative, commercial, and residential purposes, the proportion of households with livestock was significantly lower in the seven countries studied. In five countries, the proportion of households owning livestock was substantially lower as the time required to reach the urban center decreased. These estimated results are consistent with those of previous studies that have noted the difficulty of obtaining available land as an obstacle to implementing UPA and UPLF [23,47,48] and their scale expansion [49]. It is important to note here that households with farmland are more likely to have livestock and circulate organic resources. It has been reported that combining gardening, crop cultivation, and livestock with regular low-cost livestock manure collection and composting of manure as an organic fertilizer for crop cultivation would recycle substantial nutrients to farmland and vegetable gardens while reducing environmental pollution [50]. However, livestock manure is often discarded, contributing to the deterioration of the sanitary environment [51] and the spread of zoonotic diseases [52,53]. Therefore, as Roessler et al. [54] noted, linkages between households rearing livestock and those growing crops and livestock manure markets must be promoted to enable resource recycling and limit the negative externalities from livestock specialization.

In Bangladesh, Cambodia, India, and Pakistan, the proportion of households with livestock is significantly lower in urban and peri-urban areas with extreme annual precipitation. Although studies have yet to discuss the relationship between livestock ownership and rainfall in urban and peri-urban areas, floods and inundations resulting from heavy rain make it difficult for urban people to raise livestock.

Although no significant relationship has been found between household income or socioeconomic status and UPA implementation in West Africa and Uganda [23,46], our estimation results clearly show that households in poorer economic conditions are more likely to keep livestock in the urban and peri-urban areas of Asian developing countries. In the rural areas of developing countries, where there are few earning opportunities other than through agriculture, although the shock-reducing effects of owning livestock are not reported to be very large [55], livestock are often kept as movable assets or as insurance against economic risk, specifically for middle- and upper-income households. However, numerous employment opportunities are available in the urban and peri-urban areas. Typically, individuals with higher levels of education work regular jobs that offer higher incomes. Nonfarm sedentary jobs in the formal sector have smaller fluctuations in income than physical jobs in the informal sector and urban agriculture. Moreover, there is less need to mitigate economic risks, such as reduced income, due to the vulnerability of employment status and climate change. In contrast, individuals in the lower economic strata of urban areas, typically less educated, are likelier to engage in unstable jobs in the informal sector or experience unemployment. This situation occurs mainly in cases where public social security measures are well implemented due to severe government budget constraints. Consequently, livestock rearing is a survival strategy for impoverished households to mitigate the adverse effects of food insecurity, reduce food expenditure, and generate a modest income by selling products. From a humanitarian standpoint and the perspective of social stability, UPLF is a sound survival strategy compared to alternative approaches adopted by poor urban households, which might involve engaging in illegal and immoral activities, such as theft and prostitution [56].

While it is acknowledged that UPLF is used as a survival strategy specifically for low-income urban households to improve food and nutritional security, it should be noted [51] that families of lower socioeconomic status in Cambodia are more prone to discarding pig manure due to the lack of farmland and waste hauling carts. As mentioned above, the disposal of livestock manure is a common practice, contributing to the deterioration of the sanitary environment [51] and the spread of zoonotic diseases [52,53]. Furthermore,

low-quality fodder for livestock [57,58], the use of manure as fertilizer without proper treatment [59], and livestock diseases have also been reported as significant constraints on breeding [60], suggesting that agricultural extension services should be provided to households engaged in UPLF. Additionally, because low-income families sometimes engage in UPA or UPLF in vacant spaces or land without legal entitlement to use it, it is essential to develop a social system that enables low-income households to engage in UPLF continuously.

4.2. Limitations and Further Research

This study had certain limitations that must be addressed. First, this quantitative analysis used cross-sectional data and did not establish causal relationships through statistical analysis. Therefore, analyzing the causal relationships more precisely using panel data is necessary. Second, when comparing the estimation results of different countries, it is essential to note that the definitions of urban and peri-urban areas are yet to be standardized across countries. Therefore, the results of this study should be interpreted with caution. Third, in many Asian countries, urban areas often expand outward with economic growth. However, this study does not consider intra-urban disparities between areas inhabited mainly by low-income groups, such as slums, and those not inhabited by low-income groups. Therefore, conducting analyses incorporating spatial perspectives using geographic information is necessary. Fourth, due to the limited available variables of DHS, we could not analyze the characteristics of households that adopted UPLF using an economic framework in this paper. As mentioned in the Introduction section, to our knowledge, studies have yet to be conducted on UPLF using an economic framework. Therefore, further analysis is required using data from extensive sample surveys other than the DHS. This analysis should include data on risk aversion and risk dispersion, resource allocation of household labor, and time preference, considering the time lag between starting livestock rearing and receiving products. Finally, to assess the impact of livestock rearing on the nutritional status of poor households in urban and peri-urban areas, it is crucial to examine both the positive effects of livestock rearing on nutritional intake and its negative impact on the living environment, owing to the spread of zoonotic diseases and livestock manure.

5. Conclusions

This study analyzed data from the Demographic and Health Survey to identify households that engage in livestock farming in urban and peri-urban areas of eight developing Asian countries. Livestock rearing rates were highest in East Timor and Nepal (59.9% and 57.1%, respectively), followed by Bangladesh and Cambodia (31.0% and 30.0%, respectively). The Philippines, Pakistan, Myanmar, and India had lower rates of livestock rearing but were still above 10% (15.6%, 13.6%, 13.5%, and 10.4%, respectively). Most households practice small-scale livestock rearing by maintaining a limited number of poultry, goats, or swine for consumption or to earn supplementary income. This study also revealed that the lower the household's economic status, the higher the probability of livestock rearing. These findings suggest that small-scale livestock rearing is feasible for improving food and nutritional security by consuming eggs, milk, and meat or earning cash from their sale. This is particularly beneficial for lower-level households with limited access to animal proteins. Hence, the government should promote urban development, considering that livestock farming has become a survival strategy for people experiencing poverty in metropolitan areas of developing countries. To this end, a program that provides free chicks and free vaccinations to poor households may effectively improve the nutritional status of low-income families without a heavy financial burden on the government. In addition, although agricultural technology extension services are generally provided to rural farmers, giving technology extension services to households with livestock in urban and peri-urban areas should be strengthened.

Author Contributions: Conceptualization, S.U., R.I., E.R.A. and A.I.; methodology, S.U., R.I. and A.I.; analysis, S.U. and A.I.; writing—original draft preparation, S.U.; writing—review and editing, E.R.A. and A.W.U. and A.I. All authors have read and agreed to the published version of the manuscript.

Funding: This study received no external funding.

Institutional Review Board Statement: Ethical review and approval were not required for this study because we used publicly available secondary data from the Demographic and Health Survey Program.

Informed Consent Statement: Not applicable.

Data Availability Statement: Raw data are available to the public upon request from the Demographic and Health Survey Program homepage at https://dhsprogram.com (accessed on 1 October 2023).

Acknowledgments: The authors thank the Demographic and Health Survey Program for providing raw data from surveys conducted in Bangladesh, Cambodia, East Timor, India, Myanmar, Nepal, Pakistan, and the Philippines.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Erwin, D. *Urban and Peri-Urban Agriculture Case Studies—Overview, Conclusions and Recommendations. An Annex to Urban and Peri-Urban Agriculture—From Production to Food Systems*; FAO: Rome, Italy; Rikolto: Leuven, Belgium, 2022.
2. United Nations, Department of Economic and Social Affairs, Population Division. *World Urbanization Prospects: The 2018 Revision*; United Nations: New York, NY, USA, 2019.
3. United Nations. *The Sustainable Development Goals Report 2023: Special Edition*; United Nations: New York, NY, USA, 2023.
4. Szabo, S. Urbanisation and Food Insecurity Risks: Assessing the Role of Human Development. *Oxf. Dev. Stud.* **2016**, *44*, 28–48. [CrossRef]
5. Chatterjee, N.; Fernandes, G.; Hernandez, M. Food insecurity in urban poor households in Mumbai, India. *Food Secur.* **2012**, *4*, 619–632. [CrossRef]
6. Agarwal, S.; Sethi, V.; Gupta, P.; Jha, M.; Agnihotri, A.; Nord, M. Experiential household food insecurity in an urban underserved slum of North India. *Food Secur.* **2009**, *1*, 239–250. [CrossRef]
7. Joshi, A.; Arora, A.; Amadi-Mgbenka, C.; Mittal, N.; Sharma, S.; Malhotra, B.; Grover, A.; Misra, A.; Loomba, M. Burden of household food insecurity in urban slum settings. *PLoS ONE* **2019**, *14*, e0214461. [CrossRef] [PubMed]
8. Piaseu, N.; Mitchell, P. Household food insecurity among urban poor in Thailand. *J. Nurs. Scholarsh.* **2004**, *36*, 115–121. [CrossRef] [PubMed]
9. Kimani-Murage, E.W.; Schofield, L.; Wekesah, F.; Mohamed, S.; Mberu, B.; Ettarh, R.; Egondi, T.; Kyobutungi, C.; Ezeh, A. Vulnerability to Food Insecurity in Urban Slums: Experiences from Nairobi, Kenya. *J. Urban Health* **2014**, *91*, 1098–1113. [CrossRef] [PubMed]
10. Mohamed, S.F.; Mberu, B.U.; Amendah, D.D.; Kimani-Murage, E.W.; Ettarh, R.; Schofield, L.; Egondi, T.; Wekesah, F.; Kyobutungi, C. Poverty and uneven food security in urban slums. In *Rapid Urbanisation, Urban Food Deserts and Food Security in Africa*; Crush, J., Battersby, J., Eds.; Springer: Cham, Switzerland, 2016.
11. Mohiddin, L.; Phelps, L.; Walters, T. Urban Malnutrition: A Review of Food Security and Nutrition among the Urban Poor; International Public Nutrition Resource Group. 2012. Available online: https://www.urban-response.org/system/files/content/resource/files/main/nw-urban-malnutrition-jun-13-website.pdf (accessed on 15 November 2023).
12. Pottier, J. Coping with urban food insecurity: Findings from Kampala, Uganda. *J. Mod. Afr. Stud.* **2015**, *53*, 217–241. [CrossRef]
13. Tawodzera, G. Vulnerability in crisis: Urban household food insecurity in Epworth, Harare, Zimbabwe. *Food Secur.* **2011**, *3*, 503–520. [CrossRef]
14. Crush, J.S.; Frayne, G.B. Urban food insecurity and the new international food security agenda. *Dev. South. Afr.* **2011**, *28*, 527–544. [CrossRef]
15. FAO; Rikolto; RUAF. *Urban and Peri-Urban Agriculture Sourcebook—From Production to Food Systems*; FAO: Rome, Italy; Rikolto: Leuven, Belgium, 2022.
16. Graefe, S.; Buerkert, A.; Schlecht, E. Trends and gaps in scholarly literature on urban and peri-urban agriculture. *Nutr. Cycl. Agroecosyst.* **2019**, *115*, 143–158. [CrossRef]
17. Khumalo, N.Z.; Sibanda, M. Does urban and peri-urban agriculture contribute to household food security? An assessment of the food security status of households in Tongaat, eThekwini municipality. *Sustainability* **2019**, *11*, 1082. [CrossRef]
18. Gallaher, C.M.; Kerr, J.M.; Njenga, M.; Karanja, N.K.; WinklerPrin, A.M.G.A. Urban agriculture, social capital, and food security in the Kibera Slums of Nairobi, Kenya. *Agric. Hum. Values* **2013**, *30*, 389–404. [CrossRef]
19. Lynch, K.; Maconachie, R.; Binns, T.; Tengbe, P.; Bangura, K. Meeting the urban challenge? Urban agriculture and food security in post-conflict Freetown, Sierra Leone. *Appl. Geogr.* **2013**, *36*, 31–39. [CrossRef]
20. Smart, J.; Nel, E.; Binns, T. Economic crisis and food security in Africa: Exploring the significance of urban agriculture in Zambia's Copperbelt province. *Geoforum* **2015**, *65*, 37–45. [CrossRef]

21. Zezza, A.; Tasciotti, L. Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries. *Food Pol.* **2010**, *35*, 265–273. [CrossRef]
22. Jongwe, A. Synergies between urban agriculture and urban household food security in Gweru City, Zimbabwe. *J. Dev. Agric. Econ.* **2014**, *6*, 59–66. [CrossRef]
23. Maxwell, D.G. Alternative food security strategy: A household analysis of urban agriculture in Kampala. *World Dev.* **1995**, *23*, 1669–1681. [CrossRef]
24. Graefe, S.; Schlecht, E.; Buerkert, A. Opportunities and challenges of urban and peri-urban agriculture in Niamey, Niger. *Outlook Agric.* **2008**, *37*, 47–56. [CrossRef]
25. Uko, E.; Binns, T.; Nel, E. 'I lost my job suddenly, but I was prepared': The significance of urban and peri-urban agriculture in Benin City, Nigeria. *Agroecol. Sustain. Food Syst.* **2023**, *47*, 25–46. [CrossRef]
26. Gororo, E.; Kashangura, M.T. Broiler production in an urban and peri-urban area of Zimbabwe. *Dev. South. Afr.* **2016**, *33*, 99–112. [CrossRef]
27. Masvaure, S. Coping with food poverty in cities: The case of urban agriculture in Glen Norah Township in Harare. *Renew. Agric. Food Syst.* **2015**, *31*, 202–213. [CrossRef]
28. Simiyu, R.; Foeken, D.W.J. Urban crop production and poverty alleviation in Eldoret, Kenya: Implications for policy and gender planning. *Urban Stud.* **2014**, *51*, 2613–2628. [CrossRef]
29. Kanosvamhira, T.P.; Tevera, D. Urban agriculture as a source of social capital in the Cape Flats of Cape Town. *Afr. Geogr. Rev.* **2020**, *39*, 175–187. [CrossRef]
30. Olivier, D.W.; Heinecken, L. The personal and social benefits of urban agriculture experienced by cultivators on the Cape Flats. *Dev. South. Afr.* **2017**, *34*, 168–181. [CrossRef]
31. Sagar, U.S.; Singh, Y.; Mahalingam, A.; Malladi, T. Future impacts of Urban and Peri-urban agriculture on carbon stock and land surface temperatures in India. *Urban Clim.* **2022**, *45*, 101267. [CrossRef]
32. Schönfeldt, H.C.; Hall, N.G. Dietary protein quality and malnutrition in Africa. *Br. J. Nutr.* **2012**, *108*, S69–S76. [CrossRef] [PubMed]
33. The DHS Program: Available Datasets. Available online: https://dhsprogram.com/data/available-datasets.cfm (accessed on 1 October 2023).
34. National Institute of Population Research and Training (NIPORT); ICF. *Bangladesh Demographic and Health Survey 2017–18*; NIPORT: Dhaka, Bangladesh; ICF: Rockville, MD, USA, 2020.
35. National Institute of Statistics (NIS); Ministry of Health (MoH); ICF. *Cambodia Demographic and Health Survey 2021–22 Final Report*; NIS: Phnom Penh, Cambodia; MoH: Phnom Penh, Cambodia; ICF: Rockville, MD, USA, 2023.
36. Ministry of Health and Sports (MoHS); ICF. *Myanmar Demographic and Health Survey 2015–16*; Ministry of Health and Sports: Nay Pyi Taw, Myanmar; ICF: Rockville, MD, USA, 2017.
37. Ministry of Health and Population; New ERA; ICF. *Nepal Demographic and Health Survey 2022*; Ministry of Health and Population: Kathmandu, Nepal, 2023.
38. Philippine Statistics Authority (PSA); ICF. *2022 Philippine National Demographic and Health Survey (NDHS): Final Report*; PSA: Quezon City, Philippines; ICF: Rockville, MD, USA, 2023.
39. National Institute of Population Studies (NIPS); ICF. *Pakistan Demographic and Health Survey 2017–18*; NIPS: Islamabad, Pakistan; ICF: Rockville, MD, USA, 2019.
40. General Directorate of Statistics; Ministry of Health; ICF. *Timor-Leste Demographic and Health Survey 2016*; GDS: Dili, Thimor-Leste; ICF: Rockville, MD, USA, 2018.
41. International Institute for Population Sciences (IIPS); ICF. *National Family Health Survey (NFHS-5), 2019–21: India: Volume 1*; IIPS: Mumbai, India, 2021.
42. The DHS Program: Wealth Index Construction. Available online: https://dhsprogram.com/topics/wealth-index/Wealth-Index-Construction.cfm (accessed on 1 October 2023).
43. Yamashita, H.; Ishida, A. Who engages in urban and peri-urban agriculture in the condensed urban slums of Bangladesh? *J. Dev. Agric. Econ.* **2017**, *9*, 373–380. [CrossRef]
44. Mwakiwa, E. Evaluation of the Socio-Economic Determinants and Benefits of Urban Agriculture: The Case of Kadoma, Zimbabwe. Ph.D. Thesis, University of Zimbabwe, Harare, Zimbabwe, 2004.
45. Mwakiwa, E.; Maparara, T.; Tatsvarei, S.; Muzamhindo, N. Is community management of resources by urban households feasible? Lessons from community gardens in Gweru, Zimbabwe. *Urban For. Urban Green.* **2018**, *34*, 97–104. [CrossRef]
46. Dossa, L.H.; Buerkert, A.; Schlecht, E. Cross-location analysis of the impact of household socioeconomic status on participation in urban and peri-urban agriculture in West Africa. *Hum. Ecol.* **2011**, *39*, 569–581. [CrossRef]
47. Ayambire, R.A.; Amponsah, O.; Peprah, C.; Takyi, S.A. A review of sustainable urban and peri-urban agriculture practices: Implications for land use planning in rapidly urbanizing Ghanaian cities. *Land Use Policy* **2019**, *84*, 260–277. [CrossRef]
48. De Oliveira, L.C.P.; Raufflet, E.; Aquino Alves, M. Public action and policy implementation: A comparative analysis of Urban Agriculture in three regions of São Paulo. *Local Environ.* **2021**, *26*, 719–735. [CrossRef]
49. Abdoellah, O.S.; Suparman, Y.; Safitri, K.I.; Mubarak, A.Z.; Milani, M.; Surya, L. Between food fulfillment and income: Can urban agriculture contribute to both? *Geogr. Sustain.* **2023**, *4*, 127–137. [CrossRef]

50. Diogo, R.V.; Schlecht, E.; Buerkert, A.; Rufino, M.C.; van Wijk, M.T. Increasing nutrient use efficiency through improved feeding and manure management in urban and peri-urban livestock units of a West African city: A scenario analysis. *Agric. Syst.* **2013**, *114*, 64–72. [CrossRef]
51. Ström, G.; Albihn, A.; Jinnerot, T.; Boqvist, S.; Andersson-Djurfeldt, A.; Sokerya, S.; Osbjer, K.; San, S.; Davun, H.; Magnusson, U. Manure management and public health: Sanitary and socio-economic aspects among urban livestock-keepers in Cambodia. *Sci. Total Environ.* **2018**, *621*, 193–200. [CrossRef] [PubMed]
52. De Glanville, W.A.; Allan, K.J.; Nyarobi, J.M.; Thomas, K.M.; Lankester, F.; Kibona, T.J.; Claxton, J.R.; Brennan, B.; Carter, R.W.; Crump, J.A.; et al. An outbreak of Rift Valley fever in peri-urban dairy cattle in northern Tanzania. *Trans. R. Soc. Trop. Med. Hyg.* **2022**, *116*, 1082–1090. [CrossRef] [PubMed]
53. Lupindu, A.M.; Dalsgaard, A.; Msoffe, P.L.; Ngowi, H.A.; Mtambo, M.M.; Olsen, J.E. Transmission of antibiotic-resistant Escherichia coli between cattle, humans and the environment in peri-urban livestock keeping communities in Morogoro, Tanzania. *Prev. Vet. Med.* **2015**, *118*, 477–482. [CrossRef] [PubMed]
54. Roessler, R.; Mpouam, S.E.; Muchemwa, T.; Schlecht, E. Emerging development pathways of urban livestock production in rapidly growing West Africa cities. *Sustainability* **2016**, *8*, 1199. [CrossRef]
55. Fafchamps, M.; Udry, C.; Czukas, K. Drought and saving in West Africa: Are livestock a buffer stock? *J. Dev. Econ.* **1998**, *55*, 273–305. [CrossRef]
56. Ofori-Boateng, K.; Adams, S.; Ohemeng, W. Coping strategies of the urban poor: A case study from Ghana. *Poverty Public Policy* **2020**, *12*, 236–254. [CrossRef]
57. Lumu, R.; Katongole, C.B.; Nambi-Kasozi, J.; Bareeba, F.; Presto, M.; Ivarsson, E.; Lindberg, J.E. Indigenous knowledge on the nutritional quality of urban and peri-urban livestock feed resources in Kampala, Uganda. *Trop. Anim. Health Prod.* **2013**, *45*, 1571–1578. [CrossRef]
58. Schlecht, E.; Plagemann, J.; Mpouam, S.E.; Sanon, H.O.; Sangaré, M.; Roessler, R. Input and output of nutrients and energy in urban and peri-urban livestock holdings of Ouagadougou, Burkina Faso. *Nutr. Cycl. Agroecosyst.* **2019**, *115*, 201–230. [CrossRef]
59. Asadu, A.N.; Chah, J.M.; Attamah, C.O.; Igbokwe, E.M. Knowledge of hazards associated with urban livestock farming in southeast Nigeria. *Front. Vet. Sci.* **2021**, *8*, 600299. [CrossRef]
60. Kagira, J.M.; Kanyari, P.W.N. Questionnaire survey on urban and peri-urban livestock farming practices and disease control in Kisumu municipality, Kenya. *J. S. Afr. Vet. Assoc.* **2010**, *81*, 82–86. [CrossRef]