Research Article

Emerging Supply Chain of Pork and the Opportunities for Small-Scale Raisers in Catbalogan City in the Philippines

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Abstract | The emerging supply chain of pork and its effects on small-scale raisers in Catbalogan City was examined using mixed methods. Supply and consumption were forecasted using Autoregressive Integrated Moving Average (ARIMA) models. Pork prices increased by 22-50% in 2021 compared to 2010 data. Live-weight pig prices also increased by 9-39% for the same year in review. It was noted that 27% of the supply was locally produced, and 73% were imported from other regions. Locally sourced pig supply is pegged at 53%, and the rest (47%) are imported from various towns in Samar and other regions. The demand for pork and live pigs is 27% and 55% higher than the supply. The said gap can be filled in by local farmers/raisers with an overall market opportunity of 70,996 kilograms monthly.

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Introduction

Agriculturally-dependent provinces in Asia are among the poorest in the world. This is because the potential of the industry is not maximized. Many countries import agricultural products, including pork are sourced elsewhere and not produced locally. In the same way, the Philippines imports agricultural products like vegetables and livestock products, other products were imported from other provinces.

The overall swine inventory in the Philippines was expected to be 9.49 million heads. Backyard swine inventories fell by 7.0 percent, while commercial swine inventories rose by 1.9 percent. 70.6 percent of the total pig population was raised on private farms, with the remaining 29.4 percent coming from commercial farms. Western Visayas reported the highest total swine population of 1.15 million heads, followed by Central Visayas with 1.14 million heads and CALABARZON with 1.02 million heads. These three regions accounted for 34.9 percent of the total swine inventory in the country (PSA, 2021)

Catbalogan is the provincial capital of Samar in the Philippines, with 57 barangays. Its population reached 106,440 in 2020, of which 85-90% are pork eaters (PSA, 2020).

Pig farming in the backyard is extremely limited. In basic housing, many backyard families rear only one or two hogs. The feed comes mostly from crop res-

idue, kitchen leftovers, and forage. For their hybrid pigs, some raisers used commercial concentrate feed (Pan and Kinsey, 2002). The study of Bollido *et al.* (2021) stated that the sustainability of such alternative livelihood options, the establishment of a source of feedstock for swine raising is a critical requirement in swine production and breeding.

Despite the presence of large-scale hog farms in some sections of the country, backyard hog farming still accounts for 83 percent of the overall hog population in rural areas. Backyard hog farming and other smallholder hog farmers thrive primarily to supplement their income and feed their families (Armenia *et al.*, 2016).

When the market quotation is good, pig raisers can earn a profit from pig cultivation, and when the pig price is reduced, the quotation is negative; these behaviors amplify the price fluctuation (Kai, 2009).

The high prices of pork supplies in the Philippines can be addressed by rethinking food choices and alternatives, especially during the pandemic. Due to African Swine Fever-related causes, the hog population was dramatically reduced in 2020, resulting in a pork prohibition and market price spike, although for some organizations, the difficulty is distribution rather than a shortage (Endiape *et al.*, 2021).

The potential of local pork production

Pigs are economically significant due to their contribution to human nourishment and function in agricultural production systems (Huong *et al.*, 2009). Consumers are becoming more worried about their own health and the environment. When it comes to buying meat, price and quality are still the most important factors to consider. Still, consumers have added new demands to this list in recent years (Labrecque *et al.*, 2015).

The vast majority of individuals stated they eat pork at least three times each week, with only a few saying they never do (Grannis and Thilmany, 2001). Up to the point of sale to the final consumer, there was a lot of price haggling. Payment was made on a consignment basis in many transactions between chain actors, particularly at the level of dealers and processors (Manipol *et al.*, 2014).

Structure of marketing channels

Rodríguez *et al.* (2014) stated that wholesalers and retailers, including butchers are part of the marketing stage, and the direct contacts of the consumers. They are also aware the demands of the customers and their tasks is to produce a superior product based on the buyers' preferences. Maples *et al.* (2019) showed that from the time the piglet is born until the flesh is sold as pork, hogs are frequently held by a single organization.

All small backyard swine operations are sole proprietorships in business and sell the majority of their goods locally. In their swine production activities, they all rely on family labor (Aspile *et al.*, 2016). To ensure uniform distribution, the farm must implement control mechanisms. One alternative is to utilize scales in the pre-slaughter process to ensure a well-distributed truck loading process. Another key aspect that contributes to increased mortality and carcass damage is driver conduct while traveling (Reis *et al.*, 2015).

The efficiency of marketing channels

Consumer and market orientation have been cited as essential variables in the meat industry's successful future development. The major variables and attributes of a supply chain can be set to link the different stages in order to deliver the final pork products to consumers (Perez *et al.*, 2009). Reckmann and Krieter (2015) reported that a whole-farm model forecasted all significant farm flows that could affect pig production's long-term viability. It should include interactions and dependencies between different farm components.

This study was conducted to understand the market and discover opportunities for local hog raisers. It specifically aimed at analyzing the supply chains' price transmission and comparing the impact of marketing institutions on the economics of primary production. It also determined how the growing demand for pork, considered a specialty product among consumers, affects newly emerging supply chains of small-scale farmers in the areas. A dynamic system model was also developed as a tool for pig raisers/growers in visualizing and forecasting the movement of the entire production chain.

Materials and Methods

Data collection

This research study dealt with both qualitative and quantitative approaches, a purposive data gathering through online and face-to-face interviews of pork

whole sealers and retailers as respondents. The target interviewee was ten meat shop owners and 28 individual pork sellers. Respondents in the supply chain were chosen randomly from a list of pork sellers based on the Department of Agriculture and the Philippine Statistics Authority list.

Respondents of the study were pig buyers, butchers, pork retailers and wholesalers, meat shop owners, and pork consumers. The research hasn't included gathering data on processed pork, spoiled pork, and the cost of production of pigs. The study used operation research in modeling rather than using statistical analysis. The 2010-2022 data about pork consumption come from 28 villages selling live-weight pigs and ten meat shops. Follow-up interviews were also conducted to supplement the survey data gathered.

Modeling using ARIMA

Formulation of data using ARIMA modeling was used to analyze for the collected data to forecast the supply and demand of pork in Catbalogan City, Samar, Philippines. Mgaya (2019) stated that Autoregressive Integrated Moving Average (ARIMA) models were used to forecast the production of livestock products. These models were used because it considers only one variable under each. The primary assumption of these models was that there is an aspect of past patterns in time series analysis, which continue to remain in the future. These models captured the patterns and used them to forecast future expected values observation.

An 'auto.arima' function of R-studio was used for the determination of the best ARIMA model (p, d, q) for each of the time-series data of the production and consumption of pork in Catbalogan City. The basis of ARIMA model selection is the Akaike information criterion (AIC) and Bayesian information criterion (BIC) values. The best-fitted model has the lowest criterion values, which can be calculated by:

$$AIC = \frac{-2\log(L)+2k}{N} \ldots\ldots (1)$$

and

$$BIC = -2\log(L) + k\log(N) \ldots\ldots (2)$$

Where;
L is the likelihood of the model, k is the number of parameters in the model, and N is the number of examples in the training dataset (Brownlee, 2019).

The autocorrelation function (ACF) and partial autocorrelation function (PACF) were plotted to check the significance of the model. Moreover, the Mean Absolute Percentage Error (MAPE) was calculated to assess the adequacy of the ARIMA model through the formula:

$$MAPE = \frac{1}{n}\, x \sum \left(\frac{|act - fore|}{|act|}\right) x\ 100 \ldots. (3)$$

Where;
n is the sample size, ac is the actual value of the data, and fore is the forecasted value of the data.

Zhang and Wang (2020) showed the prediction model of pork supply via pig population calculation based on the pig population system was an excellent perspective to explore the forecasting of pork supply from the standpoint of modeling. This prediction model has apparent advantages over existing prediction models, which can only anticipate annual data. It can reflect the volatility in pig population and pork supply every month in the future.

Zhang and Wang (2021) specified that the pig population based on the prediction model has a greater prediction precision and its superior effect according to prediction accuracy. The pig population based on the population prediction model was the effective angle of the research on the prediction of the pig population number, according to the modeling viewpoint.

Results and Discussion

The emerging supply chain was presented in this section to show the gap in local production and consumption. Also discussed are the opportunities for local producers to address local consumption.

The supply chain of pigs

There were two pork suppliers in the City; the backyard raisers who were directly selling their pigs to the buyers/middlemen, then intermediaries sold pigs to the butchers who at the same time sold them to the retailers or directly to the consumers. The movement of supplies was from farm gate prizes to buyers and consumers (Figure 2). This buying and selling scheme had incurred lower marketing costs and eventually lower prizes at the consumer's level. The study by Ajala and Adesehinwa (2008), found out that there will be a large number of buyers and sellers on the market.

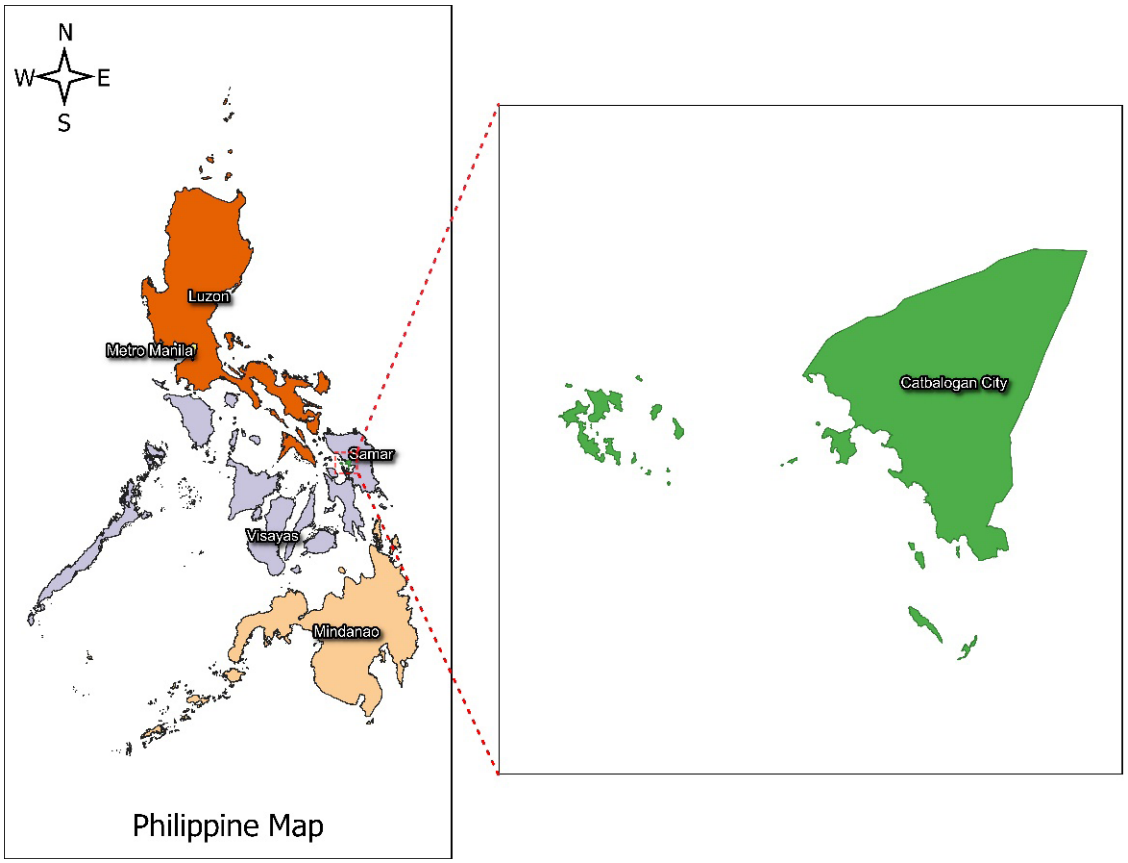

Figure 1: *Geo-reference map of the research area.*

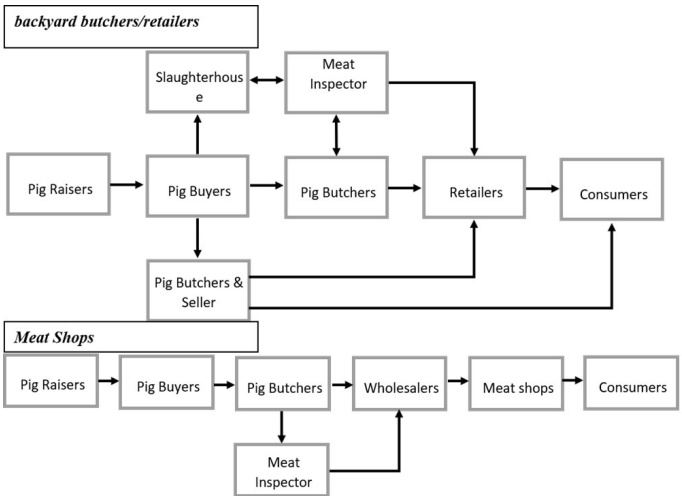

Figure 2: *Marketing channels of pigs in Catbalogan City, Samar, Philippines.*

Pig wholesaling and retailing were oligopolistic, with only a few companies controlling the majority of the market. There were fewer rural wholesalers than rural retailers, but there were more urban wholesalers.

Meat shops need a volume of pork supplies for an expected wide reach of customers from the City of Catbalogan and neighboring cities, municipalities, and villages (Figure 2). Meat shops bought a volume of pork from pig's butchers and sold volumes of pork, usually directly to the consumers. In this chain, this incurred more or less high priced than the source from raisers and eventually has high retail prices. The marketing cost was high those meat shops acquired their pork supply import from other regions; thus, the price in the meat shops was higher than the price of pork from local produce.

According to Rodríguez *et al.* (2014) Farm owners and corporate groupings contribute to the Pork Supply Chain (PSC). The key agents were concentrates, biologics, semen, gilts, feed mills, pharmaceutical enterprises, and selection farms, which provided raw materials for pig products. Pharmaceutical companies specialize in the prevention, treatment, and control of pig illnesses. Breeders, piglets, and fatteners were the responsibility of the farm owners. Product laws, business permit operations, and pre and post mortem pork inspection were all handled by the licensing authority. The sale and distribution of pork from butchers, retailers, and wholesalers to the final customer and consumption is referred to as marketing. (Figure 3).

Abattoirs and cutting lines are the most important parts of the processing, as they are where the final fresh product is sent to the market. Waiting time before stunning, slaughtering, carcass sorting, and chilling are all part of the slaughtering process (Perez *et al.*, 2009).

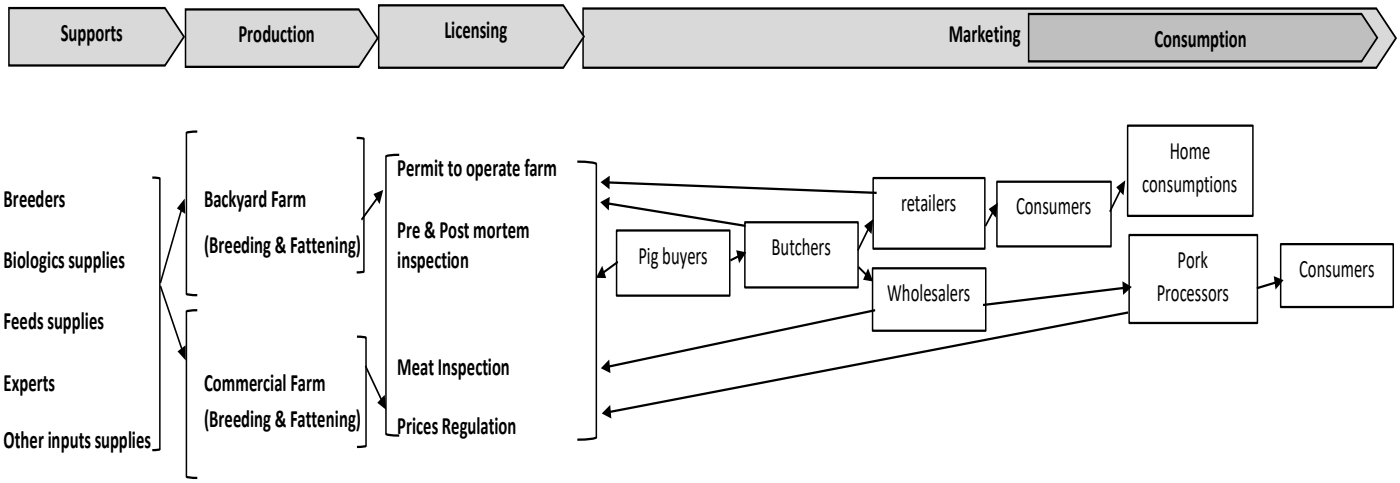

Figure 3: *Pork Supply Chain.*

Table 1: *Fitted ARIMA Models, and their selection criteria values (AIC & BIC) and estimates of parameters for time series data on production and consumption of pork (January 2020 to December 2026).*

Parameters	ARIMA model	AIC	BIC	Estimate	Standard Error	P-Value
Pork Production	(0,2,1)	471.18	473.36	-0.9128	0.2091	0.3598
Pork Consumption	(0,2,1)	453.61	455.8	-0.9393	0.2363	0.5666

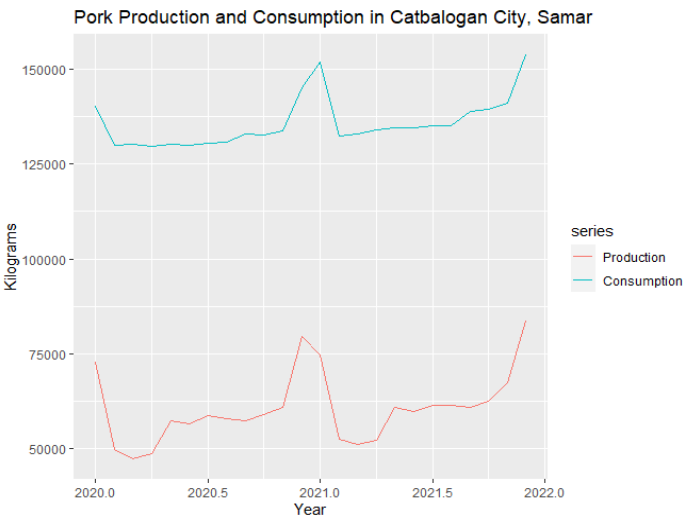

Figure 4: *Time Series Plot for Trend of Pork Production and Consumption*

Sometimes carcass was sold whole, especially for foreign trade, but they were more commonly processed further by swine processors to obtain lucrative slices. Owners of animals may have their own abattoirs. Other times, pork processors own abattoirs and deal directly with retailers and butchers (Perez *et al.*, 2009).

Modeling to foreseen production and consumption of pork (kg)

With a 95 percent confidence level, the ARIMA model performs admirably. To prepare non-stationary, non-normally distributed data for consumption, the method employs a number of statistical methods. Then, in order to conduct prediction and estimate the parameters of the ARIMA model (Alghamdi *et al.*, 2019).

Figure 4, shows the actual pork production and consumption trend in Catbalogan City, Samar, the Philippines, from January 2020 to December 2021. Pork production relies on pork consumption. Both parameters have a peak value at the beginning and later the year since those months fall on the celebration of "Christmas and New Year's Day," which produced and consumed more pork.

As a result of 'auto.arima' in RStudio, parameters were presented in (Table 1) showing the best fitted ARIMA model for specific parameters, including the coefficients, Akaike information criteria (AIC), and Bayesian information criterion (BIC). The lowest BIC value serves as the basis for the ARIMA model selection of the best-fitted model.

Based on Table 1, the following models for the production and consumption of pork in Catbalogan City, Samar, Philippines, can be formulated, respectively.

$$Y_t = 2Y_{t-1} - Y_{t-2} + \varepsilon_t - 0.9128\varepsilon_{t-1} \text{ and}$$
$$Y_t = 2Y_{t-1} - Y_{t-2} + \varepsilon_t - 0.9393\varepsilon_{t-1}$$

Table 2: *Forecast by the ARIMA model for Production and Consumption of Pork, CY 2022 (kg).*

Month	Production					Consumption				
	MAPE (10.23%)					MAPE (2.69%)				
	Forecast (kg)	Prediction Interval (kg)				Forecast (kg)	Prediction Interval (kg)			
		95%		80%			95%		80%	
		Low	High	Low	High		Low	High	Low	High
January	85359	66288	104430	72889	97829	154912	142179	167645	146586	163237
February	87116	58915	115317	68677	105556	155974	137356	174592	143800	168147
March	88873	52815	124932	65296	112451	157036	133484	180588	141636	172435
April	90630	47225	134036	62249	119012	158098	130035	186160	139748	176447
May	92387	41868	142907	59354	125420	159159	126813	191506	138009	180310
June	94145	36609	151680	56524	131765	160221	123722	196720	136356	184087
July	95902	31374	160430	53709	138094	161283	120708	201859	134752	187814
August	97659	26116	169201	50880	144438	162345	117735	206955	133176	191514
September	99416	20808	178024	48017	150815	163407	114781	212033	131612	195202
October	101173	15429	186917	45108	157238	164469	111831	217106	130051	198887
November	102930	9966	95894	42144	163716	165531	108874	222187	128485	202577
December	104687	4409	204965	39119	170255	166593	105901	227285	126908	206277

Table 3: *Forecast of by the ARIMA model for Production and Consumption of Pork, CY 2023 (kg).*

Month	Production					Consumption				
	MAPE (10.23%)					MAPE (2.69%)				
	Forecast (kg)	Prediction Interval (kg)				Forecast (kg)	Prediction Interval (kg)			
		95%		80%			95%		80%	
		Low	High	Low	High		Low	High	Low	High
January	106444	36029	176860	-1247	14136	167654	102905	232404	125317	209992
February	108201	32870	183533	-7008	223411	168716	99883	237550	123709	213724
March	109958	29641	190276	12877	232794	169778	96830	242726	122080	217476
April	111715	26340	197091	-18856	242287	170840	93745	247935	120430	221250
May	113473	22866	203980	-24946	251891	171902	90623	253180	118757	225047
June	115230	19518	210941	-31149	261608	172964	87465	258463	117059	228868
July	116987	15997	217977	-37464	271438	174026	84268	263783	115336	232715
August	118431	12401	225086	-43893	281381	175088	81032	269143	113588	236587
September	120501	8732	232270	-50434	291436	176149	77755	274544	111813	240486
October	122258	4990	239526	-57088	301605	177211	74437	279986	110011	244412
November	124015	1174	246857	-63855	311885	178273	71077	285469	108182	248365
December	125772	-2715	254260	-70732	322277	179335	67676	290994	106325	252345

Table 2, 3, 4, 5 and 6 shows the forecasted values of ARIMA model (0,2,1) for production and consumption in 5 years. The value of Mean Absolute Percentage Error (MAPE) is 10.23% and 2.69% for the prediction of the production and consumption, respectively, indicating a "very good" prediction accuracy of the model for the consumption and "good" for the production.

Figure 6b showed that all lags in ACF and PACF plots for pork consumption in Catbalogan City, Samar, do not exceed the significant limits. However, as shown in Figure 6a, the aspect of pork production, lag 10 exceeded the significant limits. Still, it can be assumed as an error that can probably happen (Kumar *et al.*, 2014; Nath *et al.*, 2019) because lag 1 to 9 and lag 11 to 20 fall within the significant limits. Hence, the ACF and PACF plots proved that the chosen ARIMA model was best fitted for forecasting pork consumption and production.

Table 4: *Forecast by the ARIMA model for Production and Consumption of Pork, CY 2024 (kg).*

Month	Production					Consumption				
	MAPE (10.23%)					MAPE (2.69%)				
	Forecast (kg)	Prediction Interval (kg)				Forecast (kg)	Prediction Interval (kg)			
		95%		80%			95%		80%	
		Low	High	Low	High		Low	High	Low	High
January	127529	-6677	261735	-77721	332780	180397	64232	296562	104441	256353
February	129286	-10710	269283	-84820	343393	181459	60746	302171	102529	260388
March	131044	-14815	276902	-92028	354115	182521	57218	307824	100590	264452
April	132801	-18992	284593	-99345	364947	183583	53647	313518	98622	268543
May	134571	-23238	292354	-106770	375886	184644	50032	319256	96627	272662
June	136315	-27555	300184	-114302	386931	185706	46377	325036	94604	276809
July	138072	-31941	308084	-121940	398083	186768	42678	330858	92553	280984
August	139829	-36395	316053	-129683	409341	187830	38937	336723	90474	285186
September	141586	-40918	324090	-137530	420702	188892	35154	342630	88368	289416
October	143343	-45509	332195	-145481	432167	189954	31328	348579	86234	293673
November	145100	-50167	340367	-153534	443735	191016	27461	354570	84073	297958
December	146857	-54891	348605	-161690	455404	192078	23552	360603	81885	302271

Table 5: *Forecast by the ARIMA model for Production and Consumption of Pork, CY 2025 (kg).*

Month	Production					Consumption				
	MAPE (10.23%)					MAPE (2.69%)				
	Forecast (kg)	Prediction Interval (kg)				Forecast (kg)	Prediction Interval (kg)			
		95%		80%			95%		80%	
		Low	High	Low	High		Low	High	Low	High
January	148615	-59681	356910	-169946	467175	193139	19601	366678	79669	306610
February	150372	-64537	365280	-178302	479045	194201	15609	372794	77426	310977
March	152129	-69457	373714	-186758	491015	195263	11575	378951	75156	315370
April	153886	-74442	382214	-195312	503083	196325	7501	385149	72860	319077
May	155643	-79491	390777	-203963	515249	197387	3385	391388	70536	324238
June	157400	-84603	399403	-212712	527511	198449	-771	397668	68186	328711
July	159157	-89978	408092	-221556	539870	199511	-4967	403988	65810	332110
August	160914	-95015	416843	-230496	552324	200573	-9204	410349	63407	337738
September	162671	-100314	425657	-239530	564873	201634	-13480	416749	60979	342869
October	164428	-105675	434531	-248658	577515	202696	-17797	423189	58524	349290
November	166185	-111096	443467	-257880	590251	203758	-22153	429669	56043	351473
December	167942	-116578	452463	-267893	603078	204820	-26548	436188	53537	356103

Pig production economics

Under the influence of a high-grade pork supply chain, pork sales and total price are the highest. When buying pork, 74.8% of people tend to consider pork quality and pork brand, and they care less about the price. This data means that people have a high demand for high-grade pork in the pork consumer market, and a high-grade pork supply chain can improve the economy of the pork consumer market (Zhang and Wang, 2020).

The trend of pork and Live pig

In twelve years, prices of pork were fluctuated and increasing (Figure 7), in 2010 to 2011-22%, 2011 to 2012- 5%, 2012 to 2013- 4%, 2013 to 2014- 4%, 2014 to 2015- 12%, 2015 to 2016- 7%, 2016 to 2017- 7%, 2017 to 2018- 6%, 2018 to 2019- 13%, 2019 to 2020- 16% and 2020 to 2021- 50% respectively. Relatively, live weight pig prices increased from 2020 by 9% up to 39% in 2021. The production of pork and live pigs was affected by the African Swine Fever (ASF) and

Table 6: *Forecast by the ARIMA model for Production and Consumption of Pork, CY 2026 (kg).*

Month	Production					Consumption				
	MAPE (10.23%)					MAPE (2.69%)				
	Forecast	Prediction Interval				Forecast	Prediction Interval			
		95%		80%			95%		80%	
		Low	High	Low	High		Low	High	Low	High
January	169700	-122119	461518	-276599	615998	205882	-30982	442746	51005	360759
February	171457	-127720	470634	-286095	629008	206944	-35456	449343	48447	365440
March	173214	-133381	479808	-295682	642109	208006	-39968	455979	45865	370147
April	174971	-139099	489041	-305358	655300	209068	-44518	462653	43257	374878
May	176728	-144876	498332	-315123	668579	210129	-49107	469366	40624	379635
June	178485	-150711	507681	-324980	681947	211191	-53734	476116	37966	384416
July	180242	-156603	517088	-334918	695403	212253	-58398	482904	35284	389223
August	181999	-162552	526551	-344947	708946	213315	-63100	489731	32577	394053
September	183756	-168558	536071	-355062	722575	214377	-67840	496594	29845	398909
October	185513	-174620	545647	-365263	736290	215439	-72617	503495	27089	403788
November	187271	-180738	555279	-375550	750091	216501	-77431	510432	24309	408692
December	189028	-186911	564966	-385921	763976	217563	-82282	517407	21505	413620

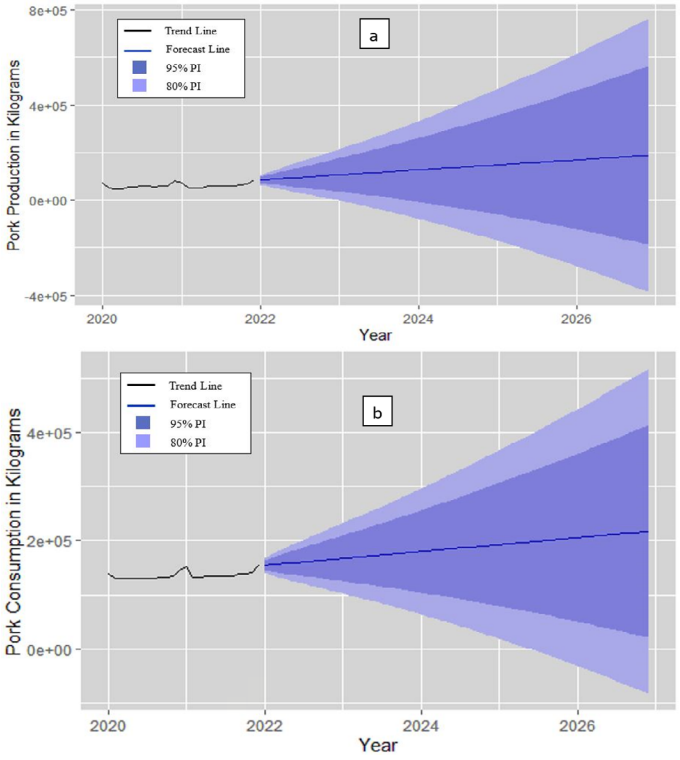

Figure 5: *Forecasting of (a) Pork Production and (b) Pork Consumption*

the restricted mobility attributed to the Covid19 pandemic.

Pork and live pig consumption

Since 90%-95% of the populace of Catbalogan City and nearby towns were eaters of pork, there was an increase in consumption (Figure 8) of both pork and live pigs. The City of Catbalogan consumes 73% imported from other regions, while 27% was locally produced. Catbalogan City has 47% import from the other areas while 53% is produced locally in live pigs.

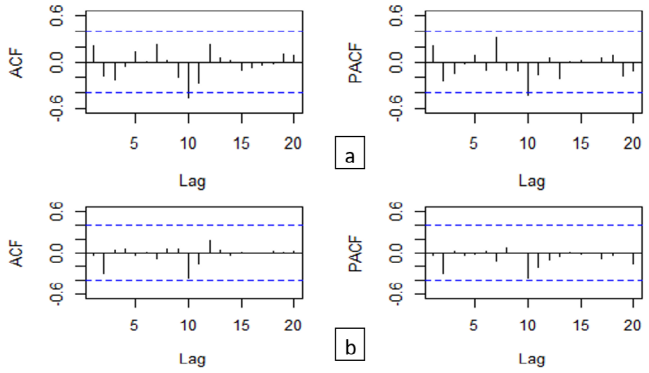

Figure 6: *Auto-correlation Function (ACF) and Partial Auto-correlation Function (PACF) plot of second differentiated data (a) Pork Production and (b) Pork Consumption.*

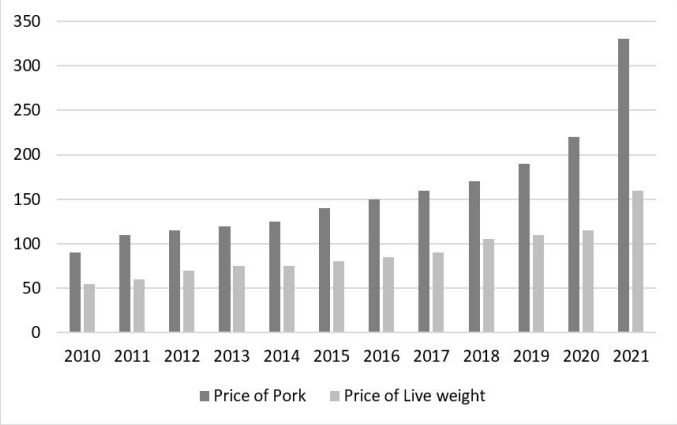

Figure 7: *Price's trend of pork & carcass in five years*

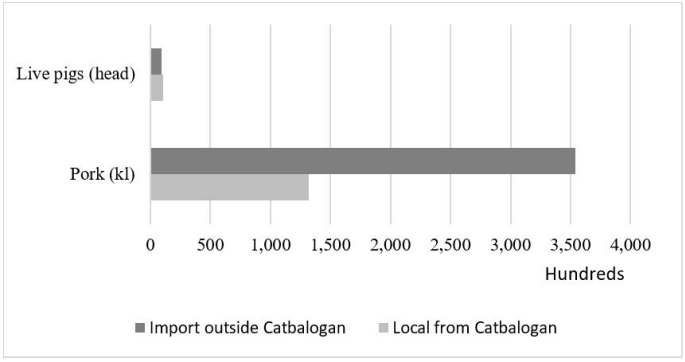

Figure 8: *Live pigs & pork consumed in a year*

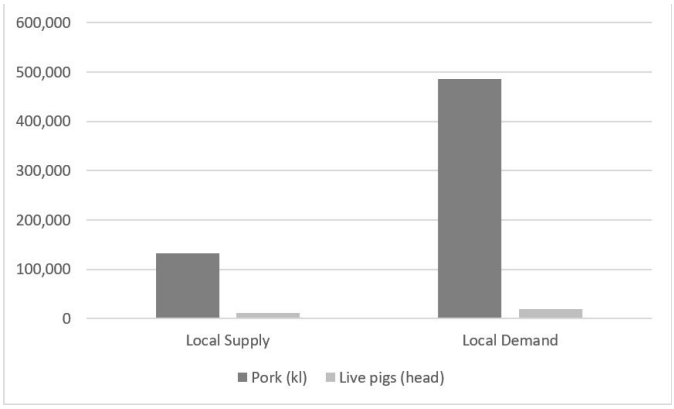

Figure 9: *Yearly supply and demand of pork and live pig*

Pork & live pig supply and demand

The data showed (Figure 9) the demand for pork is 27% higher than the supply; this connotes that Catbalogan pig raisers have the opportunity to raise and produce more pigs/pork to satisfy the demand of the City. The need for live pigs is 55% higher than the supply, which is an additional opportunity for the local pig raisers to produce. The overall market opportunity for pigs for the local farmers/raisers in Catbalogan City is high. Estimates pegged it at 70,996 kilograms of pork monthly for Catbalogan City alone.

The data (Figure 10) provided has a mean of 58.96 heads per month with a standard deviation of 40.4. Around 42.9% say Catbalogan needs 40 to 80 heads per month. Two outliers said Catbalogan needs more than 120 heads per month. A follow-up interview reveals this is during peak months like December and August. For the holidays, December for the holidays, and August during Catbalogan Fiesta, where lechon (roasted whole pig) is mostly served during these celebrations.

Based on survey data, the City of Catbalogan needs between 2,620 to as high as 9,200 kg of pork per month (Figure 11). The behavior, however, seems to vary depending on the participants. A popular meat shop franchise in Catbalogan shares that they sell an average of 9,200 kg per month, while a smaller vendor says their sales average is 2,620 kg per month.

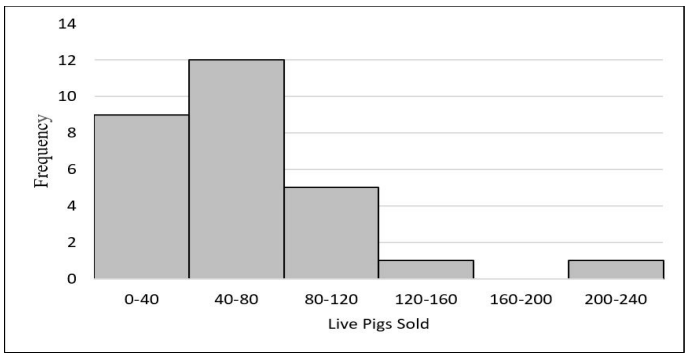

Figure 10: *Liveweight pigs supply from backyard raisers and butchers*

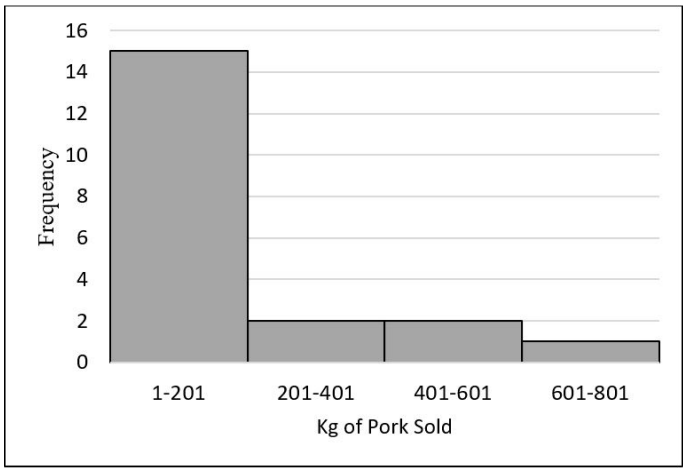

Figure 11: *Pork supply from meat shops*

Conclusions and Recommendations

In this research study, we have reviewed pork and live weight pig population from a supply chain perspective and was forecasted the production and consumption in Catbalogan City, Samar, Philippines. The present supply chain of pork in the City was more from regional export and limited production from the local pig raisers. In the current situation, small-scale pig raisers were affected by the exportation of pork and live pigs in the City, which caused the increasing trend of prices of the products. However, export had also satisfied the demand of the customers.

Most pork and live pig supply in the City are sourced elsewhere, offering local producers a real opportunity. Backyard raisers, however, need to be helped to make their production operation more profitable. They are heavily affected by problems like ASF and other diseases; they have no direct access to veterinary help. Addressing the issues that local producers of pork or

pigs eventually benefit them. Authorities, especially the Department of Agriculture, should look into account the support of the local raisers for pig production to meet the demand of consumers of Catbalogan City, Samar, Philippines. This intervention will ultimately help small hog raisers improve their socio-economic conditions, provide more affordable pork meat for the local population, and improve the local economy.

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Novelty Statement

Forecasting the supply and demand of pork using ARIMA was a vital part of this research, where pig raisers can now plan how much pigs/pork to produce in a year to address the demand for the product. This will ensure the income of the small-scale pig raisers since there is an assurance market for their produce.

Authors' Contribution

Marcos E. Bollido: Data collection and processing, analysis of data, and writing the manuscript.
Engr. Renell Jay G. Villaluz: Data analysis using modeling tool (ARIMA).
Dr. Ronald L. Orale: Compilation of data, helped in drafting and technical analysis of data in the manuscript.

Conflict of interest
The authors have declared no conflict of interest.

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