SUPPLY CHAIN IMPROVEMENT (SCI) OF THE NATIVE CHICKEN INDUSTRY IN REGION VI

Joy C. Lizada¹, PhD, Reynold D. Tan, and Joey P. Pedrajas
College of Management, University of the Philippines Visayas, Iloilo City

Keywords: Supply chain improvement, Native chicken industry, Region VI, Philippines

INTRODUCTION

The Philippine chicken industry significantly contributes to the country’s economic growth and food security. In terms of volume and value of production, the chicken industry is second to the hog industry in the animal husbandry sector. Approximately 40% of the total volume of combined livestock and poultry production is credited to the chicken industry. The total per capita consumption of chicken meat in 2008-2009 in urban areas was 9.32 kilograms while that in rural areas was 6.14 kilograms. It placed second to pork with total per capita consumption of 10.66 kilograms and 7.90 kilograms in urban and rural areas, respectively (BAS, 2011).

The scale of operation of chicken production in the country is either commercial or backyard. Backyard raisers are those who have less than 100 birds while those with flocks more than 100 are categorized as commercial. On the other hand, chickens are commonly categorized as broiler, layer, or native. Layers and broilers are imported hybrids with foreign strains. Broilers are grown for the meat carcasses while layers, for egg production. Native chickens are of a local breed as well as the so-called “improved” breeds that are crosses of local chickens with foreign traits. They are used both for meat and egg production.

While the broiler and layer production can be said to be tied up with large scale production and major food industry, the native chicken industry is linked through local markets to low-income networks of small enterprises (Heft Neal, S. et al., 2008). Native chicken production is a viable investment option for small and medium enterprises (PCARRD, 2007) and an important component of the Philippine economy especially in rural families (Abamo, et.al., 2010). Generally, the native chicken industry is characterized by backyard production which utilizes very little resources resulting in low productivity and high mortality rates (Chang, 2007). The main reason for raising native chickens is more for subsistence than for commercial purposes.

According to Haitook and Zoebisch (2003), in the case of Thailand, local chickens present a typical “niche” market that is not attractive to large businesses given the fact that demand exceeds supply. This, however, provides an opportunity for small farmers to augment their income. As far as production is concerned, Conroy et al. (2005) noted that the productivity of the scavenging system tends to be low with high mortality rates and low hatchability rates. On the other hand, there is a wide scope of opportunities where the scavenging system could be improved with low-cost interventions in the sector. A full integration of the industry is needed to benefit more from the economies of scale and scope (Chang, 2007).

While the commercial sector has received much attention in terms of production and marketing issues, the backyard sector has been marginalized in terms of research and development. There have been few studies which directly address specific issues in backyard production particularly with the native chicken. It is therefore imperative to investigate the native chicken industry, considering its significant impacts primarily on the food security of the country.

Thus, to make the most of its potential in the agribusiness sector, the bottlenecks in producing native chicken and up-scaling their production and marketing would necessitate certain S&T interventions. This study will provide the bases in formulating the supply chain interventions needed in successfully creating an S&T – based enterprise.

¹ Corresponding author, College of Management, UP Visayas, Iloilo City, e-mail address: joylizada@yahoo.com
The study is comprised of two levels. The first level is the assessment and analysis of the supply chain of native chicken in the province of Iloilo in general. In the second level the STBF for Darag Native Chicken is contextualized in the local industry supply chain.

CONCEPTUAL FRAMEWORK

The conceptual framework of the study is shown in Figure 1. The S&T-based enterprises are viewed as the interphase of two systems, namely, the R&D system and the enterprise system. The former is technology-centric, being focused mainly on the generation and transfer/commercialization of technologies. The latter is market-centric as the viability/competitiveness of enterprises depends entirely on its ability to satisfy market demand/requirements.

The enterprise system consists largely of three subsystems which embody the functions, activities, and processes necessary to make products available to the consumers. The production subsystem defines the A to Z of producing a given product. Organization and management refer to the way the enterprise is organized and managed either individually or by groups or clusters. On the other hand, linkages include the upstream and downstream player considered to be crucial in the successful operation of the enterprise. This covers the input providers, providers of support services (e.g., technical, credit, etc.) and logistics, and, most importantly, the product market.

The Pinoy S & T Services for Farmers and Entrepreneurs (PSF) is situated clearly in the framework as a modality of technology transfer and commercialization. The modality is a synergistic combination of TechnoMart, STBF, and OSIS designed to create S&T based enterprise or transform an existing enterprise to one where S&T becomes a fundamental driving force.

Supply chain analysis is depicted as an integral component of PSF. The analysis enables the identification of gaps in the enterprise system which should become the basis for the packaging of the intervention under the PSF. The gaps and the corresponding interventions may cover not only technical but also behavioral, institutional, market, and economic aspects of the enterprise/industry, among others.

Figure 1. Conceptual framework of the study.

Supply chain analysis aims to utilize and capitalize on strengths, improve weaknesses, explore opportunities, and mitigate threats in the supply chains. As an analytical gap identification tool, the

2 This section was drawn from the SCI for PSF Program Proposal prepared by PCAARRD.
analysis draws contributions from various disciplines and scrutinizes these areas to determine how the supply chain of the various products can be developed to achieve competitiveness.

OBJECTIVES OF THE STUDY

The study is designed to assess the supply chain of the native chicken in general, and Darag Native Chicken in particular as well as to identify areas for improvement. Specifically, the study aimed to:

1. Provide an overview of the current state of the native chicken industry in the Province of Iloilo and of the STBF program for Darag native chicken;
2. Map out the supply chain of the native chicken industry in the Province of Iloilo including that of STBF for Darag native chicken that will show the: a) key customers and their product requirements; b) key players and their roles; c) activities and processes involved; d) flow of product, payment, and information; e) logistic concerns; and f) external influences;
3. Analyze the performance of the supply chain of the native chicken industry in the Province of Iloilo including that of STBF for Darag native chicken in terms of efficiency, flexibility, and overall responsiveness; and
4. Provide recommendation for improvement in the supply chain towards efficient and effective production and marketing of native chicken, subsequently improving the plight of the actors in the supply chain particularly the chicken raisers.

METHODOLOGY

Study Site

The research study was conducted in the Province of Iloilo, Western Visayas. Notably, the locale has the highest chicken production in Western Visayas from 2001 to 2011. The province is located in Panay Island and comprised of 43 municipalities, divided into five political districts.

Method of Data Collection

Both primary and secondary data were utilized in the study. Secondary data such as production data and other relevant information were gathered from the Bureau of Agricultural Statistics (BAS), National Statistics Office (NSO), and other agencies through Internet and library research. Field survey and key informants’ interview were conducted to generate primary data.

Considering the inherent characteristic of raising the native chicken in the Province of Iloilo, the entry point of the value chain analysis was at the demand side (i.e., institutional buyers). Eight supply chains were traced, consisting of four restaurants serving native chickens as specialty, Chicken barbecue kiosk, wet markets, a supermart and household consumers. An attempt was made to include a hotel and a hospital in the chain; however this was later excluded since no hotel and hospital is serving native chicken due to its relatively expensive price.

Initially, four restaurant owners/managers were interviewed. Subsequently, the “snowballing” technique was used to identify the downstream chain actors who are vertically linked with buyers of native chickens. A query with the buyers of the native chickens on their trading partners was done to identify the prospective first and second levels of the supply chain, the traders and native chicken raisers. Fifty traders consisting of pantings, compradors, as well as mayor compradors and 30 raisers were interviewed from several municipalities of the Province of Iloilo. Other key players of the industry from the academe, local government units, and national government agencies were interviewed as key informants to further substantiate the information. In addition, focus group discussions were conducted among raisers and traders to validate the veracity of data gathered particularly the traditional/conventional classifications and practices employed in the trading of native chickens.

In order to contextualize the Science and Technology-based Farm (STBF) for the Darag native chicken in the overall native chicken industry, a review of STBF contracts, published reports and other relevant documents obtained from WESVARRDEC was conducted. The Magsasakang Siyentista,
WESVARRDEC Director, and representatives of Partner Member Agencies (PMAs) were interviewed to triangulate the information. Experts’ opinions were also elicited.

**Research Instruments**

Questionnaires were used in gathering primary data from buyers, traders, and raisers. Questionnaires and guide questions were prepared for a particular group of respondents or key informants. These were pretested in order to establish validity and reliability.

**Data Analysis**

Primary data gathered during the survey were encoded, processed, and analyzed vis-a-vis the secondary data and information generated from key informants and experts.

The study is comprised of two levels. Firstly, the state of the native chicken industry in general was assessed, employing trend analysis in production, yield, prices, and SWOT analysis. The supply chain map consisting of eight routes was traced to illustrate the general picture of native chicken industry in the study site. Secondly, the supply chain of Darag native chicken in the milieu of STBF was traced and analyzed.

Issues and concerns of the native chicken industry in general and the STBF for Darag native chicken in particular were identified and analyzed. Consequently corresponding recommendations were provided.

**THE PHILIPPINE CHICKEN INDUSTRY**

**Chicken Production in the Philippines**

Chicken meat is one of the most popular meats consumed in the Philippines. The total volume of chicken production in the country has increased from 919 metric tons in 1998 to 1,414 metric tons in 2011 (Figure 2). This is equivalent to over 50% increase in volume of production within the said period. Figure 3 shows that, in terms of value of chicken production based on the constant prices, it amounted to Php 51.82 billion in 1998 and significantly escalated to Php 79.82 billion in 2011 (BAS, 2000). There is, however, no data reported on the breakdown of the volume and value of chicken production according to type.

![Figure 2. Volume of Chicken Production in the Philippines from 1981 to 2011 (in thousand metric tons)](image)

Source: Bureau of Agricultural Statistics, 2011
There are two scales of operation of chicken production in the Philippines. These include the commercial sector and the backyard sector. The commercial sector operates on a large-scale with a highly integrated marketing and production system (SEARCA1999; SIKAP/STRIVE Foundation 2001; Costales et. al. as cited by Chang, 2007). It is associated either with broiler industry or with layer industry. Broilers are raised for their meat carcasses while layers are raised mainly for egg production.

The backyard sector or the household sector, which is associated with the native chicken industry, raised a small number of heads - from 5 - 10 hens and 1-2 roosters - to supplement the household income and nutritional needs (Lambio, 2005). Native chicken heads for the rural households are regarded as component of security assets of the family wherein unexpected financial discomfort can be alleviated by the cash earned from selling the flock. In this sector, minimal inputs are required to rear the flock as compared to the capital-intensive commercial sector.

The chicken inventories by type (i.e., broiler, layer, and native) from 2001 to 2011 are shown in Figure 3. In 2001, the inventory consisted of 62% of native chicken, 25% of broilers, and 13% of layer. In 2011 the stocks of native chickens decreased by 15%.

The Native Chicken Industry in the Philippines

Zoologically, the domesticated native chickens, which are called Gallus domesticus, have four species that include (1) Gallus gallus, the red jungle fowl; (2) Gallus layette, the Ceylonese jungle fowl; (3) Gallus sonnerati, the gray jungle fowl; and (4) Gallus various, the black or green jungle fowl (PCARRD, 2007). They are commonly found in rural areas.

The importance of the native chicken industry in the country cannot be overemphasized, considering its contribution to the total stock of chicken. Native chicken production in the Philippines accounted for more or less 50% of the chicken inventory from 2001 to 2011. It provides an additional livelihood to about 2.5 million Filipinos (PCARRD, 2007). The growing demand for the commodity in
recent years due to its distinct taste compared to broilers indicates future significant economic potential contribution to the industry (PCARRD, 2011).

Native chicken production in the Philippines is categorized as backyard poultry production. Chang (2007) noted that rural households in the country often keep in their backyards a small number of chickens with 5 – 10 hens and 1 – 2 roosters. The common and most significant feature of backyard poultry is the low-input, low-output production system which is based almost entirely on native birds and local breeds (FAO as cited in Chang 2007). Native chicken can be grown under conditions of minimal material inputs (feeds, medications, housing, etc.) and management (De Los Santos, et.al., 1995).

Notably, native chicken production in the country is highly concentrated in Western Visayas followed by Central Visayas (Figure 5). Western Visayas has been consistently the top producer of the commodity in the country for the last decade. In 2011, out of 76 million native chicken heads inventoried, approximately 18% of the stock is accounted to Region 6 while Northern Mindanao and Central Visayas each contributed almost 10% to the whole (Figure 6).

![Figure 5. Average Inventory of Native Chicken by Region, Philippines, 2001 – 2011](image)
Source: Bureau of Agricultural Statistics, 2011

![Figure 6. Percentage Distribution of Average Inventory of Native Chicken by Region, Philippines, 2011.](image)
Source: Bureau of Agricultural Statistics, 2011

As noted earlier, Region 6, which includes the provinces of Aklan, Antique, Capiz, Guimaras, Iloilo and Negros Occidental, has been the highest producer of native chicken for the last 10 years. Most of the raisers in these provinces are situated in rural areas where there are wider spaces for scavenging and free ranging of native chicken. Among the six provinces in Region 6, the Province of Iloilo and Negros Occidental have the most number of native chickens recorded from 2001 to 2011. Guimaras has the least number of flocks monitored (Figure 7).
For the past ten years since 2001, the rate of increase of an average inventory of native chicken in Western Visayas is 25%. Likewise, the rate of increase of average inventory in the Province of Iloilo is 32%, which is higher than the regional rate of increase (Table 1).

Table 1. Rate of Increase of Average Inventory of Native Chicken for 10 years (in thousand heads)

<table>
<thead>
<tr>
<th>Province</th>
<th>2001</th>
<th>2011</th>
<th>Difference</th>
<th>Rate of increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aklan</td>
<td>842.46</td>
<td>1033.41</td>
<td>190.95</td>
<td>22.67%</td>
</tr>
<tr>
<td>Antique</td>
<td>1071.99</td>
<td>1000.61</td>
<td>-71.38</td>
<td>-6.66%</td>
</tr>
<tr>
<td>Capiz</td>
<td>1123.88</td>
<td>1122.11</td>
<td>-1.78</td>
<td>-0.16%</td>
</tr>
<tr>
<td>Guimaras</td>
<td>441.99</td>
<td>522.26</td>
<td>80.27</td>
<td>18.16%</td>
</tr>
<tr>
<td>Iloilo</td>
<td>3624.66</td>
<td>4767.60</td>
<td>1142.95</td>
<td>31.53%</td>
</tr>
<tr>
<td>Negros Occidental</td>
<td>3433.88</td>
<td>4741.17</td>
<td>1307.29</td>
<td>38.07%</td>
</tr>
</tbody>
</table>

As shown in Figure 8, the Province of Iloilo has the highest production of native chicken in Region 6, followed by Negros Occidental.

Native Chicken in the Province of Iloilo

The strain of native chicken indigenous to, and most dominant in, Western Visayas particularly in the Province of Iloilo is called Darag which evolved from the red jungle fowl (PCARRD, 2007). These chickens have the ability to adapt to their environment making them suitable for the production of healthy, chemical-free, or organic meat addressing the food safety and health issues of the consumers. They also possess a unique flavor and texture that are more preferred and highly valued by Filipinos. However, most of the native chickens raised in the area are not pure-bred Darag native chickens, for there are mixtures of other strains of native chickens.
The Provincial Agriculture Office of the Province of Iloilo reported that in 2011 the top five municipalities in terms of native chicken production were the Municipalities of Tigbauan, Cabatuan, Calinog, Oton, and Sta. Barbara having 10.9%, 9.5%, 6.7%, 5.6%, and 4.4%, respectively, of the total production of the province.

As shown in Figure 9, the 3rd District, which comprised of municipalities located at the central part of Iloilo Province, has about 28% of the total native production.

Demand/Consumption of Native Chicken

Apparently, the demand for native chicken is increasing in view of the growing concern of consumers’ food safety and health issues. Filipinos prefer the meat and eggs of native chickens because of their taste, leaniness, and suitability to the Filipino dishes (Abamo, et. al, 2009). These have lower fat content and entail more convenient and versatile methods of meal preparation, when compared to others meats (Landes et al. as cited in Chang, 2007).

However, there is a dearth of empirical studies quantifying demand as well as documenting consumer behavior and market specification. This information is vital in the design of market-responsive and technology-based value offering.

SUPPLY CHAIN MAPPING

Supply Chain Map of Native Chicken

Figure 10 illustrates the supply chain of native chicken in the Province of Iloilo. Eight routes were traced, consisting of the chains of four restaurants serving native chickens as specialty, chicken barbecue kiosk, wet markets, a supermart and household consumers. The Figure shows the total picture of the native chicken supply chain as well as its major players and flow.
Key Customers and Product Requirements

Native chickens, regardless of whether they are pure-bred Darag or cross-bred with other strains, belong to a “niche market” for their specific product features are aimed at satisfying specific consumers’ preferences. Their meat and eggs are preferred by consumers because of their distinct flavor, taste, and texture. Native chicken is also known to be healthful because it is raised organically. Finally, preparations of local delicacies and rituals necessitate the use of native chickens.

Thus, to understand the product requirements of each key customer, it is necessary to comprehend the prevailing market practices of native chicken in the region which are anchored on the local culture and tradition.

The key customers for native chickens are the restaurants serving specialty dishes of native chicken particularly lechon manok, chicken soup cooked in lemon grass (Tinuom), rice porridge with chicken (Arroz caldo); kiosks selling different grilled parts of native chicken; wet markets, a supermart, and household consumers. Their product requirements are in accordance with the purpose or menu of the chicken. The restaurants in Iloilo City serving lechon manok prefer native chickens with tender meat which, according to industry players weigh about 700 grams to 850 grams while restaurants in the municipality outside Iloilo City serving specialty chicken soup (Tinuom) prefer native chickens weighing 850 grams to one kilogram. Likewise, restaurant owners serving rice porridge with chicken (arroz caldo) as specialty prefer more-than-1-year-old native chicken weighing more than 1 kilogram, for the meat is tougher and believed to be tastier when mixed with rice porridge.

The kiosks selling different grilled parts of the native chicken prefer native chickens weighing less than 700 grams. Wet markets sell live and dressed native chickens of different sizes and weights that will satisfy the preferences of its customers while a supermart prefers dressed chicken weighing between 850 grams to one kilogram.

Household consumers’ preferences depend highly on how the commodity will be cooked or used as well as their capacity and willingness to pay for the native chicken.

Key customers are not very particular about the strain or type (i.e., pure-bred Darag or “improved” breed) of native chicken they purchase except for customers purchasing native chicken for ritual practices. They have particular product requirements in terms of color, age, and size, among others.

Consistent with the product requirements of key customers, the following are four traditional/conventional classifications or types of native chicken as categorized by the industry key players in the local dialect:

a. Pisû – Literally this is a local term for “chick”. However, industry players use this to refer to 3 – 4 month-old native chickens weighing less than 700 grams and usually utilized for grilling or chicken barbecue. This also refers to the native chickens which are unacceptable to restaurants or called the “reject type”.

b. Tamanyo – This has an estimated age of 4 – 6 months old and weighs 700 – 850 grams. This type of native chicken is preferred by restaurants serving lechon manok due to its tender meat.

c. Dresson – from the term “dressed”. This refers to native chicken which is intended for dressed native chicken. It is about 7 – 11 months old and has an estimated weight of 850 grams to one kilogram and sold in supermart and wet markets for household consumers. This category is also the preference of restaurants serving specialty chicken soup (tinu-om).

d. Arrozcalduhon – originates its term from the local delicacy called arroz caldo, i.e., rice porridge mixed with different ingredients usually chicken products varying from egg to chicken parts. This type of native chicken is usually older than one year and has tougher meat weighing more than one kilo.

Key players in the industry claimed that customers have no specific requirements as for the quantity or volume to be purchased and delivered. Instead the buyers are more particular about the regularity of delivery and availability of the native chickens when needed.

Key Players and Their Roles

The key players in the native chicken industry are the raisers; traders who are categorized as panting, comprador, mayor comprador or por mayor; and retailers; institutional buyers comprising of
restaurants, kiosks, wet markets and a supermart; and the end – consumers, the households. The native chicken industry is customary industry wherein relationships among key players are closely intertwined, particularly the traders and the institutional buyers. Informal arrangements and unwritten practices in trading and financing had been established through the years.

**Raisers**

The raisers are the producers of the native chicken. Most of the native chickens they raise are not pure-bred *Darag* native chickens for there are mixtures of other strains of native chickens. In fact, raiser-key informants said that they prefer to raise “improved” *Darag* native chickens with mixtures of other strains. *Jolo*, a native chicken from Mindanao, is widely preferred to cross breed with pure-bred *Darag* because it is fast growing, and more meaty and resistant to diseases.

Following FAO (2004) classification as cited in Chang (2007), generally the native chicken raisers in the Province of Iloilo are under Sector 4 – Village or backyard production. Typical of the backyard poultry, native chicken raisers maintain an average of 18 birds on a free-range system (scavenging). However, there are few raisers; mostly farmer-cooperators of research projects undertaken by an academic institution raised no less than 20 heads.

The survey showed that the raising of native chicken is a family affair, i.e. the members of the households are involved in the said activity with the father having the highest percentage of participation. Native chicken raisers belong to the marginalized sector of society where half of the respondents reported to have an average monthly income from PhP1,000.00 to PhP5,000.00 while 40% are earning an average monthly income of PhP 5,001 to PhP 10,000.00. The primary source of income of most of these raisers is farming. Majority of them had not reached college level while 33% have completed elementary education. The average household income of raisers is PhP 7,267.00 per month. In view of the aforementioned circumstances, native chicken raisers are more of the price takers.

Raising native chicken by rural families is a tradition wherein each family had a flock of native chickens scavenging in the surroundings, surviving on food left-overs, grass, and farm by-products. Thus, raisers engaged in raising native chicken at an average of 19 years. Majority of them have been into native chicken production for not more than 20 years. The entrepreneurial mindset was not entrenched among native chicken raisers. The survey results showed that they engaged in raising native chicken for the following purposes: a) source of additional income; b) food security asset (i.e., rural household will slaughter a chicken if they have no other viand; c) source of cash in times of emergency; and d) food for unexpected guests. Consistently, 54% of the native chickens raised are sold while 15% are slaughtered for the food of the family.

The respondents were unanimous in statistics that they engaged in raising native chicken compared with other livestock or poultry products since they are easy to raise, considering that they are on a free-range system. Raising native chicken is a low-input and low-maintenance production system but has the access to high-value niche market.

More than half of the respondents raise native chicken with other livestock and other poultry products. Remarkably, the proportion of native chicken raised is 50% or more of the total livestock raised.

In terms of market access, the mean distance of the home of the raisers interviewed to the nearest market is 4.7 kilometers while the average distance of their home to the nearest road is 1.2 kilometers. All raisers interviewed use public transport available in the area such as jeepneys, tricycles, or motorcycles.

**Traders**

As shown in the Supply Map of Native Chicken of the Province of Iloilo (Figure 10), traders of native chicken in the study area have hierarchy and are categorized as *panting*, *comprador*, *mayor comprador* or *por mayor*, and retailer. These traders observed an unwritten “gentlemen’s agreement” in setting buying prices. Such an agreement emerges from a collusion among the players, thereby eradicating “cut-throating” during transactions.

Native chicken trading is a traditional source of livelihood in the Province of Iloilo; hence, the traders were in live native chicken trading at an average of 19.46 years and 23.20 years in dressed chicken trading. Forty percent of the traders were in live native chicken trading for more than 20 years.
The average starting capital of the traders was PhP 5,004.00 while their average current capital has amounted to PhP 17,756.00. Some of the traders are also engaged in trading other products aside from native chickens as a source of income. They are also into trading of livestock, fruits, and vegetables as well as other poultry animals like ducks.

a. Panting

The pantings are the first-level traders who buy native chicken directly from raisers in the farm or in the public market and subsequently sell these chickens to the comprador or mayor comprador/por mayor. They serve as conduits between the raisers and the comprador or mayor comprador/por mayor. They are the primary source of information for the sources of live native chicken. During lean months when there is a short supply of chicken, they are tasked to aggressively look for native chickens for sale in the different barangays in the study area. Some of them are being financed by the comprador in order to buy native chickens in the far-flung barangays.

The knowledge about the location of raisers and the ability to negotiate with raisers are the important assets of pantings for they have minimal or no financial capital at all.

b. Comprador

Compradors are consolidators of native chickens from raisers or pantings. They are the second-level traders. The word “comprador” originates from the local term “compra” which means bulk buying. The number of chickens the compradors buy depends on the availability of native chickens in the market in a given day and the availability of cash on hand.

c. Mayor Comprador/Por Mayor

Mayor compradors, also called the por mayors, are also bulk buyers or consolidators of the native chickens from the compradors or pantings or raisers. They are the third-level traders who serve as conduits to the institutional buyers. The mayor compradors/por mayors provide financial capital to the pantings and compradors when necessary especially during lean periods of supply. They have the clout to control the supply delivered to institutional buyers in order to maintain the price of native chickens during peak supply.

d. Retailer

Retailers are individuals involved in selling the dressed native chickens in wet markets. They buy live native chickens from compradors and sell dressed native chickens to household consumers or restaurant owners.

Institutional Buyers (Restaurants, Wet Markets, Supermart)

The institutional buyers referred in this study are the four restaurants, a kiosk, wet market and a supermart from which the supply chains were traced. More than half of the institutional buyers interviewed are micro-enterprises with the net worth below PhP 3 M.

The two restaurants serving lechon manok as specialty are medium-sized enterprises with a net worth between PhP 15 M to PhP 100 M. The survey results showed that one of these restaurants is a price setter for its prices set in a given period serve as the benchmark of the mayor compradors/por mayors, subsequently the basis of pricing of pantings and compradors. In addition to the aforementioned restaurants, one restaurant is serving specialty chicken soup (tinuom) while the other one is serving specialty rice soup (arroz caldo). If necessary, these restaurants provide financial capital to selected mayor compradors/por mayors whom they trust as proven by long years of business transactions.

Consumer (Households, Restaurant Customers)

The end consumers of the supply chain of native chicken are the households and the customers of the restaurants who enjoy eating the different menus of native chicken, given their distinct flavor, taste, and texture.

Product/Information/Payment Flow

Product Flow

Most of the raisers do not sell their native chickens to the final customers but rather pass through intermediaries, each one performing a variety of value-adding activities. These intermediaries or channels are sets of interdependent entities involved in the process of making products or service available for use.
or consumption (Kotler, 2010). They also capture the pathways a product or services follows after production, culminating in the purchase and use by the final customers. It essentially answers the basic question: What are the flows of products in the supply chain?

The product flow for native chicken in the Province of Iloilo is shown in Figure 10. In the context of this research, we will use the number of intermediary levels to capture the length of the channel.

Channel length for native chicken in the Province of Iloilo ranges from zero to three. A zero-level channel consists of native chicken raisers selling directly to final customers. A one-level channel contains one intermediary in between producers and consumers; a two-level channel, two; and a three-level with three intermediaries in between. The channels are as follows:

- **Zero level**: Native chicken raisers to household or institutional buyers
- **One-level**: Native chicken raisers – panting – household or institutional buyers
- **Two-level**: Native chicken raisers – panting – comprador – household or institutional buyers
- **Three-level**: Native chicken raisers – panting – comprador – comprador Mayor – household or institutional buyers

Notably, raisers delegate control of how and to whom native chickens are to be sold. This can be attributed to the following: 1) raisers lack the financial resources to carry out the marketing function; 2) raisers may earn a relatively higher return on investment by increasing financial exposure to production rather than marketing; and 3) direct marketing may not be financially viable.

The key consideration in the length of the channel varies mainly depending upon the desired level of output by the target customers. These are the following: 1) lot size; 2) waiting and delivery time; 3) spatial convenience; 4) product variety; and 5) service back-up.

- **Lot size** would refer to the volume demanded per transaction. The higher the volume demanded, the longer the channel length as reflected in three-level channels. This will ensure consolidation of native chicken from the various sources/channels to come up with the required volume.
- **Waiting and delivery time** attempts to address the question of the timing of delivery and the duration of time the customers are willing to wait. The shorter the elapsed time from the time of order, the shorter is the channel required as illustrated in zero level channels. Key customers requiring immediate delivery of native chickens would go directly to the raisers.
- **Spatial convenience** is associated with the venue where the chickens are to be delivered as specified by the market. The shorter the delivery place from the source, the shorter is the channel required consistent with the customer specification associated with delivery time.
- **Product variety** would refer to other product types demanded by the market. As the number of products demanded from an existing supplier increases, there is an increased tendency to increase the number of channels.
- **Service back-up** takes into consideration the level of service demanded by the clients. Examples will include delivery on consignment basis and on-site deliveries, among many others. The higher the level of service required, the shorter will be the most appropriate channel.

**Information Flow**

Information sharing among industry participants is vital in achieving full industry integration, eventually leading to an increased level of competitiveness. The literatures are rich in highlighting the role of information flow as the foundation for integration especially in the context of forging strategic alliances among industry participants. Chopra and Meindl (2001) stress that information “serves as the connection between the supply chain’s various stages, allowing them to coordinate their actions and bring about many of the benefits of maximizing total supply chain profitability.”

Zhou and Benton (2007) described information flow by three characteristics, and these are as follows: 1) level of information sharing; 2) information quality; and 3) IT supply chain applications. Information sharing is the sharing of knowledge among partners to serve downstream partners effectively. Knowledge will include, but will not be limited to, production status, planning process, business environment, and the goals of each player. Information quality is the indicator of quality and usefulness of information measured by the degree to which the information shared between supply chain partners meets the needs of the different partners.
Neumann and Segev (1979) in Vanpouke (2009) described high quality information as being accurate, frequently exchanged, recent, and containing the appropriate content. Bailey and Pearson (1983), also in Vanpouke (2009), described several dimensions of information quality as accurate, timely, precise, reliable, current, and complete. IT supply chain applications are concerned with the role of information technology in permitting the large amount of information between industry participants.

Industry information is basically shared by three key participants who are the raisers, the traders (panting, comprador, comprador-mayor), and the buyers (Figure 11). From the perspective of the raiser, market intelligence is gathered from a myriad of sources. About 97% of the respondents reported that information is through personal built-upon past experiences.

It is observed that there is no full disclosure of information among the key participants in the chain. The information flow in industry is fragmented in nature such that no total industry picture exists.

Information emanating upstream of the chain include production capacities, inventories, and location of production sites. Native chicken classification, and volume and timing of demand and pricing originate downstream of the chain. Information flow is bidirectional, i.e., succeeding key players react accordingly on the basis of information received.

Figure 11. Information Flow in the Native Chicken Supply Chain

Five key market intelligence elements are critical in the analysis of information flow. These are prices, volume and timing of production, volume and timing of demand, product quality specifications, production capacities/inventories, and location of producers as well as markets.

1. Prices
   Pricing decision originates downstream specifically from institutional buyers (i.e., the restaurants) where it is then passed on to compradors and pantings. While prices at the consumer level are fairly stable all year round, there exists volatility in prices across different value-adding activities in the chicken supply chain. It is worth noting that players will have different levels of access to end-level prices of native chicken. As the level of the player goes upstream, access also to prices at the consumer level diminishes. As such, native chicken raisers have limited information on end-consumer-level pricing vis-à-vis their counterparts upstream of the chain. Information on prices is sourced from informal sources passed on through mechanisms like cellular phones and personal discussions.

2. Volume and timing of demand
   Information concerning the volume and timing of demand emanates from institutional buyers. Similar to their role in looking for the sources of native chicken, the pantings and the compradors perform an equally important task of looking for information regarding the volume and timing of demand as a result of their contact with institutional buyers.

3. Volume and timing of production
   Information on volume and timing of production emanates from raisers which is then passed downstream of the supply chain. The compradors and the pantings perform an important task of continuously looking for information regarding volume and timing of production as a result of their contact with raisers.

4. Product quality specifications
The key customers have the final say regarding the product specifications. As discussed in the section on key customers and product requirement, different market segments will require different sets of product specifications.

5. Location of producers as well as markets
   Information of producers as well as markets is best supplied by the *pantings* and the *compradors*. This is because no such information provider for the above data requirements exists.

**Payment Flow**

Payment flow in the native chicken supply chain is basically simple in nature (Figure 12). Immediate cash payment is practiced at all levels of the chain except in the institutional buyer – to – *comprador* where there are cases of produce consigned to institutional buyers, payable after the chickens are sold. Duration of payment is approximately two to three days.

In some instances, the *compradors* advance cash payments to *pantings* especially during the period of peak demand. The extension of cash advances is built upon the level of trust. However, this sometimes resulted in the piling of bad debts of *pantings* with the financier-*compradors*.

![Figure 12. Payment Flow in Native Chicken Supply Chain.](image)

**Activities and Processes along the Chain**

**Production**

Generally, the raising of native chickens in the study site is characterized by backyard production. Survey results showed that in the Province of Iloilo there are no reported commercial raisers or those who have 100 or more native chicken heads. As stated earlier, most of these native chicken raisers are farming households who customarily raised livestock and poultry as an inherent activity in their farming operations. They raise native chicken based on their own experiences. Reproduction is through the natural method where raisers have usually five hens and one rooster which will reproduce chicks for grow-out with no financial outlay involved on the part of the raisers. Consequently, the native chickens raised are not pure-bred *Darag* native chickens. Production practices employed by raisers are traditional despite the availability of technology packages for native chicken production. The raisers interviewed have inadequate knowledge of technologies to improve the productivity of raising native chicken.

The production system is low-input and low-maintenance. It is free-range, i.e., the native chickens fend for themselves, scavenging around the farm water and food comprising of left-overs, farm by-products, earthworms, or anything edible for them. Nine out of ten respondents provide housing, feeding tray, watering tray, and hatching tray for their flocks. These facilities and equipment are made of indigenous as well as recycled materials. Chicken coops are mostly made of bamboo with *nipa* roofing. Likewise, the feeding and watering trays are old plastic containers or are made of bamboo or coconut shells.

In controlling the diseases of their flock, for instance, all respondents confirmed that no vaccination is given to the native chickens. All raiser-respondents claimed that they experienced losses of
native chicken, 90% of which were attributed to diseases, 50% to theft and 30% blamed on predators like snakes.

Costs of inputs are very difficult to estimate and value for they are mostly public good. As mentioned earlier, native chicken raisers are not entrepreneurs. They are engaged in raising native chicken as a source of additional income; food security asset (i.e., members of a rural household will slaughter a chicken if they have no other viand); source of cash in times of emergency; and food for unexpected guests. In view of this, raisers are not keen on recording cost of production, and income from sales and maintaining financial records.

Critical Factors Affecting Native Chicken Production

There are four interrelated factors affecting significantly the production of native chicken, and consequently, its population. These are breeding prolificacy, prevalence of diseases, feed abundance and mortality rate (Table 2).

The survey results showed that the prolific breeding time of native chicken is from September to December. This is also the period when feedstuffs are in abundance due to the palay harvest. Moreover, it is also during September to December when the prevalence of diseases is low.

Likewise, there is high prevalence of diseases during the month of May to July which is the rainy season. The common disease infecting native chickens is the avian flu or locally termed as aratay. This would wipe out the whole flock when epidemic occurs. Consistently, the mortality rate is high from the months of May to August.

This implies that production is low from March to August while it is high during the rest of the periods. Such a pattern explains the irregularity of the supply of native chickens. In addition, this situation is aggravated by the occurrence of an extreme, intermittent weather condition. A case in point is the experience of key informants who shared that, after Typhoon Frank in 2008, native chicken farms were devastated resulting to a drastic reduction of the native chicken population.

Table 2. Critical Factors Affecting Native Chicken Production

<table>
<thead>
<tr>
<th>Factors</th>
<th>Degree</th>
<th>MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Jan</td>
</tr>
<tr>
<td>Breeding Prolificacy</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Prevalence of Diseases</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Feed Abundance</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Mortality Rate</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>

Seasonality of Supply and Demand

Anent to the aforementioned critical factors affecting native chicken production, Table 3 shows the seasonality of supply and demand of native chicken in the perspective of the raisers, traders, and buyers. Notably, the raisers and traders claimed that there is a peak supply of native chicken during the months of September to December. This is consistent with the period of high breeding prolificacy, feed abundance, and low mortality rate. Traders and buyers stated that it is also during these months when there is high demand for native chicken in view of the fact that it is the months of festivities particularly the month of December which is the Christmas season. On the contrary, the buyers claimed that there is a low supply during these periods. Given the standpoint of the buyers, this implies that during the months of September to December, the demand is greater than the supply.
The raisers and traders considered the months of March to June as having a lean supply consistent with the periods of high prevalence of diseases and high mortality rate. Meanwhile, the buyers noted that it is the period of peak supply. This viewpoint of the buyers is due to the fact that the demand is low. This implies that the supply is greater than the demand.

Such seasonality is critical in the dynamics of key players in the native chicken industry considering that there are numerous and fragmented raisers. This leads to disparity in the distribution of benefits among key players where raisers as price takers are at the disadvantage.

### Table 3. Seasonality of Supply and Demand

<table>
<thead>
<tr>
<th>Seasonality</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
</tr>
<tr>
<td>Peak Supply</td>
<td>Raiser</td>
</tr>
<tr>
<td>Trader</td>
<td></td>
</tr>
<tr>
<td>Buyer</td>
<td></td>
</tr>
<tr>
<td>Lean Supply</td>
<td>Raiser</td>
</tr>
<tr>
<td>Trader</td>
<td></td>
</tr>
<tr>
<td>Buyer</td>
<td></td>
</tr>
<tr>
<td>Peak Demand</td>
<td>Raiser</td>
</tr>
<tr>
<td>Trader</td>
<td></td>
</tr>
<tr>
<td>Buyer</td>
<td></td>
</tr>
<tr>
<td>Lean Demand</td>
<td>Raiser</td>
</tr>
<tr>
<td>Trader</td>
<td></td>
</tr>
<tr>
<td>Buyer</td>
<td></td>
</tr>
</tbody>
</table>

### Marketing

**Identification of sources and buyers of live native chickens**

The sources of live native chickens are located through “word of mouth”. Marketing transactions would normally commence when pantings visit barangays to scout for the native chickens for sale. In some other cases, raisers bring their native chickens for sale to the public market during the municipal market day. The once-a-week market day in every municipality in the province provides a venue for the raisers and traders to have market transactions. An area is designated in the public market for the trading of live native chickens.

**Classification/grading of live native chickens**

The customary practice of classifying or grading the live native chicken (i.e., Pisù, Tamanyo, Dresson, and Arrozcalduhon) is heavily based on the subjective assessment agreed upon by the buyers and sellers in terms of weight and age estimates as well as some obvious prominent features of the native chicken such as the spurs (tahod) and comb (padong).

The skill of determining the weight and age is acquired from years of involvement in and experiences of trading native chicken. The weight and age are determined by the buyers and sellers intuitively by holding the chicken and stroking its whole body, subsequently setting the price of the whole chicken. Notably, the trading of native chicken is per head and not by the kilogram; thus, the weighing scale is absent in the trading area of live native chicken. According to key informants, this traditional system of classifying and pricing native chickens has been the practice since time immemorial and has been handed down from generation to generation. When asked about the use of weighing scale, key informants say it is unsuitable and unreliable because of the innate characteristics of native chickens with small bodies but thick feathers or otherwise.
Pricing

Table 4 shows the prices of the different types of native chicken set by different key players with respect to the seasonality. The prices of native chicken fluctuate accordingly by season. The prices are lower by PhP 10.00 to PhP 50.00 per head during peak supply and low demand compared to times of low supply and high demand.

In reference to the Supply Chain Map, Restaurant T is a price setter. Other institutional buyers will simply follow the price set by Restaurant T. The traders’ buying price is between PhP 10.00 – PhP 25.00 per head lower than the price set by the said institutional buyer. Notably, the price is based on the size and age, i.e., the Pisu, which is about 3 – 4 months old and less than 700 grams in weight, is the cheapest while the Arrozcaldoohon, which is more than one year old and weighs more than 1 kilogram has the highest price.

Table 4. Prices of Native Chicken According to Type Per Season Set by Key Players

<table>
<thead>
<tr>
<th>Seasonality</th>
<th>Type</th>
<th>Type</th>
<th>Type</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pistamanyo</td>
<td>Dresson</td>
<td>Arrozcaldoohon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ave</td>
<td>Min</td>
<td>Max</td>
<td>Ave</td>
</tr>
<tr>
<td>Peak Supply/Lean Demand</td>
<td>Raiser</td>
<td>70</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Trader</td>
<td>75</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Buyer</td>
<td>95</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Lean Supply/Peak Demand</td>
<td>Raiser</td>
<td>80</td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Trader</td>
<td>95</td>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Buyer</td>
<td>110</td>
<td>100</td>
<td>120</td>
</tr>
</tbody>
</table>

Manner of Payment

The manner of payment of the live and dressed native chicken is usually on a cash basis. In some circumstances, credit is also made available either through cash advances or consignment. This arrangement is founded on a sense of trust among and between involved participants.

Handling and transporting

The handling of the live native chickens from farms to the traders, subsequently ending up with key customers, entails a simple process that incurs no cost or a very minimal cost, if there will be any. The chickens are simply tied on the legs so as to prevent them from flying or running and then bundled.

The live chickens are transported from the farm to the public market by the raisers or pantings through the public transports (i.e., jeepney, motorcycle or tricycle). Meanwhile, some compradors and mayor compradors use public transports while others own motorcycles, which they use in transporting the live native chickens they purchased from different municipalities to the key customers in the city.

Processing and Packaging

Native chickens are sold live or dressed. They are sold live from raisers to mayor compradors and finally to restaurants. They are sold as dressed in public markets. In some cases, market retailers sell live native chickens which may be dressed for an additional service fee of PhP 10.00 – PhP 15.00 per head. A supermart sells vacuum-packed frozen dressed chickens as supplied.
The processing of native chickens entails simple primary techniques of slaughtering. The technique involves manually slitting the neck using a knife until the chickens die, soaking the dead chickens in the boiling water, manually removing the feathers and innards, and washing. Processing takes 10-15 minutes depending on the skills of the processors. The technique of slaughtering is learned through experience. The processing and packaging of native chicken is illustrated in Figure 13.

![Processing and Packaging of Native Chickens](image13)

Institutional buyers purchase live native chickens and cook them into different menu items such as *litson manok*, *chicken adobo*, *tinuom*, *binakol*, among others, and serve them in restaurants (Figure 14).

![Samples of Menu of Native Chicken](image14)

**Storage**

Only surplus live native chickens are kept in the chicken coops by institutional buyers. In addition, an excess inventory is being kept to cushion the impact of demand and supply uncertainty. Maintaining a dressed frozen native chicken inventory is not a common practice in the study site because the attributes such as color and texture altered, resulting in reduced customer acceptability.

**External Influences**
The importance of the native chicken industry as one of the primordial pillars of the rural economy in the Province of Iloilo cannot be overemphasized. Through the years, numerous agencies had undertaken several initiatives for the development of the native chicken industry in Region 6, particularly the improvement, utilization, and conservation of *Darag* Native Chicken (Table 5).

<table>
<thead>
<tr>
<th>Year Undertaken</th>
<th>Implementing Agency</th>
<th>Research Project/Program/Initiative/Activities</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985(^1)</td>
<td>WVSU</td>
<td>Establishment of the Philippine Native Chicken Center</td>
<td>Existing</td>
</tr>
<tr>
<td>1986-1996(^1)</td>
<td>WVSU</td>
<td>Several research projects initiated</td>
<td>On file</td>
</tr>
<tr>
<td>1997-1999(^1)</td>
<td>WVSU, PCARRD-GIA, IAS-UPLB</td>
<td>Research on “Improvement, Utilization and Conservation Project for Philippine Chickens (<em>Darag</em> Type) in Western Visayas.”</td>
<td>Introduction of hardened chicks among cooperators; Start of training for <em>Darag</em> native chicken production among cooperators by WVSU</td>
</tr>
<tr>
<td>2000</td>
<td>WVSU</td>
<td>Research on “Organoleptic Test and Chemical Analysis of Meats of Philippine Chicken”</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>PCARRD; LGU</td>
<td>Start of Establishment of FITS Center in Region 6</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Magsasakang Siyentista</td>
<td>Developed an AC-DC incubator prototype for the production of <em>Darag</em> native chicken hardened chicks</td>
<td>Introduction of incubator for <em>Darag</em> native chicken. Operation terminated June 2010 after the STBF Field Day on <em>Darag</em> Native Chicken</td>
</tr>
</tbody>
</table>
| 2005-2008\(^2\) | S&T Anchor Program for Philippine Native Chicken | 1) R&D Interventions for Improving Productivity, Marketing and Distribution of *Darag* Native Chicken  
2) R&D Utilization for Increased and Improved Product Quality of *Darag* Native Chicken  
3) Socio-economic and Policy Studies | A. Development of new technologies  
1) Hardening of chicks  
2) Reduced egg holding period prior to incubation  
3) Open nucleus system  
4) Improved cultural management practices  
B. New knowledge  
1) Day-old chick production information module  
2) Breeding and reproductive performance module  
3) Improved free-range native chicken production information module  
4) Native chicken production and marketing information module  
C. Capacity building  
D. Improved fund-sourcing capability  
No terminal report submitted |
| 2005-2008\(^2\) | UPV                 | Establishment of Substations to include  
1. DA – WESVIARC  
2. ISCOF – Dingle Campus  
3. CAPSU – Dumarao, Campus  
4. ASU – Banga, Aklan  
5. PVAO – Makato, Aklan | Operating;  
The establishment of substations is aimed to expedite *Darag* native chicken production. |
| 2008            | LGU                 | Start of breeder stock dispersal of some LGUs | Typhoon Frank devastated the Province of Iloilo, damaging some projects. |
| 2009            | VSU                 | Research on “Impact Assessment of the R&D Utilization Component Project of the S&T Anchor Program for Philippine Native Chicken” | Completed |
| 2009-2010       | MS                  | Operation of Science and Technology Based-Farm | Formulation of indigenous feeds and |
The introduction of an incubator.
Production and selling of hardened chicks; slaughtered chickens.
Operation terminated June 2010 after the STBF Field Day on Darag Native Chicken

<table>
<thead>
<tr>
<th>Year</th>
<th>Organization</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-2013</td>
<td>WVSU</td>
<td>Darag Native Chicken –Based Rural Enterprise</td>
<td>Ongoing</td>
</tr>
<tr>
<td>2010-2011</td>
<td>WSU; LBP</td>
<td>Darag Native Chicken Livelihood Enterprise Technology Promotions Center</td>
<td>Ongoing</td>
</tr>
<tr>
<td>2011-2013</td>
<td>Development</td>
<td>Sustainable Production System for Darag Native Chicken (Gallus gallus domesticus) in Western Visayas</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

- WVSU; ASU; CapSU; Project 1. Establishment of Sustainable selection, breeding and hatchery operation for Darag native chicken production
- On-going; distribution of hardened chicks among cooperators;
- CPU; PCARRD; Project 2. Formulation and distribution of supplemental concentrate feeds for free-range native chickens
- Ongoing
- PCARRD; CapSU; Project 3. Production and distribution of ethnobotanical anthelmintics for free-range native chicken
- Ongoing
- PCARRD; ASU; Project 4. Production and Distribution of New Castle Disease Vaccine
- Ongoing
- PCARRD; CapSU; Project 5. Establishment of range enhancement and free-range management protocol for Darag breeder chickens, hardened chicks and slaughter native chickens
- Ongoing

Source: 1 Genandoy, H., 2012  
2 Abamo et. al., 2009

It is apparent from the above table that the initiatives toward the promotion of Darag Native Chicken as an industry have been addressed. However, its long-term sustainability has to be matched with the market. This takes cognizance of the market preference which is indifferent to a particular strain of native chicken. The product attributes sought for by the market are taste, texture, flavor, and health benefits which can be supplied by strains other than Darag.

**Regional Level**

The Department of Agriculture (DA) in Region 6, through the Western Visayas Agricultural Research Center (WESVIARC), has distributed hardened chicks and breeder stocks to the different municipalities of Iloilo Province as part of its Poultry and Livestock Dispersal Program. It also provides technical assistance to the cooperators of the program. The program and project implementation of the DA Regional Office are restricted in view of the devolution of functions of the Department of Agriculture as stipulated in the 1990 Local Government Code.

**Provincial Level**

At the provincial level, there is no rationalized program intended to improve the native chicken industry in the province. With a recognized initiative led by the West Visayas State University (WVSU), it seems that nominal effort is undertaken by the local government unit at the provincial level to complement or supplement such an initiative that can maximize the industry potential. Assistance, if any, is limited to stock dispersal, vaccination programs, and extension work rendered by local agriculturists or technicians.

**Municipal Level**

Initiatives at the municipal level vary across the different municipalities in the province of Iloilo. The nature of involvement ranges from collaboration with other agencies and stock dispersal in the
respective community to provision of technical assistance to the raisers. Two municipalities, however, are identified to have institutionalized the promotion of the local native chicken industry. These are the municipalities of Oton and Cabatuan.

In the case of the Municipality of Oton, Iloilo, the FITS center was established in 2006. It is the only center that focuses on Darag native chicken production as its primary agricultural commodity. Since then, the LGU, through the Municipal Agriculture Office, has set aside a yearly budget amounting to sixty thousand pesos (PhP 60, 000.00) for Darag native chicken-related projects. The Darag native chicken project started in 2007 with the formulation of IEC materials and the sending of participants to the training related to Darag native chicken production conducted for free by the WVSU. Participation in the training is a prerequisite in availing themselves of the Darag native chicken dispersal project of the LGU. In February to September 2010, a total of 35 cooperators were given free 10 – 30 hardened chicks sourced from WVSU and paid by LGU of the Municipality of Oton. The LGU requires cooperators to return at least six hardened chicks as repayment, but so far only three beneficiaries have complied. As of April 2011 it was monitored that the 576 heads dispersed has increased to 1,033 heads. This is aside from the unrecorded number of heads consumed and utilized for other purposes. At present, LGU Oton has continued to send participants to the aforementioned trainings. This has paved the way for the dispersal of 294 hardened chicks out of the 760 heads targeted for 37 cooperators of the Municipality.

In the case of the Municipality of Cabatuan, the LGU initiated the dispersal of native chicken breeding stock in 2009 and 2010. This is in support of the “One Town, One Product (OTOP)” of the Municipality. A total of 825 native chicken breeder flocks were distributed to 165 recipients during the period. Breeder stocks were sourced from traders around the province. Recipients of the project are identified cultural minorities in the community, parents of malnourished children, barangay tanods, families relocated from the site of the existing airport, and typhoon Frank victims. Each recipient was given four hens and a rooster with the condition to return the same number of heads as repayment if the project succeeds. The 2009 recipients had not maintained any record of inventory of their stocks. The stock dispersal in 2010 failed since the breeder stocks bought from the traders were infected by new castle disease which resulted to high mortality.

In June 2011, the LGU, in partnership with the Department of Agriculture, has launched the native chicken production in one of the barangays in the Municipality. The program is aimed to expedite production as it includes the procurement of an incubator and hatchery. The ongoing project aims to disperse hardened chicks among local residents.

Academe

The academe is one of the important partner member agencies of the STBF program for Darag native chicken with funding from the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) through the Western Visayas Agriculture and Resources Research and Development Consortium (WESVARRDEC). Key educational institutions which have been taking part in research and development for Darag native chicken include the West Visayas State University (WVSU), Aklan State University (ASU), Capiz State University (CapSu), Central Philippine University (CPU), Visayas State University (VSU), and the University of the Philippines Visayas (UPV). Notably, WVSU having the Philippine Native Chicken Center, serves as the catalyst of Darag native chicken conservation and production improvement in the region.

The West Visayas State University established the Philippine Native Chicken Center in 1985 with the vision of improving the production and the industry of the Darag native chicken as a whole. The Center becomes a repository of knowledge of Darag native chicken industry in the region. In 1985 to 1996 numerous studies have been conducted by the University on Darag native chicken.

In 1997, PCAARRD funded the collaborative research project of WVSU on the improvement, utilization, and conservation of Darag native chicken in collaboration with UP Los Baños. The conservation project has served as a building block for more researches on native chicken. The project was undertaken for two years. It has conducted several trainings related to Darag native chicken production and introduced the technology of hardened chicks among cooperators.

The S&T anchor program for native chicken was launched in 2005 – 2008 with WVSU as the lead research institution. As part of the project, the University dispersed among cooperators a total of 13,070 hardened chicks from August 2005 to June 2008 (Abamo, et.al 2009). Participation in the training on Darag native chicken production by interested individuals is a prerequisite in order to avail themselves of
the hardened chicks. The University is also the partner implementing agency of Landbank and NEDA in their *Darag* native chicken enterprise which started in 2010 up to 2012. At present, the University is involved in the project for the development of a sustainable production system for *Darag* native chicken specifically on the “Establishment of Sustainable Selection, Breeding, and Hatchery Operation for *Darag* Native Chicken Production.” The project has set the criteria for the selection of *Darag* native chicken entrepreneurs or cooperators of the project.

**Science and Technology-based Farm (STBF): A Case of Darag Native Chicken**

**The STBF Concept**

The Science and Technology-based Farm (STBF) is a project funded by PCAARRD under the Techno Gabay Program. It aims to demonstrate the effectiveness of S&T interventions in improving the productivity and income of the Magsasaka Siyentista (MS) and other adoptors/beneficiaries in the locality through the Farmers’ Information and Technology Services (FITS) Center. The project aims to: 1) improve/enhance processing operations of the *Magsasaka Siyentista* through various S&T interventions; 2) showcase S&T interventions or science-based technologies; and, 3) produce IEC materials based on the results of the S&T intervention.

To accelerate the entry of S&T products into the mainstream market, PCAARRD has simultaneously instituted the TechnoMart Program. TechnoMart is a modality for pushing agri-based products from the communities to the markets. It looks at the interventions needed by the regional products by providing a direction of the agri-based products towards local and global markets. The said program aims to fast track the movement of S&T products from the source to the markets, increase product value, establish and implement business match, synchronize strategies with other sectors involved, and track the road towards the commercialization of the S&T products. It also intends to provide a dynamic venue where S&T products are promoted, markets are assessed, and feedback mechanisms are triggered.

It is envisioned that S&T products under the STBF project must be successfully commercialized through the TechnoMart.

**The STBF Product for Western Visayas**

For Western Visayas (Region VI), it is recognized that native chicken is an important commodity, taking cognizance of the potential in which small farmers can participate. With native chicken as the commodity, small farmers and rural households can participate without necessarily depending on the outside for production inputs. This becomes a very good venue where technocrats can generate or extend appropriate technologies and outside assistance, leaving the production to farmers. The STBF anchor program on native chicken covers the entire Western Visayas.

The project on the development of the Philippine native chicken is about the improvement of animal performance, production, efficiency and value addition to products through the application of scientific and indigenous knowledge without necessarily jeopardizing and altering the existing genetic resource. Specifically, it attempts to map the adoption pathways of organized hardened chicks production and improved free-range management system for native chicken production and factors affecting and influencing adoption.

**The Magsasakang Siyentista**

The identified *Magsasakang Siyentista* for *Darag* native chicken is Mr. Margarito Andrade. His Science and Technology-based Farm (STBF) located in Barangay Libas, Banga, Aklan seeks to 1) produce quality hardened chicks and desired dressed chickens; 2) produce quality native (*Darag*) chicken breeders; and 3) showcase a self-sustaining native chicken project in the locality. Prior to his involvement as MS for *Darag* native chicken, Mr. Andrade has worked as a banker for two decades. He developed an AC-DC incubator prototype in 2003 which can hatch up to 2000 eggs at a time. The establishment of his

---

3 This section is heavily drawn from PCAARRD website and project concept documents
native chicken farm financed by PCAARRD contributed significantly to the production of hardened chicks ready for disposal to cooperators.

Among the significant accomplishments of MS Andrade are the following:

- In 2008, incubated 200 eggs needed by Aklan State University’s Darag station for the Angara-sponsored Darag native chicken project in the Banga Campus;
- Original incubator concept was able to attract some following;
- Advocacy in organic farming, which allows for the use of natural fodder for chickens, intensified his support for the Darag native chicken initiative continuously bannered by WESVARRDEC and by PCAARRD.

Unfortunately, the operation of his farm terminated in June 2010 after the STBF Field Day on Darag Native Chicken.

**The Supply Chain of STBF for Darag Native Chicken in Region VI**

The following is the supply chain of STBF for Darag Native Chicken in Region VI, elucidating the key players, processes and activities, end-product specifications of each key players, value-addition, business function support, and enabling environment (Figure 15).
Figure 15. Supply Chain of STBF for Darag Native Chicken
Key Players and Relationships

The key players in the STBF program include the Magsasakang Siyentista (MS); the Partner Member Agencies (PMAs), namely, WVSU, ASU, and CapSU; and the Department of Agriculture. The MS and the state universities provide or sell hardened chicks to the different adopters/cooperators, individual farmers, LGU dispersal projects, and other non-governmental organizations. From the cooperators and individual raisers, the flow of supply and relationship downstream follows the same path of the conventional native chicken supply chain.

The line connecting the MS downstream of the supply chain is broken since it stopped operating in June 2010. The PMAs led by WVSU continue supplying hardened chicks of Darag native chickens to their adopters/cooperators, LGU dispersal projects, and other clients. The solid line indicates formal contractual arrangements existing among transacting parties. In the case of academe-partners and technology adopters, there exists a formal contract clearly defining the deliverables of the involved parties. The broken line traversing from player to player indicates spot market relations. This relationship is characterized to favor market forces.

Processes and Activities

The distribution of hardened chicks of Darag native chicken to the adopters/cooperators/beneficiaries is a primary initiative in the STBF program. The Partner Member Agencies (PMAs) as well as the MS are responsible for the incubation and rearing of hardened chicks for distribution. The activities commence with the selection of the adopters/cooperators. In the case of WVSU, there is a set of criteria that individual farmers need to meet as well as training to attend in order to qualify. A one- or two-day training on Darag native chicken production is conducted by the University for free.

For the LGU-initiated projects, the requirements is for the availment of the dispersal project vary from attendance in the training, inclusion in the indigenous group of the community, and a typhoon victim. The location where the Darag native chickens will be raised is assessed for suitability. The WVSU and agencies involved in the dispersal provide hardened chicks to qualified individual cooperators. These hardened chicks are 21 – 45 days old and are twice vaccinated before they are delivered to the cooperators. The cooperators have to employ the production technology learned during the training. The PMAs are expected to monitor and supervise the implementation of the project.

The marketing of Darag native chicken from the STBF program follows the same path and activities of the conventional native chicken supply chain. The raiser-cooperators sell their native chicken in their farms through the pantings or in the public market during the municipal market day. These chickens in turn are consolidated by the compradors to the mayor comprador, and finally to the institutional buyers.

Knowledge on End-Product Specifications

At the PMA level, there is an emphasis on the pure Darag strain of uniform color as value offering to the market. The control of chick quality dispersed is ensured by strict adherence to breeding practices and protocols that will result in standard Darag traits. The plumage of the birds is taken as an important indicator as to its purity.

From the perspective of the raisers, they are not particular with regard to the purity of the strain. High preference is credited to native chicken cross-bred of various types that are fast growing, not susceptible to diseases, particularly with high resistance to frequent changes of weather condition. Some would even prefer cross-breeding with other native chicken types like Jolo which is meaty, of bigger body built, and with high resistance to diseases.

Traders and institutional buyers do not require any specifications as to the type of native chicken that will be purchased so long as the dominant feature of the chicken traded is close to native chicken and would generate profit. Plumage is not important to the two groups of players; rather they are more conscious of the weight of the flocks sold. Household consumers prefer to purchase native chickens because of their unique taste, flavor, and possibly organic nature.
Value Addition

Hardened chicks are produced by WVSU and MS, and these are sold at P55.00 per head. Based on the costing of the PMAs, the costs to produce a hardened chick amount to P25.00. These are already vaccinated twice and are given commercial feeds. Cooperators of the University received the hardened chicks for free while LGUs and agencies involved in native chicken dispersal pay the aforementioned amount. WVSU is responsible for the free delivery of hardened chicks to the cooperators. These hardened chicks are grown for slaughter. However, there is no established data on the costs incurred by the PMAs and by the MS on raising chickens for slaughter.

WVSU, aside from its hardened chick production venture, has also tried marketing dressed Darag native chicken at P180.00 per kilo. The pricing strategy employed is value-based and is contrary to the conventional pricing mechanism that is based on a buyer’s subjective assessment. There is no additional marketing cost involved since customers are walk-in buyers.

In the case of individual cooperators and traders, they are integrated in the market with the same value-adding activities as the conventional supply chain of native chicken.

Business Function Support

The business function support extended to the STBF program includes input provision in the form of hardened chickens and improved breed of native chicken. There are also financial supports extended in the form of loans to the cooperators by the QUEDANCOR, Land Bank of the Philippines, DA-NAFC, and LGUs. The human resource support available to the program includes the conduct of native chicken production training for individual cooperators of the project.

Marketing support across different value-adding activities along the supply chain is still wanting. It is incorporated as a component under the training program.

Enabling Policy

Aside from the national direction to develop the Darag native chicken industry in the region, the local government units concerned allocate funds for the dispersal project of native chickens and PMAs provide counterpart funds in the research and development of Darag native chicken.

ISSUES AND CONCERNS

Production

The key issues in native chicken production are high mortality and low productivity resulting in meager economic returns for the raisers. As discussed earlier, several programs and projects had been initiated through the MS, academe, and various government organizations, but it seems that the S&T-based production system had not trickled down to the raisers. Most of the raisers are still employing traditional free-range production practices.

Consistently, according to Chang (2007), several literatures noted that advances in technology do not benefit backyard raisers due lack of access to important inputs such as high quality stock, credit, and extension services. She further noted that studies show that backyard raisers are not interested in extension services or new technology for there is little incentive because of little gain from a very small production base.

One of the primary interventions of STBF to improve native chicken production in the region is the production of hardened chicks for distribution to the cooperators. However, production of hardened chicks requires a relatively more sophisticated level of technology and financial requirements cannot be afforded by most supply chain participants. Moreover, the STBF of MS has not spun off nor has impacted the Darag native chicken industry in the region through spillover effects to highly fragmented myriad raisers. The technologies that are used which primarily include the use of indigenous feeds like marande leaves and the duckweeds and the introduction of incubator are not replicated. Further, the steering project from the supposedly conceptualized STBF as a catalyst to push the Darag native chicken into a TechnoMart
product was hardly established, given the loopholes in the implementation and operation of the MS which ultimately stopped operating in June 2010.

The failure of MS to sustain the operations left the WVSU as the only provider of the hardened chicks in the province. In retrospect, WVSU is observing strict adherence to pure-bred Darag Native chicken which is divergent to the preference of the market. Further, it was also observed that the occasional introduction of vaccinated hardened chicks in the farms has increased vulnerability to diseases of the unvaccinated existing stocks resulting in high mortality.

Given the inherent biological characteristics of native chickens, the unpredictable and extreme weather condition due to climate change affected their breeding prolificacy and aggravated the prevalence of diseases, decreasing production, if not totally wiping out all the stocks. This redounds to uncertainty and pronounced seasonality of supply which leads to the disparity in the prices of native chickens at the disadvantage of raisers as price takers.

In addition, operational efficiency in production is wanting, considering that the entrepreneurial mindset was not entrenched among native chicken raisers. They are not keen on recording cost of production, income from sales, and maintenance of financial records which served as bases in evaluating business performance and enhancing profitability given the limited resources. In fact, even the MS was not able to maintain financial records despite the fact that it is one of his deliverables for the project.

Marketing and Logistics

According to Costales (2003), access to market and market information, high transaction costs, and poor bargaining position are some of the marketing issues confronting the backyard poultry producers. The same concerns are faced by the native chicken raisers in the Province of Iloilo.

The survey showed that market information is asymmetric with raisers as price takers, considering the apparent collusion among traders. As discussed earlier, most of the raisers do not sell their native chickens to the final customers but rather pass through intermediaries. The raisers have no control on how and to whom native chickens are to be sold. The current modality of selling native chicken by raisers, which involves individual transporting to the trading areas and transaction with the pantings, does not maximize the benefits of economies of scale. There is no observed entity that consolidates or pools the produce before it is integrated in the market. This can possibly reduce the transaction cost and increase the bargaining power of the raisers.

The native chicken industry is so fragmented that shared perceptions on the key product attributes by the supply chain players is non-existent. As mentioned earlier, the PMAs are into pure-bred Darag native chickens while the market is indifferent of the strains as long as it can generate profits for the key players consisting of raisers, traders, and institutional buyers. Thus, the latter preferences are the cross-bred native chickens that are fast growing, not susceptible to diseases, and resistant to frequent changes of weather condition.

The problem in marketing is further worsened by the absence of standards. The trading of native chicken is on a per head basis and not by the kilogram; thus the weighing scale is absent in the trading area of live native chicken. Notably, the customary practice of classifying or grading the live native chicken (i.e., Pisú, Tamanyo, Dresson, and Arrozcalduhon) is heavily based on the subjective assessment which is acquired from the years of involvement and experiences in trading native chicken. The key players have reservations on the use of a weighing scale since it is allegedly not suitable and reliable, considering the innate characteristics of native chicken where some chickens have a small body but thick feathers or otherwise which affects pricing.

Live chickens are transported by compradors or mayor comprador usually by motorbikes and some through public transport. The delivery time to the institutional buyers, who are usually located at the heart of the city, is at least an hour and may vary depending on the place of purchase. There are incidents of chickens dying due to severe heat and overcrowding during transport. Product handling that will preserve product quality and one that may capitalize on economies of scale remain a challenge. Mortality rate during the travel time could account from 2 – 5% of the total number of flocks purchased. These industry norms do not only result to significant increase in overall systems cost but also decrease customer service satisfaction level through reduction in over-all product quality, product consistency as well as inventory reliability. Moreover, though currently a non-issue, the practice breaches the animal welfare rights.
No institutional slaughtering facility exists to slaughter/process native chickens in contrast to hogs and big ruminants. Slaughtering of live native chickens is usually done at home before it is delivered to the supermart or for stall display. Retailers of live native chickens in public markets slaughter the native chickens instantly at the request of their customers. There is no concrete safety control measure that could facilitate the identification of disease-infected chickens for the assurance of the consuming public and investors. In the absence of technical know-how in the determination of health condition of the flocks, food safety and health issues are compromised. This is in addition to losses in investments attributed to the reduction in the quality of stocks.

Trading areas are of immediate concern in the native chicken industry. Albeit the local governments collect market permits from the traders and benefits from the industry, there is no established definite area allocated for trading of live native chickens except at the roadsides and street corners. Displacement and poor market facilities for native chicken trading are common complaints received from traders.

CONCLUSIONS AND RECOMMENDATIONS

The study of Conroy et.al. (2005) on improving backyard poultry keeping in India suggests that there is plenty of scope for improving the traditional scavenging system with simple and low-cost technologies. Traditionally, native chicken are kept in smallhold farms; however, with the application of science-based interventions, the potential of the native chicken as sources of sustainable livelihood can be improved. The view of improving the supply chain of the native chicken in general and Darag strains in particular would necessitate certain S&T interventions that have to be implemented.

In the S&T-based technology being promoted by PCAARRD through the MS and R&D projects of academe Partner Member Agencies (PMAs), the specialization of function exists in contrast with the traditional technology of raising native chickens where chicks are produced by the raisers themselves. It is interesting to note that MS and the PMAs carried out an important task of supplying the critical input which is the hardened chicks. In addition, under STBF technology adopted in the raising of stocks until marketable size considered: 1) housing; 2) selection of breeder stocks; 3) management of breeder stocks; 4) feeds and feeding management; 5) health management; and 6) marketing. The STBF concept has expanded the profile of the native chicken producers from one that is dominantly family-based to one that includes individual agri-based entrepreneurs, LGU, and other technology adoptors.

The sustainability, however of the STBF as a modality in fast tracking development of the native chicken industry has to be further probed. Elements that require focus are the following:

1) Selection of the MS. In the case of Darag native chicken, the MS did not prosper in performing the task as conceptualized (i.e., stopping before the project is over, failure to document farm activities and corresponding costs and revenue; etc.);

2) Provision of safety nets to guarantee the success of the project. The damage brought about by typhoon Frank in 2008 devastated stocks and records of the project such that cooperators have difficulty in recovering and rebuilding the project after the catastrophe.

On the other hand, the R&D projects of PMAs showed significant contribution to the improvement of Darag native chicken production in the region. The R&D projects, however, focus on the production of Darag native chicken which is not aligned with market preference. While there is consciousness and strict adherence among PMAs on the specificity of the type of native chicken to be provided to individual raisers and to the market eventually, which should be the Darag native chicken, traders and downstream players are not very particular about the purity of the strain to be purchased and supplied to them. For individual raiser-cooperators, the preference of high resistance to disease and the fast growing type of native chickens are favored. The idea of cross breeding of Darag to other native chicken type is therefore possible, given the aforementioned market behavior of actors towards the finished product. Existing R&D on Darag may be continued to preserve endogenous breeds like Darag. However, initiatives have to be explored to determine cross breeds that may satisfy customers’ wants yet be profitable on the part of farmer-raisers. Perhaps the appropriate track would be R&D, then R&D utilization, and then TechnoMart. The success of a number of cooperators affirm that it could be another track to expedite significant competitiveness and profitability gains in Darag production through the utilization of appropriate technologies.
On the prevalence of high mortality for hardened chicks raised in higher densities, hatchery operations in view of technology requiring an all-in and all-out production system must be thoroughly studied. By adopting the new technology being introduced, grow-out operations for native chickens need not be in the same geographical locations where they are produced. Transfer of hardened chicks to production sites put them into an unnecessary stress, eventually leading to mortalities. A mechanism transfer without subjecting them to stress must also be developed.

The sector cannot afford to set aside S&T interventions during the critical months (March to August) of raising native chicken. As mortality and diseases are widespread within the said period, this should be reciprocated with concerted efforts of involved agencies and technical experts to formulate intervention necessary to address the problems which may be in the form of the technological aspect or raising practices. For now, the least that the study could recommend is the modification of the practices of raisers which include the confining the flocks, culling the disease-infected heads by the raisers, and making biologics particularly vaccination available for them.

There has been a poor monitoring system in various dispersal projects implemented by various agencies. An indispensable effort to monitor on a regular basis the various dispersal projects initiated is a must.

Numerous literatures highlight the role of information as vital in achieving full industry integration in the context of forging strategic alliances among industry participants. However, in the case of the native chicken industry in Region VI, data on the demand, consumption, volume and value of production of native chicken is absent. There is dearth of empirical studies quantifying demand as well as documenting consumer behavior and market specification. Knowledge regarding the quality end-product specifications varies from one supply chain participant to the other; thus, the shared perception of the specifications demanded by the market is non-existence. On value-addition, except for the value paid by cooperators to the hardened chicks produced by the input suppliers and to the marketable size native chicken by the end users, no data exists. The data to document the costs under the STBF is assigned to the MS but such data was not gathered. This information is vital in the design of market-responsive and technology-based value offering. As such, it is recommended that a thorough market study be conducted to characterize customer demand and generate other relevant data. This information should be established to configure appropriate supply chains.

At present, there are limited product forms of native chicken available in the market. These products which are usually catered by restaurants, are usually expensive for the general public and limit household daily consumption especially among the lower income group. The study highly recommends the experimentation of other products aside from the usual menus offered by restaurants and incorporating household preferences. R & D on native chicken product forms has to be explored and perhaps additional product forms have to be created to increase per capita consumption. Entry of the commodity to additional market outlets must be initiated.

On business function support, analyzing the supply chain in the context of the business function elements, would make it appear that every business function was properly addressed. The question of whether business assistance has reached the industry players has to be probed as well.

Finally, under the TechnoMart Program, the following are recommended: 1) incorporate opportunity-seeking skills among project participants. It was noted that the individual business function for the native chicken industry to thrive was appropriately addressed but entrepreneurial skills are still wanting. 2) a thorough market definition has to be designed (who the consumers are, willingness-to-pay, characteristics, etc.) and an appropriate chain will be designed to capture the derived value proposition; and 3) activation of Marketing Intelligence System to streamline the information flow, eventually reducing transaction cost. (i.e., FITS may be activated or an investment facilitation arm under the TechnoMart Program may be institutionalized).

REFERENCES


PCARRD-DOST.2007. Profitability analysis: 200-hen Module Native Chicken Production. . Los Baños, Laguna


Western Visayas Agriculture and Resources Research and Development Consortium (WESVARRDEC). WESVARRDEC Science and Technology Agenda 2011-2016.