



FROG VALUE CHAIN CASE STUDY IN HO CHI MINH CITY VIETNAM

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ABSTRACT

Frog is valuable product in Vietnam but the natural frogs are overexploited thus, the new model to raising frog is desired. Many species of frogs are cultured in Vietnam, especially in Ho Chi Minh City, for trial of the adaptive ability of exotic species in Vietnam condition. Recently, the frogs' species from Thailand and Taiwan are prepotent and spread out Vietnam. Nowadays, frog culture becomes one of the newest industries in Vietnam. With a short life cycle, frog culture is farming as economic efficiency for farmers to get return. However, being a new industry, it is quite hard to manage the supply chain of frog. Developed from 2000, this industry production has been growing up and down many times due to the spontaneous development of farmers. Recently, frog farming has new potential horizon to progress firmly. There are new potential partners from US, EU, Taiwan, etc cooperating with Vietnamese farmers for lasting cooperation. This study tries to apply the theory of value chain to analyse the activities of participants along the linkages of frog farming around Ho Chi Minh City. Moreover, the fluctuation of the final price of this product is the biggest problem of farmers. There are many farmers who have to quit this industry because of the fall of price. Of course, the output price is impacted by many internal and external factors thus I want to point out the causers of the inordinary change of price and suggest solution for that.

Supply chain of frog in Ho Chi Minh City is made up by four main actors: The hatcheries, the frog farmers, the whole salers and the retailers. Most of frog farmers are small scale and they raise frog with other aquatic products. Besides, the supporters such as medication, feed suppliers, and processing factories also adhere this chain and build up the added value for the final products of frogs. However, frog processing is not developed in Vietnam thus the export volume of this product is limited. Most of frogs are supplied directly to the market for consumers.

This study has represented the map of frog value chain in HCMC, analyzed the cost and benefit of frog based on the data of farmers' budget and the transmission prices along the chain.

The superprofit and low cost of frog culture attract many farmers join in frog industry but the risk of unstable price let them give up quickly. Hatchery farm achieves more than 100% profit from selling juvenile for farmers. The farmers can obtain a profit of 0% to 250% per kg of frog. The net profit of wholesaler and retailers are more stable.

About 11% of the frog value is added by the wholesalers and 17% value is added by retailers.

This study is conducted mostly in Son Ca Farm, Hoc Mon Distreet. Data is collected from many sources, most of them are primary data surveyed by questionares.

Keywords: Value chain, costs and price analysis, risk analysis, frog farming.

ABBREVIATIONS

APP	Average Physical Product
CPI	Consumer price index
DARD	Department of Agriculture and Rural Development
HCG	Human Chorionic Gonadotropin
HCMC	Ho Chi Minh City
MPP	Marginal Physical Product
SWOT	Strengths, Weaknesses, Opportunities, Threats matrix
USD	United States Dollar
VCA	Value Chain Analysis
VND	Vietnam Dong (1USD=20,860VND in April, 2012)

1. INTRODUCTION

Thanks to the natural condition, Vietnam is dominant in aquaculture with plenty of valuable products. Vietnamese farmers always examine new models for new species to apply in practical farming. Frog culture is applied in small scale farming system around Ho Chi Minh City from 2000 and considered as profitable industry. Frog can be cultured rotatorily in artificial pond or raised with rice crop in the field. Frog is supplied to Ho Chi Minh from many sources around Ho Chi Minh City. Mekong delta, especially Dong Thap Province has the highest quantity of frog supply. Compared with shrimp culture, frog farming is easier with higher potential of profit. Shrimp farming have to faces to the high mortality rate. Shrimp is very sensible with the change of pH in their environment. The rain can destroy all shrimps within one night. When the shrimps are diseased, the pathogen spreads out quickly and all of the shrimps seem to be valueless. Meanwhile, frog mortality rate is less than two percent and the resistance of frog is better than shrimp. Technically, raising frog is so much simpler than shrimp culturing. However, small scale farming always copes with many challenges particularly the unstabilized price in the market. From 2010, the price of frog is more stable and increased steeply due to the spreading of the market of frog. The development of frog farming meets the demand of export that causes the increase in demand of frog in Ho Chi Minh City. Frozen frog's thigh is a new product in Vietnam which has high potential in international market.

Daily frog's yield in Ho Chi Minh is about 36 tonnes and most of them are distributed by wholesalers and retailers. Frog from provinces around Ho Chi Minh City such as: Tay Ninh, Dong Nai, Dong Thap, Tien Giang, Vinh Long, Ca Mau is transported to Binh Dien Market ¹. If the price is 48,000VND/kg, each kilogram of frog gets about 14,000VND profit back to farmers. Frog of Vietnam is planed to be exported and some agricultural companies are thinking about applying model for frog processing to export frozen frog' thigh.

On the world, raising frog is not popular and their quantities in commercial are limited. In America, bullfrog is raisen for food in Virginia but unsignificantly. Africa has developed frog raising industry and export frog's leg as agricultural product. However, frog quantity is

¹ Binh Dien is located in Binh Chanh district. This is the biggest wholesaling market supplying all agricultural products to Ho Chi Minh City.

inconsiderable, and their production in the world is humble compared with other seafood products such as tuna, cat fish, etc.



Figure 1.1: Map of South of Vietnam

[Source: <http://www.hotelvietnamonline.com>]

From the North, Tay Ninh, Binh Phuoc, Binh Duong, Dong Nai are provinces raising frog for Ho Chi Minh City. In the south, most of Mekong delta provinces supply frog to Ho Chi Minh City, especially, Dong Thap and Tien Giang.

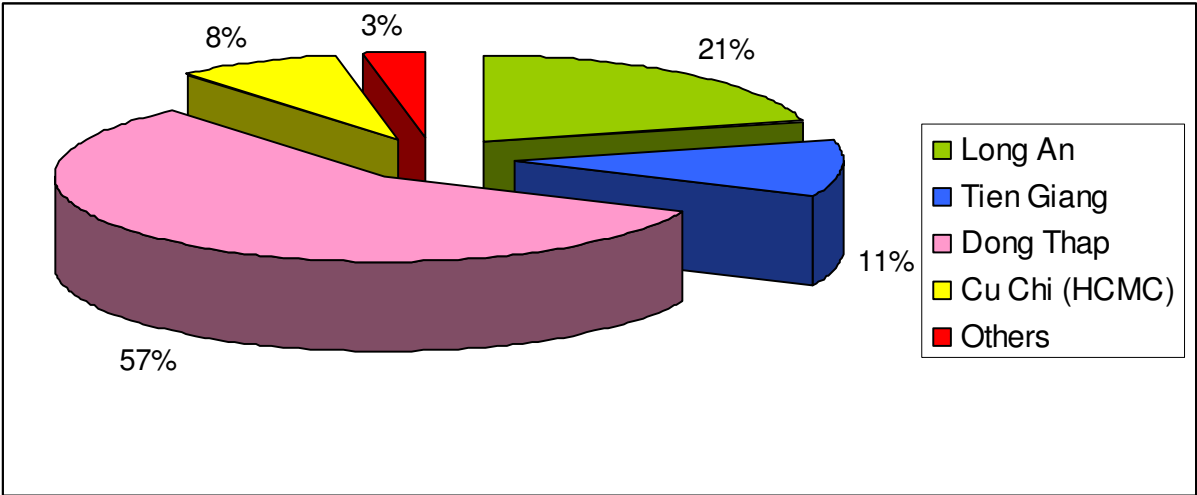


Figure 1.2: Quantities of frog supplied from provinces

[Source: Collected by author]

Most of frogs in the market Ho Chi Minh City are supplied from Dong Thap Province. Dong Thap is the leader of agricultural products both in quantities and species. In Long An and Tien Giang, agriculture is dominant and farmers have long experience with frog culturing. Cu Chi province develops raising frog on land so they also got skills and experience in this pattern. Dong Nai, Binh Duong and other provinces have supplied frog for Ho Chi Minh City but limit in quantity.

As I discuss above, raising frog is profitable but risky because the price of frog is fluctuated. Tropical countries such as Vietnam and Thailand have two seasons and the price of frog depends on these seasons. The wet season (from March to September) is the “properpous season” of frog and other aquatics. In this season, frog can bear and spawn naturally due to the properpous of frog. When the frog is abundant, the price of frog will be low down. In the inverse season (from October to February), especially in the winter, frog merely spawn because of the coldness. In the cold season, frog accumulates fat around their abdominal cavity so they become yield.

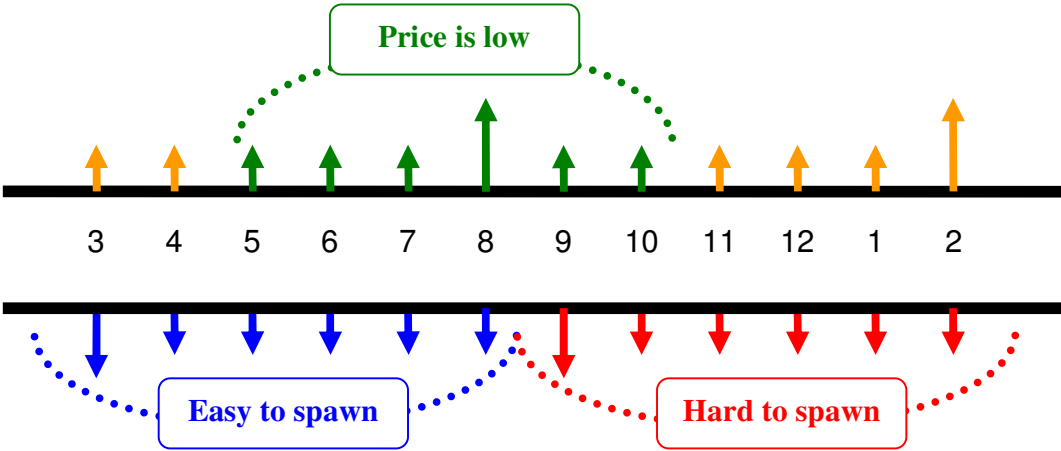


Figure 1.3: Timeline of the frog’s price and frog’s physicals

[Source: From survey]

Female frogs are easy to spawn on March and they can lay out their eggs easily in June. Tadpoles need two months to grow up therefore frog will be thriven in August lead to the fall of the price of frog at that time. After August, frog will accumulate fat to protect them from the coldness in winter so they can not lay out their eggs in the inverse season. In the end of winter, tadpode is very rare lead to the lack of frog in the next spring, particularly in February. Law of supply and demand will push up the price of frog at that time and farmers get more profit in the inverse season. However, to earn more profit in the inverse season, farmers have to raise the frog parents in special condition to force them spawn in the cold weather.

Technically, frog farming is efficient and riskless. Farmers are easy to cover the costs and earn profit from farming frog. Frog is easy to be fed and taken care and they do not require high technique like the other aquatic products. However, farmers must actually cope with the fluctuation of the frog price on the market. How to control the price and increase the benefit for both producers and consumers involved the value chain? What should we do to improve this situation? This study is conducted to point out the solution for frog value chain in Vietnam, especially in Ho Chi Minh City.

Objectives of the thesis

Farmers are easy to be ruined because of the price fluctuation. To achieve above issues, this stuty focuses on specific objectives as follows:

1. Analyze the structure of Frog value chain in Ho Chi Minh City, Vietnam.
2. Determine the cost and benefit of each stakeholder along this value chain.
3. Analyse price transmission in the frog supply chain
4. Analyse the risk of frog' price chain and solutions.

Thesis structure

This thesis concludes 6 parts

Chapter 1 provides the introduction with the general information about frog market in Vietnam, the problem statement, the objectives and methodology procedure.

Chapter 2 contains general information of frog and frog farming.

Chapter 3 mentions the theories of value chain, price transmission, and risk analysis.

Chapter 4 is the methology used in this study

Chapter 5 presents the results of performance analysis.

Chapter 6 is the conclusion about frog industry.

Chapter 7 is the reference of this research.

Limitation and Assumption

In this study, I want to illustrate the budgets of all actors in this value chain. However, there are some reasons limiting my research. I can not expose the budgets of wholesalers, retailers and processors because the scale of this industry is still small. Frog is not the main products of wholesalers, retailers and processors. The wholesalers collect frog with other aquatic products and retailers also sell frog with other fishes. Processors do not consider frog as the main products of their factories. Frog is usually processed when they are plentiful. When the frog is rare, their quantity is not enough for processing. Processors must switch their targets to balance the processing scale.

Recently, the inflation in Vietnam is very high thus the CPI climbs up fast in last year. This is the biggest problem for me to collect the data of prices and costs since the price has been increasing continuously. This problem also impact on the data analysis of this study.

The price of frog is fluctuated daily thus the data I collect are the average. The prices of costs also increase due to the inflation in Vietnam so I update the new price of costs in 2012 to analyze this study.

2. GENERAL BACKGROUNDS

2.1. Frog and its biological properties

Frog is an amphibian animal with short body and no tail. It means that frog can live both in the water and on land. They can move under water easily because of webbed. Most of frogs have protruding eyes and strong legs which help them jump exceptionally. Because of semi-aquatic characteristics, their skins are permeable membrane to help them exchange oxygen and carbon dioxide in water. Life of frog has two different phases. Mature frogs live both on land and in water but their larvae most live in water. Female frogs spawn their eggs in water such as puddles, ponds or lakes. Frog's larvae, called tadpoles, have gills and tails and live in water as fish. Their prey is plankton and other small larvae in water. When tadpoles grow up, their tails will disappear and their lungs will develop for landed respiration. However, adult frogs can respire under water by skin as well. Bloodstream under frog's skin can absorb oxygen transmitted directly through skin. Like other reptile, frog has three-chambered heart so oxygenated blood from the lungs and de-oxygenated blood from the respiring tissues are mixed in the ventricle of the heart. Frog has lungs but they mainly exchange oxygen by skin. They can't live without humidity or water. If their skins are dry, they will be dead.

Frog, *Anura*, is divided in 33 families such as, Leptodactylidae (1100 spp.), Hylidae (800 spp.) and Ranidae (750 spp.). It is said that 88% of amphibian species are frogs. Until now, scientists have discovered 4810 species of frog in over the world.

There are some important properties that we have to take care when raising frogs.

Firstly, frogs hide in holes in the dry season and mating in the rainy season. If we want them spawn in the dry season, we have to create the suitable environment for them to mating and spawning. Secondly, frogs are very sensible with sound, keep them far away from noise to help them grow up well.

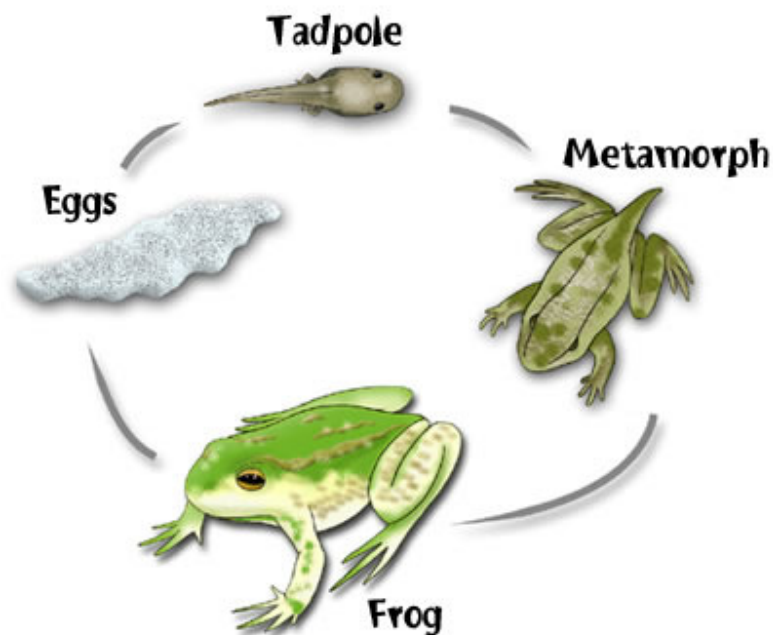


Figure 2.1: Frog life cycle

[Source: <http://www.ourclassweb.com>]

Frog life cycle has four stages but separated into two phases: the water phase and the land phase. Frogs can not live without water but their lives have two main avatars. Eggs and tadpoles must develop in the water. This is the water phase of frogs. When the tadpoles have legs, their lungs also develop and they can live on land. They are called metamorphs and start to move up to the ground but need water or humid condition to survive.

2.2. Frog framing operation

Recently, Thailand frog (*Rana rugulosa*) is popular in Vietnamese farms because of its specific characteristics. Frog from Thailand does not only growth well in Vietnam but also easy to feed. Natural frog can not be fed because they do not consume static food. If you give them fish feed or other artificial food, they will die in hunger. Thailand frog is different. They can eat static food as other aquatic animals. One more benefit of Thailand frog is the short life cycle. They can be harvested after two months. There are many benefits from frog farming that I will introduce you in the farming operation.

To raising frog we need the seed of the frog. This section will show the whole procession of raising frog. We will start with the seed.

2.2.1. Hatcheries operation

Seed rising needs good parents so farmers have to choose the healthy mature frogs for hatchery. The parents are put in the pond with the coupling ratio 1:1. It means that one female can mate with one male. The pond is about 20 m² thus farmers can put 20 couple in one pond. The density in hatchery pond is 2frogs/m². The male cries continuously during the mating period. Four days after mating, the female will spawn their eggs along the waterside of the pond. Frog eggs have the cycle shape and link together in a chain or a bunch. It is very easy to distinguish the eggs of frog due to the long mucous string suspending in the ponds, lakes or rivers.



Figure 2.2: Frogs' eggs

[Source: <http://www.chicagowildernessmag.org>]

The frogs' eggs have two parts as other eggs. The core contains most of nutrient for new tadpole to grow up. The eggs of frogs have two poles. The animal pole containing the embryo is black and up and the nutritious pole is down. The new tadpoles can break the boundary within 24 hours after spawn. The mucous membranes cover eggs to protect them from physical impactions.

To hatch the eggs, farmers need a hatchery box covered by silk or nylon. The box dimension is about 90x50x25cm. This dimension is not important; just keep the density around 15,000individuals/m². Farmers fulfil hatchery box with water and put the eggs into this box carefully for hatching. The temperature must be controlled around 23-27°C. If the temperature is higher than 33°C, the eggs can be addle. Farmers can also leave the eggs in the ponds and polliwogs will grow up in those ponds. However, hatching in box is better for farmers to control the quantity. After 18-21 hours, the new polliwogs will break the cover to swim. During hatchery period, farmers refresh the water 4-5 times. After 2-3 days, the tadpoles can find food for themselves actively.

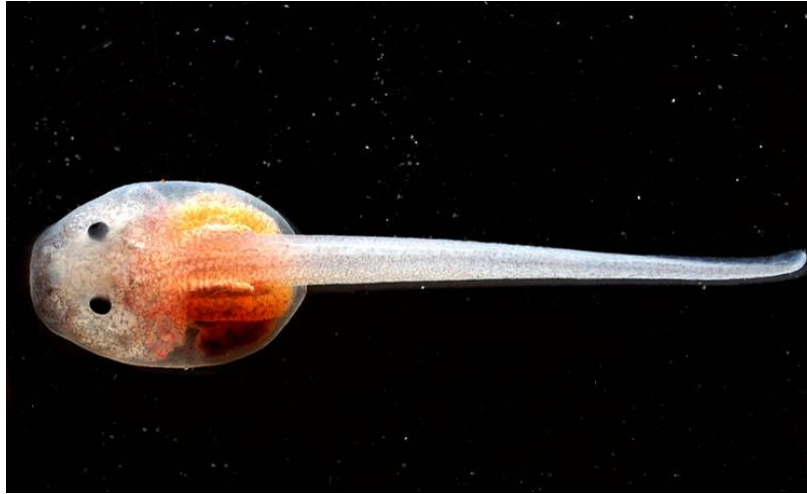


Figure 2.3: Tadpole after hatching

[Source: <http://www.frogforum.net>]

The red abdominal marsupium under its belly is nutrition. Tadpoles consume it to survive in four first days then he will chase plankton for food independently.

At this time, farmers will put tadpoles in the pond to culture them as the seed. The pond must be clean by lime and fulfil with fresh water and fertilizer. Nitrates and Phosphates are essential for plankton which is the food for tadpoles. Sometimes, farmers feed tadpoles with the red of chicken eggs. Two environmental indexes that farmers have to care for tadpoles are pH and degree of salting. pH should be in range 6.8 – 7.5 while degree of salting must be controlled under 1%. Tadpoles and frogs are very sensitive with salt concentration in water. They will be dead if salting degree is greater than one percent. Temperature is easier to control. Frogs and tadpoles grow well in Vietnamese weather. When tadpoles are put into ponds, density is 15,000-20,000/m². After eight day, farmers have to resize the density: 500-1000/m². Mortality ratio of tadpoles is fifty percent. Beside plankton, farmers feed tadpoles with animal protein and cereal powder in the ratio 1:4. For 10,000 tadpoles, farmers need 0.5-1.0kg/day. After 25 days, all tadpoles will have legs and become small frogs. Total days for a frog egg grow up until it has legs is 28 days. This period depends on the weather and temperature. In Tay Ninh province, tadpoles need 22-28 days to grow up but in Hoc Mon or Dong Thap province, tadpoles needs 28-35 days to become small frogs.

When tadpoles lose their tails and get their own thighs, the seed raising period is over. Now, the juveniles are ready for frog farming.

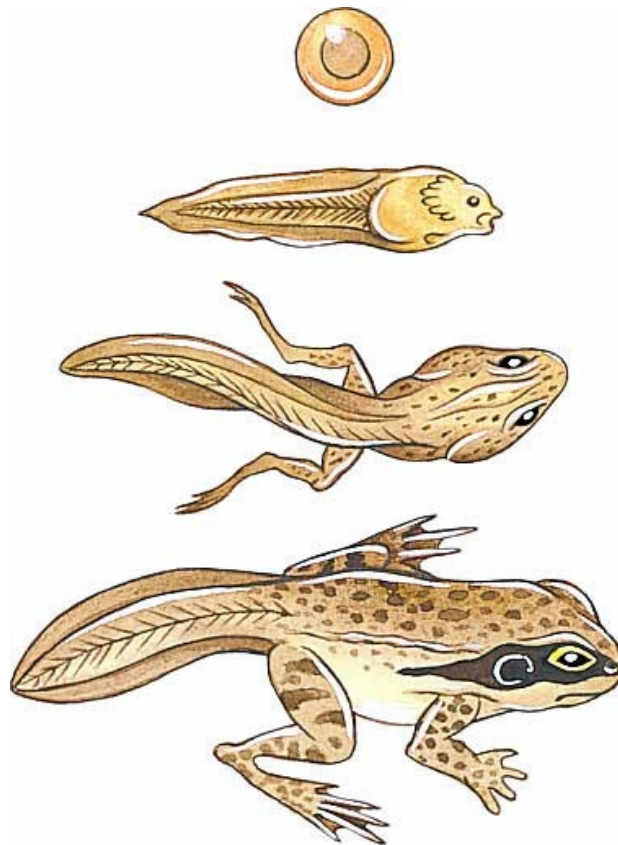


Figure 2.4: The four-stage development of tadpole from egg to small frog

[Source: <http://images.yourdictionary.com/tadpole>]

In the winter, frogs have to accumulate fat to protect them from the coldness so they can not spawn at this time. Farmers need a green house to create a warm condition for them to spawn. The green house is made of poly propylene plastic sheet. Poly propylene sheet is hung up as the wall and the roof of the pond. The green house effect will warm up the environment for frogs to spawn easily in winter. Human Chorionic Gonadotropin (HCG) is injected to the parents (both male and female) to make them copulate and spawn.



Figure 2.5: Ponds covered by poly propylene plastic sheet

[Source: <http://nongdan24g.files.wordpress.com>]

2.2.2. Frog farming for market

Frogs can be raised in cement ponds or in the plastic sheets. It depends on the budget of farmers. When the juveniles have legs, they are ready to be cultured as adult frogs. Industrial feed and living organisms such as small worms, small fish, small shrimp, etc...which are smaller than their mouths are perfect food for them to consume. Frog is about 2-5gram and density is 100-150 individuals/m². Farmers feed them twice per day and 50-100gram/100individuals/day. When the frog grows up to 20-25gram, density must be reduced to 40-60frogs/m². Mortality ratio of frog is less than two percents if they are taken care well.

The water in ponds must be refreshed usually and the level of water in ponds is lower when the frogs are larger. Rain is natural problem of raising aquaculture products. Raising frog has to pay attention to the rain as well. The rain contains acids thus the pH in water will be reduces. Farmers can not use lime to control pH in ponds directly because frog is very sensible of lime. Hence, the ponds must be refreshed immediately after the rains.



Figure 2.6: Raising frog in cement pond (left) and in plastic sheet (right)

[Sources: <http://agriviet.com>, <http://suctrebinhphuoc.com>]

In the center of the ponds, farmers put wood pallets for frogs to get out of the water. Because of the amphibian characteristic, frog needs water and land. The wood pallets are the land for them.



Figure 2.7: Wood pallet for frogs in ponds

[Sources: <http://nongdan.com.vn>]

2.3. Diseases and Therapies

As other creatures, frog also has some problems about diseases that farmers have to take care. The treatment for frog increases the variable costs of farmers during commercial farming period. Some popular diseases of frog are:

Table 2.1: Frog diseases and therapies

Disease	Cause	Diagnostic	Treatment
Indigestion	The food is rotten. Water is uncleansed.	Frog's venter is intumescd. Frog can not move.	Stop feed them in 2 days. Immingle Sulphadiazine and Trimethroprim in their food. (4 - 5g/kg food). Feed them continuously within 5 days
Dysentery		Frog's excrement is white. Frog's anal has blood	Grind Ganidan and mix it with food for frog. One pill per one kg food. Reduce the food quantity 50%. Feed them continuously within 4 days
Leg ulcer	The appearance of Aeromonas hydrophila bacteria in uncleansed water.	Frog is slow and does not eat well. Red spots appear on skin and thigh.	Mix Norfloxaxine 5g/kg food or Oxytetracycline 4g/kg food. Put the diseased frog in iodine solution (5ml iodine/m ³ water)
Helminthiasis	Worms	Growth rate is low	Use helminthic with food.
Head and eyes disease	Pseudomonas sp bacteria	Frog eyes are intumescd. Frog's head is turned back.	Remove the diseased frog. Clean the ponds.
Fungi disease	Achya sp	White fungi grow on the frog's body	Wash the frog by formalin (2-3ml/m ³ water)

[Source: <http://agriviet.com>]

2.4. Economics of frog farming

The graph below is the production function of frog farming. In general, production function is the relationship between the inputs and outputs during processing period. Production function implies the level of technology in producing and reveals the efficiency of production. Inputs include feed, ponds, chemicals, services, labours, time, etc. Outputs are physical materials such as length, weight, etc. It could be the yield or the quality of products. The algebraical form of production function can be written as:

$$Y = f(X_1, X_2, X_3, X_4, \dots, X_n)$$

Where:

Y is the output variable.

$X_1, X_2, X_3, X_4, \dots, X_n$ are input variables

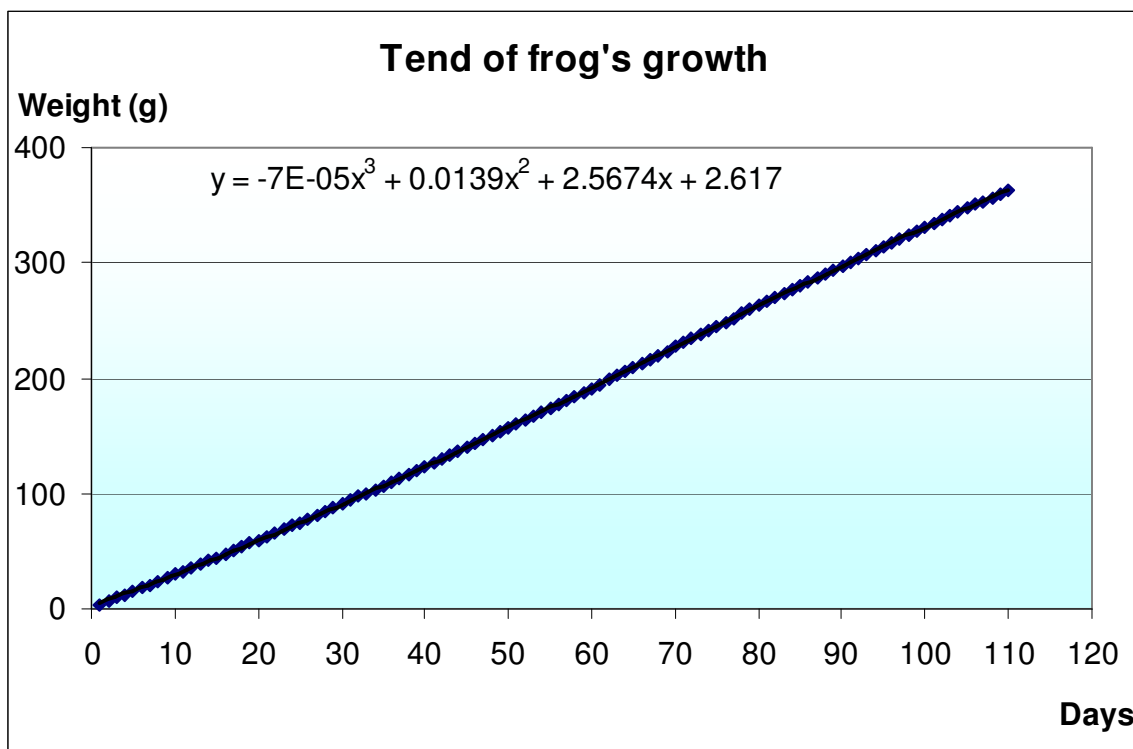


Figure 2.8: Physical growth of frog

[Source: Bao Huy and Cao Thi Ly 2011, Frog farming's techniques and Efficiency]

All biological processes have to follow the law of diminishing returns. Frog's production function also has four stages like others biological function. Assume the inputs is increased continuously and other factors keep constant. The four stages of biological process are:

-Output increase at an increasing rate.

-Output increase at a decreasing rate.

-Output can not increase more.

-Output declines.

According the data above, the frogs increase at increasing rate during first 66 days. Then, they will increase at a decreasing rate from the 66th day and touch the maximum level after a year. The frog will declines after one year raising. To get highest return, farmers usually sell frogs after two months.

An important note in this graph is the start point. The first day in this graph is the day farmers begin to raise the juveniles for marketing since this is the tend frog farming. At the first day in this graph the frog is 25-28 days old and weigh 4 gram on average. Since this is just a introduction of frog farming efficiency thus I stop this chapter in here. I will explain more detail about the deadline of frog farming in the result chapter.

3. LITERATURE

Value chain is not unfamiliar with the business or economic researchers. This theory is firstly proposed by Michael Porter in *Competitive Advantage: Creating and Sustaining Superior Performance*, in 1985. This chapter shortly introduces the concept of the value chain, the development of this concept and its application in economy. The overview of the development of the value chain concept in the past shows the essentiality and the adaption of this theory in economic researchs.

3.1. Definition of Value Chain

The terminology “value chain” was firstly proposed in *Competitive Advantage* published in 1985 by Michael Porter. Value chain or supply chain implies the link of related activities involved in the goods productions to provide higher value for customers. The added value makes profit for producers and gains benefits for consumers. Nowadays, value chain is applied in every fields and its implementation spreads out over the world. The main core of value chain implies that no company can stand alone without the link with others. Each stakeholder becomes an essential element in the connected chain of the supply chain and any action of each element will impact the rest of the chain. The products pass through activities of the value chain and obtain added value from each fraction while each activity has gained some certain profit from processing products. The value chain analysis concerns the activities and how to improve the chain to acquire highest value for customers and producers. The added value created from the chain of activities is more than the sum of the independent value of each activities working without link. Value chain is classified into two levels. The firm level is limited inside a company or a factory. Value chain at firm level analyze added value base on the infrastructure of the firm. The higher level is industry level. The value chain (or supply chain) at industry level is expanded out of one firm. The industry value chain is a chain from the raw material to the final products. This chain needs more than one actor to build up the value for products. The chain connects all actors involved the products processing both vertically and horizontally.

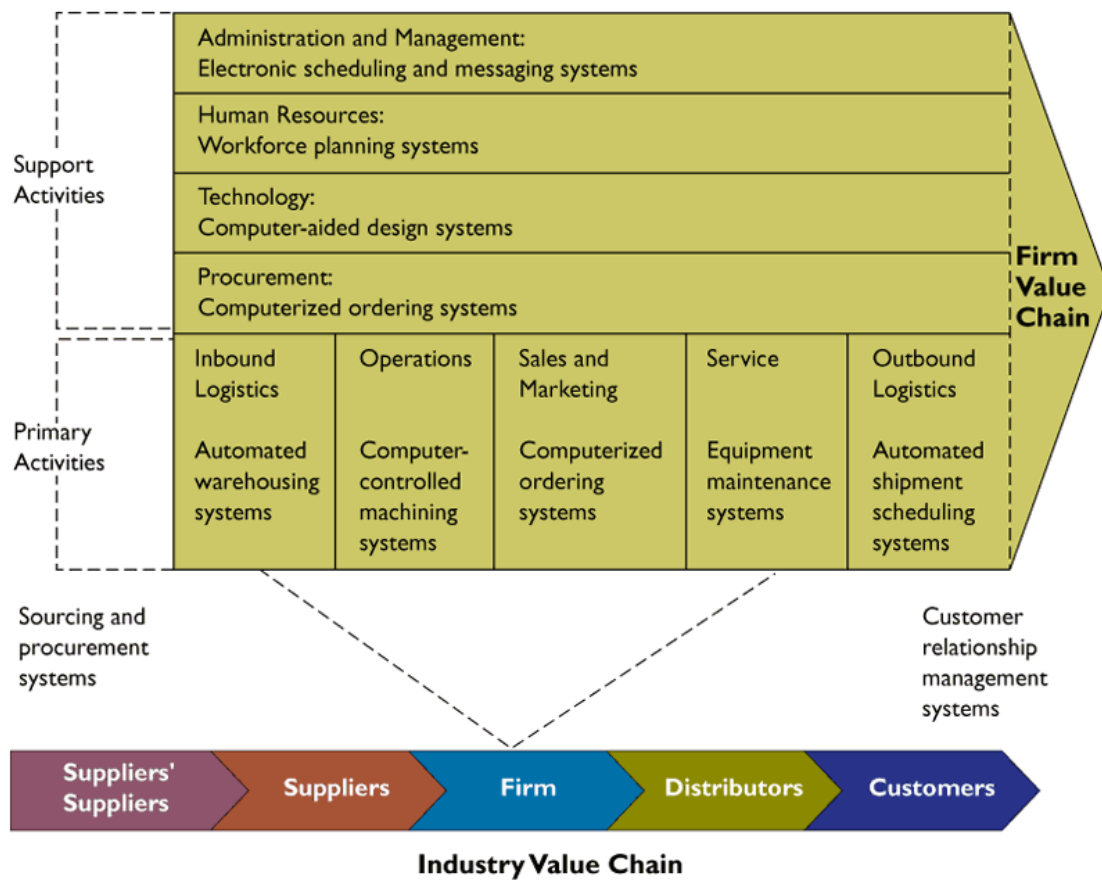


Figure 3.1: Value chain

[Source: <http://wiki.triastelematica.org/index.php>]

Firm value chain (or simple value chain) is made up from two main sectors: the primary activities and the support activities. Inbound logistics, Operations, Sale and marketing, Service and Outbound logistics are activities impacting directly the products. These activities create higher value for the products. This is the value added into the products from processing, packaging, marketing, saling and service. However, the magnitude of added value depends on the support activities. The technology and infrastructure of the factory or company will decide the amount of firm value chain added to the products.

The extended value chain is made up by many firms in the chain of products' processing line. The industry value is decided by the structure of the firms and the connecting of each firm in the industry. Moerover, industry value chain is complex and implemented by various factors. Producers, processors, traders, service providers impact the raw material and expose the final product with added value for customers. All backward and forward linkages get the profit from

processing products and consumers is satisfied by the added value they have got from the products. The industry value chain assesses the potential of each actor in the chain and evaluates the SWOT of the firms along the chain.

Value chain can be applied in any scale from local to global. This concept is considered as a useful tool to analyse the competitive advantage of a firm or company based on inside and outside advantages they have. Associated with the cost advantage and the differentiation, value chain implicates the firm compete with other rivals in the same industry.

Cost advantage is the extreme profit that a company obtains from reducing the cost of producing. Cost of production can be saved due to the improvement of technology. Technology can save electricity, labors, and the in-purchased materials. Moreover, technology also improves packaging, marketing and distributing.

Differentiation is special value that consumers or partners of company acquire when they do business with the company. It could be the quality of products, the marketing promotion, the advantage of distribution, etc...

Competitive advantage (or positional advantage) does not only create benefits for companies but also generate the higher value for consumers.

However, the industry value chain does not represent the interaction of industries and it does not explain the “domino” effect in the real world economy. The diversified value chain model of Porter illustrates the full picture of real value chain.

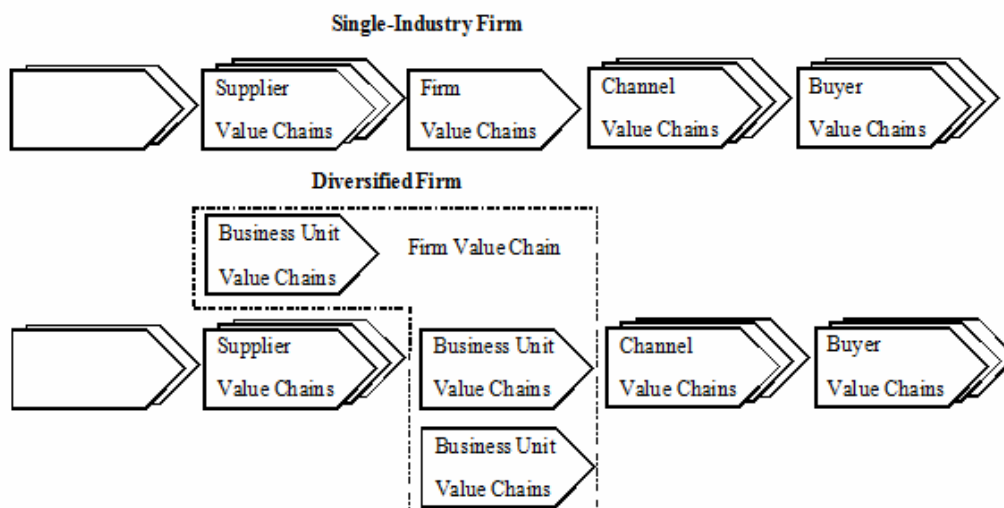


Figure 3.2: Diversified value chain

[Source: <http://wiki.triastelematica.org/index.php>]

Firms working in the industry value chain also need the supporting of other industries. The horizontal interaction between firms spread out the industry value chain. The diversified chain represents the bonds of industries in the economy. This linkage reduces the cost of production due to the specialization. Each business specifies their duties thus the price will be down. Moreover, firms or business are easy to switch their horizontal partners to assure the best quality is provided with the lowest cost.

3.2. Value chain analysis in aquaculture context

Because of its flexibility, VCA can be applied in all fields of economy. As agriculture, aquaculture is a large industry with many profitable products hence the value chain of this industry is very concerned. The value chains of aquatic products are researched so much in the world because the investors need analysis reports about this profitable industry to concentrate their investment. In Vietnam, shrimp and cat fish are “hot” products thus the value chains of these aquatic products are needed. Many projects are developed to study about aquatic products in Vietnam. Most of value chain analysis of aquatic products is conducted in Mekong delta. According to Kaplinsky and Morris 2001, agriculture encompasses aquaculture and the theory of value chain to apply these fields is same. There are many factors of the supply chain in agriculture but there are 4 main elements that we should focus in agriculture value chain analysis. (Doan Van Bay, 2011)

Initially, value chain analysis has to map the actors participating in production processing chain. The value chain links actors through the flow of product and characterize the actors’s function in the chain. From the framework, experts can imply the importance of each actors participating.

Next, value chain analysis has to illustrate the allocation of benefit of actors along the chain. All actors have to invest costs to get profit but the allocation of net income is not same among the actors. It means that value chain points out the cost and revenue of each actor then compares the profit they have got with the investment they sacrificed. The difference of profit is decided rather by the technology and the level of risk than the real value of the product.

However, value chain analysis will be useless if it can not show off the advantage and disadvantage of the supply structure. Value chain analysis must present the improvement for the actors in the chain. Base on the result of value chain analysis, involved actors can adjust their activities and acquire the highest value from the lowest cost.

Finally, Value chain analysis must highlight the governance in the chain. Governance protect the good relationship of the links between factors. The coordination assures the progression of product processing.

3.3. Empirical studies related to VCA in aquaculture in Vietnam

In Vietnam, tra catfish and shrimp are hot products thus there are many VCAs have been applied to investigate value chains of these aquatic supply chain. Khoi (2007) has assessed the value chain of Pangasius in Vietnam. Khoi's study concentrates the firm value chain of trading actor in the supply chain of Pangasius. He explained the primary activities' success of the firm based on the supporting activities drivers and the role of supporting institutions. At the same time Ha (2007) also analyze the value chain catfish in the South of Vietnam. However, Ha focuses her attention on the margin, the added value and the profit of every actors in the chain and range them due to the the profit they acquire from their activities. Bay (2011) has represented a very detail framework of black tiger shrimp value chain in Bac Lieu province. Bay's study assesses the margin cost and profit of each actors along the current of shrimp and examines activities of the the supporting actors such as feed and medicine enterprises. Furthermore, he assessed the social cost and benefit from shrimp industry in Bac Lieu.

3.4 Price transmission

The vertical price transmission is applied in value chain analysis to investigate the impact of the upstream holders to the downstream holders. Hereby, it represents the economic structure of the value chain and the role of participants in the chain.

Vavra, P. and B. K. Goodwin (2005) analysed the price transmission along the food chain. They focused on the vertical price transmission and the price shock in the chain. This study concentrated on the wholesaler and retailers of the food supply chain who have enough market power to create a shock price.

Initially, price transmission was used to check the asymmetric price transmission. The asymmetric price transmission occurs when the upstream price change does not affect to the downstream prices. This phenomenon is different from the classic economic structures thus price transmission is a new method suggested to solve this puzzle. In other words, the downstream price does not react (or react in defferent way) to the change of upstream price. This is the vertical price transmission reaction. The effect of the increasing of rude oil price to the price of

petroleum gas is an example of the vertical price transmission. Price transmission also implies the horizon reaction between same level products. For instance, how the price of meat impacts the price of fish and vice versa is the horizon price transmission. Theoretically, price transmission is considered when the downstream price does not responses to the change of upstream price. Practically, the downstream price can be lagged and responses in slower phase. For example, after the fall of crude oil price, the price of petroleum is not down immediately but reduces more slowly. It means that the price of petroleum actually reacts to the change of crude oil price and the asymmetry of time is the lag of market.

3.5. Methods applied in this study

The value chain framework of frog supply in Ho Chi Minh City reveals the link of actors in this chain. The framework also demonstrates the role of each actor in the frog line. Furthermore, I illustrate the frog quantity current in the line to show how they are distributed in this value chain. Next, I analyse the production function of frog to assess economic of frog culturing. To develop sustainably, production function is used to point out the suitable time the harvest and get highest benefit. Base on the frodution function, economists can compute the cost and revenue function to analyse the profit for farmers. Theoretically, following the production function is a strategy suggested to work in farms.

One more important part in this research is the economic budgets of the actors in this chain. Actually, I focus on the budgets of the hatchery farmers and the marketed farmers because they are the main actors creating primary products for this chain.

Next, the wholesalers and retailers finance are analyzed in the price transmission to assess the profit of the distributing channel. Farthermost, the price transmission point out the powerful actor who can controls the chain to get profit from the supply chain.

Finally, I discuss about the fluctuation of frog price in the market and tend of this industry.

4. METHODOLOGY

4.1. Map the value chain of frog farming

This research applies descriptive statistics to illustrate the value chain of frog in Ho Chi Minh City. The first step of mapping the value chain is forming the general chain and the connection between the actors in the chain. After that, we need the practical data and information. Data and information are collected from the farms, the wholesalers and retailers. Next is the most important step of mapping, we adjust the value chain from the real information. The survey must acquire the product flows, the main actors, their relationships and economic activities at each stage. Profit and monetary flows are also related to the framework of value chain and they will be analysed more in the finance budget section of the results chapter.

4.2. Analyse the costs and benefit

4.2.1. The Production Function

This analysis associating with the finance budgets illustrate the bebenefit from frog farming.

Production function represents the relationship between the output and the inputs. Hereby, Y is the output (the dependent variable) and X is the output (the independent variable). In general, it could be more than one output variable impacting directly to the Y variable.

$$Y = f(X_1, X_2, X_3, X_4, \dots, X_n)$$

In this study, the production function is used to assess the relationship between cost of feed (input) and the weight (output). The data I got implied that this relationship has a polylominal relationship.

$$Y = aX^3 + bX^2 + cX + d.$$

Where a, b, c, d are the coeffiencies.

4.2.2. The enterprise budget

This research also uses the enterprise budget to determine costs and profits of involved actors. The enterprise budgets results illustrate the added value of actors of this industry. Associated with value chain theory, the cost and benefit analysis shows off the economic perspective of the value chain.

4.3. Price transmission

The linear function is adopted to represent the relationship between the prices of farmers and wholesalers and between the wholesaler and retailers. This application is to find the market power along this supply chain and the price shock during the product line.

4.4. Data collection

Data collected from actors along the chain base on the questions followed the theory of Porter. Survey follows the primary activities of main actors since these activities mostly create added values for products. The support activities are applied flexibly by the experience of each actor. The old hands in this industry can utilize the support activities to acquire profit in the worst condition but they can not create added value without primary activities. Survey is conducted around Ho Chi Minh City: Hoc Mon Povice, Binh Duong Province, Dong Nai Province, Tien Giang Province and Cu Chi Province. Main objects questioned are farmers, collectors, wholesalers and retailers. The price is updated from Binh Dien Market. The data are surveyed to answer these questions: Costs, Incomes, Price and Problems in every section of the chain.

Most of investigated objects are farmers since they are the main actors in this chain. Moreover, farmers are the prime actors who have to suffer the fluctuation of output price heavily.

5. RESULTS AND DISCUSSIONS

In this chapter, I mention about four main results. First, value chain framework of frog supply and actors involved in the product line are introduced in the map of actors. Second, to analyze costs and benefit of each participant, I apply the production function and the interprise budgets to determine the benefit of of hatchery and farmers. The costs and incomes are showed in detail. Next is the price transmission analysis between farmers and wholesalers and between wholesalers and retailers. Finally, I discuss more about the price fluctuation and its impaction on the activities of chain.

5.1. Value chain framework of the frog farming industry

Frog culturing blossoms out from 2000 but the fluctuation of output market drives many farmers to be ruined. Farmers mostly imported seed from Thailand at the beginning. After 2006, most of farmers in Vietnam can product the seed for themselves and provide seed for need comers. The internal hatchery farms of frog pread out the technique of frog farming for adhering famers. So far, almost farmers can self- supply the seed (99%) and the hatchery farms mainly help the new farmers.

Collectors are essential actors in the value chain. Wholesalers need the collectors to aggregate the frogs in the local areas and supplied them in the large scale. Literally, collectors are transporters who convey frogs from farmers and bring them to wholesalers. Does it mean that if the farmers can transport their products by themselves they don't need collectors anymore? It seems to be right if you are farmers, and you will get more when you sell your products directly to the wholesalers. However, the wholesalers prefer large scale of transportation which can not be met by the farmers. Since collectors aggregate frogs from many sources they can save the fee of transportation. Furthermore, collectors are responsible for their goods. The added value for collectors is the responsibility of the products they collected. Collectors have to assure about the products quality. Most of farmers sell their frogs to the collectors because collectors can transport frogs for farmers. The local collectors are the permanent partners of farmers. Collectors are the vital connectors from local farmers to the central wholesalers.

Of course, all collectors sell their frogs to the wholesalers. However, the wild caught frogs are also sold to the wholesalers. The wild frogs thrive in the wet season (from April to September) but their yield is unstable and very hard to estimate thus I do not specify their volume in my studied chain.

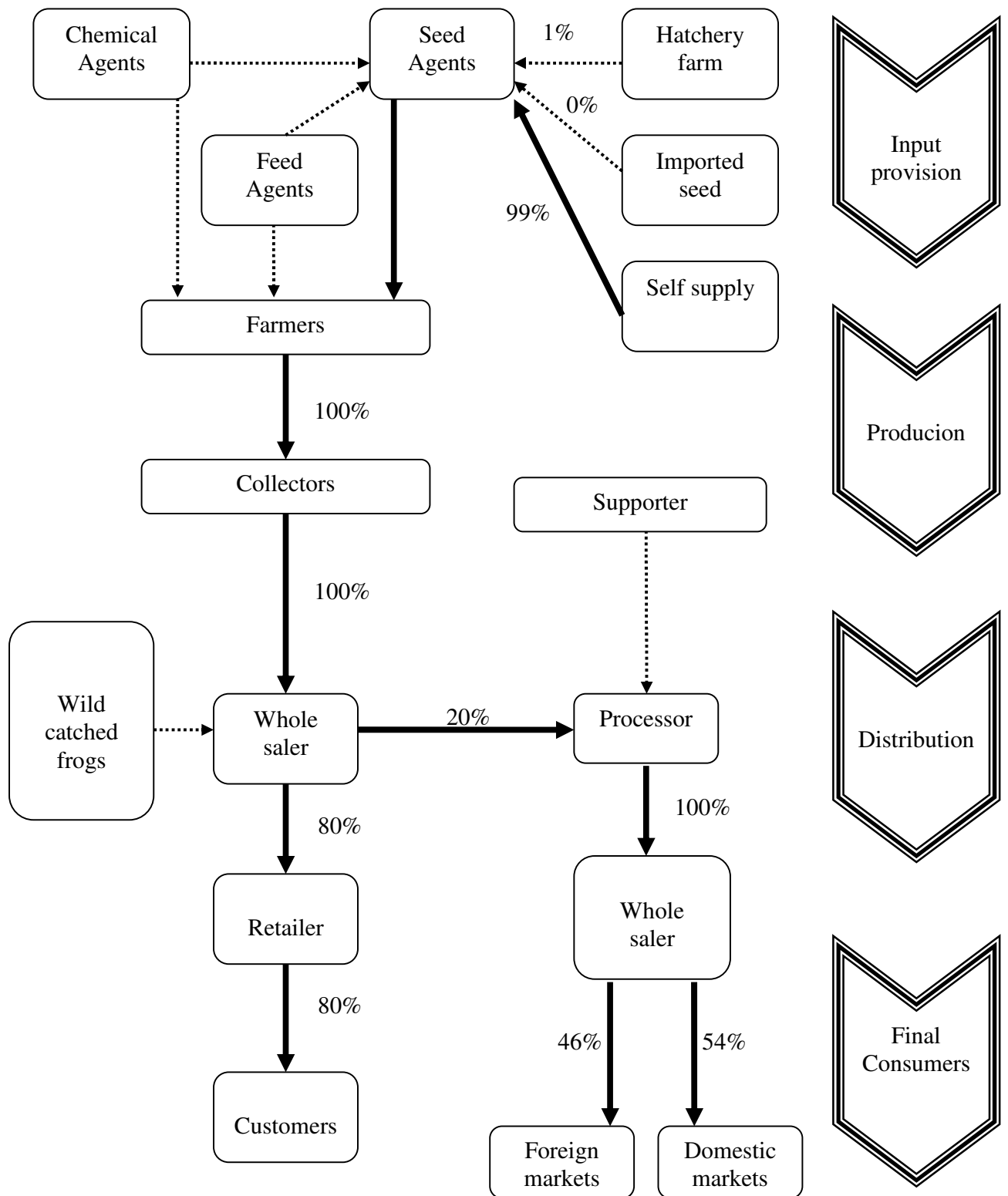


Figure 5.1: Value chain framework of the frog industry

[Source: Surveyed in 2012]

The wholesalers distribute frogs for retailers and supply standard frogs for processors. Only wholesalers have enough standard frogs to sell for processors because just 20 percent frogs from farmers are big enough to be processed. As I discuss above, farmers can not supply frogs in the same size thus the wholesalers will sort the highest size to distribute for processors and sell the rest for retailers.

All retailers sell the frogs to consumers and get benefit from the arbitrage of the price. The retailers are the final distributors in the chain and they are free in the price decision. They set the price flexibly to balance between the benefit and the liquidation ²

In 2006, most of frozen frog is supplied for domestic market (70%) and 30% is exported to to the foreign market. Recently, the demand of frog increase rapidly. Yield of frozen frog increases annually due to the demand of new markets such as US, EU, HongKong, etc. In 2006, Vietnam export is 360 tonnes frozen frogs, and in 2011, the exported volume has been up to 724 tonnes. 54 percent products after processing will be distributed to the supermarkets in domestic segment while the rest is imported by foreign markets. Recently, the there are new forgein partners request continuous frogs supply for long cooperation.

5.2. Production function of frog farming

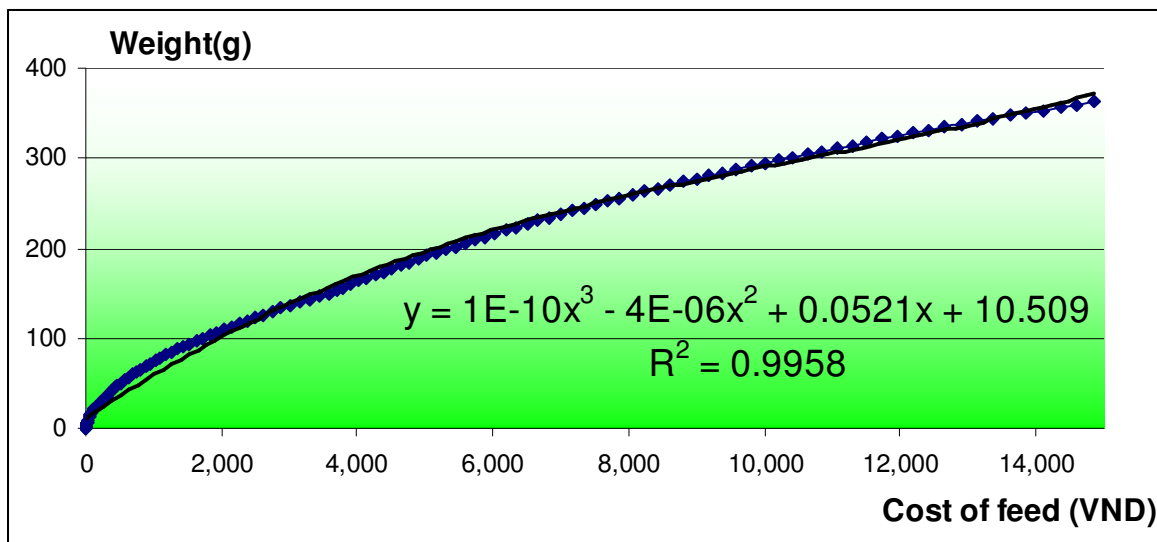


Figure 5.2: Physical Input-Output Relationship of Frog farming
(The Production Function of Frog)

² Selling off at lower price

Mathematically, this graph represents the relationship between the weight of frog and the cost of feed. Cost of feed increase daily. So does the growth of frog. However, the rate of growth is not constant. The law of diminishing returns suggests that we should harvest the live stock in the end the first stage when the biomass starts to growth at the decreasing rate.

The function $Y = 1E-10X^3 - 4E-6X^2 + 0.0521X + 10.509$ depicts the increasing of frog size bases on the feed input.

Where

Y: the frog weight (g)

X: cost of feed (VND)

To find out the point at that the growth rate start to diminish we take the second derivative of this function.

$$Y'' = 6E-10X - 8E-6$$

The inflection point is the point when $Y'' = 0$. It is also the point that the curve change its rate.

$$Y'' = 0 \Leftrightarrow X = 13,333\text{VND}$$

This value implies that if the cost exceeds this value the net return tends down since the decline of the growth rate lead to the increasing of cost.

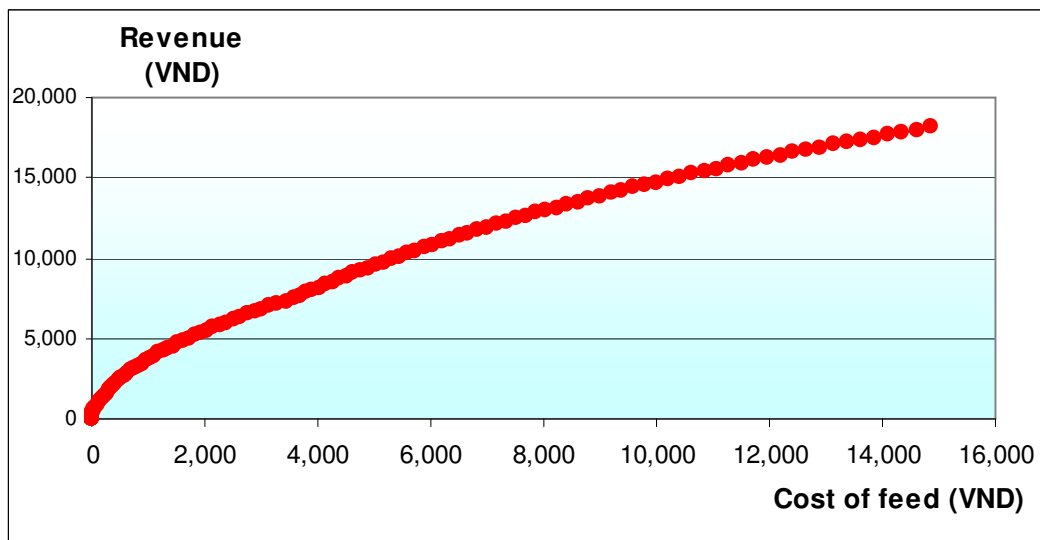


Figure 5.3: The Production Function of Frog

If the weight in the Y axis of Figure 5.2 is multiplied with the price of frog we have the Figure 5.3. This graph is easier to find out the net income of farmers during the farming period. However, the next graph represents the cost and revenue function of farmers obviously.

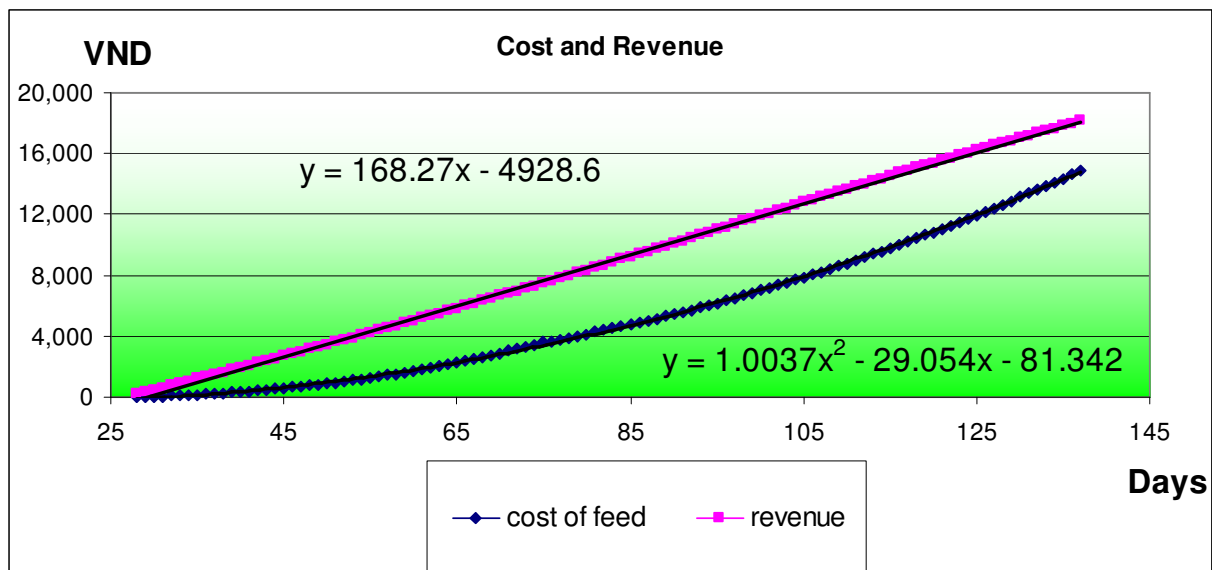


Figure 4.3: Daily Cost and Revenue Function of frog farmers

Because this graph analyzes the cost and revenue of farmers, it starts at the 28th day of frog. That is the first day of frog farming. After first 28 days in their lives, frogs are ready to growout and this graph illustrates the cost and revenue of frog farming by days. The net profit is the difference between of revenue and cost. To find out the highest net profit, algebraic method finds the angular coefficients of both cost and revenue curves. The highest profit is where the angular coefficient of cost equals the angular coefficients of revenue.

To calculate the angular coefficient we take the first derivative of the cost and revenue function

Angular coefficient of cost function: $y' = 2.0074x - 29.054$ (1)

Angular coefficient of revenue function: $y' = 168.27$ (2)

Then we find x

$$(1) = (2) \Leftrightarrow 2.0074x - 29.054 = 168.27 \Leftrightarrow x \sim 98 \text{ days}$$

The highest profit is acquired when frog is 98 days old. In other words, after 70 days after farmers should sell them to get highest money back.

5.3. Enterprise Bugets – Cost and Benefit Analysis

Enterprise budget is a record of financial aspect of producing. It lists all the costs and returns of the enterprise activities (Curtis M. Jolly and Howard A. Clonts 2003). The gross receipts, the

variable costs, and the fixed costs are indices that illustrate the income, the net return of the activities. Moreover, the enterprise budget points out the breakeven price for managers to control the activities of enterprise. Breakeven price is very important because it is the lowest price of the product that enterprise can suffer to cover the variable costs and keeps going on to cover fixed costs in the long run. If the price of output lower than this point the enterprise must be closed. The following enterprise budgets (Table 5.1) will illustrate the financial records of frog chain and implies the efficiency of frog farming industry.

Table 5.1: Partial enterprise budget of hatchery

Item	Quantity	Unit	Price (VND)	Total
Revenue				
Juvenile	20,000	Individuals	2,000	40,000,000
Expense				
Medication				
-Lime	0.4	Kg	5,000	2,000
-KMnO ₄	2	Kg	100,000	200,000
-HCG	2	Ampoule	6,000	12,000
-Digestion enzyme	500	G	300	15,000
-Vitamin C	1	kg	10,000	10,000
Feed				
-Organic fertilizer	0.2	Kg	6,000	1,200
-Natural feed	60	Kg	8,000	480,000
-Aquatic feed	10	Kg	14,000	140,000
Power	3	Kwh	1,068	3,204
Interest in investment	1.58	% per month	100,000,000	1,580,000
Labor	1	Farmer	4,000,000	4,000,000
Others				
-PP plastic sheet	100	m ²	25,000	2,500,000
Operating expense				8,943,404

[Source: Surveyed by the author]

Case study in Hoc Mon frog farm,

Farmers need lime to clean the ponds for farming. For every 100m², farmers need 2kg of Canxi hydroxide. Thus, farmers need 0.4kg for one pond (20m²). If the price of CaO is 5000VND, farmers have to pay 2,000VND to cleaning the ponds.

Sterilizing cost (KMnO₄):

$$[20 \times 0.2 \times 1,000/10] \times 5 = 24,000 \text{ mg} = 2 \text{ kg}$$

The parents have to be injected HCG (Human Chorionic Gonadotropin) to spawn completely. One ampoule HCG can be used for 5kg females and 15kg males thus farmers need more than one ampoule for one pond of hatchery.

Digestion enzyme is very important for frogs since they are at least indigested once in their life cycle. When frogs become indigested, farmers insert 5g digestion enzyme for every kilogram feed. In this context, we need 2kg feed per day and the veterinarian advises that keep on imposing during next 5 days. Thus we have the equation:

$$5 \times 2 \times 5 \times 300 = 15,000\text{VND}$$

Vitamin C is needed to reinforce the resistance of frogs. Adding vitamin C frequently in the feed can reduce the costs of treatment for frogs.

The natural feed for tadpoles is calculated like this equation:

$$200\text{g} \times (20,000/1000) \times 10 \times 1.5 = 60,000\text{gram} = 60\text{kg}$$

The mortality ratio of juvenile is 50% so we have to multiply with 1.5 to calculate extra feed for the juvenile.

Because 1,000 tadpoles need 200g natural feed per day and farmers have to feed them within ten days, the aquatic feed is used when tadpoles have legs.

60g aquatic feed is needed for 1,000 tadpoles per day and farmers feed them with aquatic feed in last 8 days.

$$60\text{g} \times (20,000/1000) \times 8 = 9.6\text{kg} \sim 10\text{kg}$$

Raising tadpoles needs 22 days. The level of water in ponds is 25cm. Water must be refreshed every day.

Hence the water that farmers have to pump to refresh the ponds is:

$$12 \times 0.25 \times 20 = 60\text{m}^3$$

The fomula of the pump:

$$N = P \times Q / 612$$

N: Power of the pump (kW)

P: Pressure in the water pipe (Bar)

Q: The volume of water pumped in one minute (Littres/minute)

612: The coefficient

Asumme that:

The power of the pump we use is 1.5 HP~1.1175kW.

The pressure in water pipe is higher than the pressure of atmosphere: P = 1.5Bar

So:

$$Q = N \times 612 / P = 1.1175 \times 612 / 1.5 = 455.94 \text{ Littre/minute}$$

The time farmers use electricity to pump is:

$$60 \times 1000 / 455.94 = 131.59 \text{ minute} \sim 2 \text{ hours}$$

The electricity that we need is:

$$1.1175 \times 2 = 2.235 \sim 3 \text{ kWh}$$

The price of electricity is 1,068VND/kWh

Hence:

The cost that farmers have to expense for pumping water is:

$$1,068 \times 3 = 3,204 \text{ VND}$$

Table 5.2: Fixed cost of hatchery

Items	Price
Cement pond	4,560,000VND
Pump	6,000,000VND
Plastic sheet	348,000VND
Total fixed cost	10,908,000VND

In practice, the price of seed is vary from 1,500VND to 2,500VND thus the hatchery actors always get profit to cover the costs. In the reverse season, the cost can be increased since farmers need Human Chorionic Gonadotropin to inject to the frog and antibiosis to protect the seed. Most of hatchery farms are also commercial farms thus the parents for hatchery are always available.

The cost of parents is zero because farmers can sell parents after hatching.

Table 5.3: Hatchery budget

	Item	Quality (kg)	Price/kg	Value
1	Gross receipts	20,000	2,000	40,000,000
2	Total variable cost			8,943,404
4	Total fixed cost			10,908,000
5	Total cost			19,851,404
6	Net returns above all specified expenses			20,185,596
7	Breakeven price			
	To cover specified variable expenses			447
	To cover specified total expenses			992

Table 5.4: Partial enterprise budget of frog farming

Item	Quantity	Unit	Price (VND)	Total
Revenue				
Frog	2520	Kg	50,000	128,500,000
Expense				
Juvenile	17,200	Frog	2,000	34,400,000
Feed	3000	Kg	14,000	42,000,000
Power	31	kWh	1,068	33,108
Chemicals				
-Lime	5	Kg	3,000	15,000
-KMnO ₄	24	Kg	100,000	2,400,000
Labor	2	Farmers	4,000,000	8,000,000
Interest in investment	1.58	% per month	100,000,000	3,600,000
Others				
Operating expense				90,448,108

Assume we have a farm with twelve ponds (4x5m).

Hence, we have 240m² available for culturing frog. The density of commercial frog is 70individuals/m² thus we can farm 16,800 frogs.

$$240 \times 70 = 16,800$$

The average mortality rate of frog is 2% so we need 17,142 frogs.

$$16,800 / (100\% - 2\%) = 17,142$$

Assume we have 17,200 seeds of frogs to raise then we will have 2,520kg mature frog for market since the average weight of mature frog is 150g.

$$16,800 \times 150 = 2,520\text{kg}$$

The average weight of the seed is 3-5g. It means that we have about 69kg of seeds.

The feed conversion ratio (FCR) of frog is 1.2 therefore they need 1.2kg feed to increase 1kg.

The feed we need:

$$(2,520 - 69) \times 1.2 = 2,941 \sim 3,000\text{kg}$$

The price of feed is 14,000VND/kg so the cost of feed is about 42,000,000VND

$$14,000 \times 3000 = 42,000,000\text{VND}$$

The electricity we need is to pump water for frogs. Farmers must refresh the water in ponds 3times per week. The level of water in ponds is about 0.2m.

Raising frogs needs nine weeks. The level of water in ponds is 20cm in the first months and down to 5cm in the last months.

Hence the water that farmers have to pump to refresh the ponds is:

$$3 \times 4 \times 240 \times 0.2 + 3 \times 5 \times 240 \times 0.05 = 756\text{m}^3$$

The fomula of the pump:

$$N = P \times Q / 612$$

N: Power of the pump (kW)

P: Pressure in the water pipe (Bar)

Q: The volume of water pumped in one minute (Littres/minute)

612: The coefficient

Asumme that:

The power of the pump we use is 1.5 HP~1.1175kW.

The pressure in water pipe is higher than the pressure of atmosphere: P = 1.5Bar

So:

$$Q = N \times 612 / P = 1.1175 \times 612 / 1.5 = 455.94 \text{ Litre/minute}$$

The time farmers use electricity to pump is:

$$756 \times 1000 / 455.94 = 1658 \text{ minute} \sim 27.63 \text{ hours}$$

The electricity that we need is:

$$1.1175 \times 27.63 = 30.88 \sim 31 \text{ kWh}$$

The price of electricity is 1,068 VND/kWh

Hence:

The cost that farmers have to expense for pump is:

$$1,068 \times 31 = 33,108 \text{ VND}$$

Farmers need lime to clean the ponds for farming. For every 100m², farmers need 2kg of Canxi hydroxide. Thus, farmers need 5kg for 240m² of ponds. If the price of CaO is 5000VND, farmers have to pay 25,000VND to cleaning the ponds.

Before putting the frogs in ponds, farmers have to sterilize the ponds by KMnO₄. Experts suggest that 10 Litres in ponds needs 5mg KMnO₄ to sterilize so the mass of KMnO₄ is:

$$[240 \times 0.2 \times 1,000/10] \times 5 = 24,000 \text{ mg} = 24 \text{ kg}$$

Others costs will be zero if the Lime and KMnO₄ are used. If some problem of disease occurs, the chemicals expense will be added in other costs.

Labor is assumed two assistants. They help farmers feed the frogs and refresh the water.

Salary for each labor is 4,000,000VND hence, the cost of labor is 8,000,000VND

I assume that there is no pathogen in ponds and frogs grow up healthily. It means that this crop is successful and no risk increasing the cost of products.

The interest for investment is 1.58 % per month. To complete one crop of frog farming, farmers need two months thus the interest is calculated as below:

$$1.58\% \times 100,000,000 \times 2 = 3,600,000 \text{ VND}$$

The fixed cost of frogs farming:

Table 5.5: Frog farming fixed cost

Items	Price
Cement ponds	54,720,000VND
Pump	6,000,000VND
Plastic sheet	4,176,000VND
Total fixed cost	64,896,000VND

Cost to build up one pond is 4,560,000VND so the total cost to build up 12 ponds is 54,720,000VND

To supply water for farming, we need one 1.5HP pump. Price of one pump is around 6,000,000VND

Plastic sheet is needed to protect frog from the cement of the ponds because frogs usually hurt themselves when they jump and touch the cement walls of the pond.

One meter square of plastic sheet costs 12,000VND. One pond needs 29 m² to cover the cement. Hence, the total plastic sheet farmers need is 348m² and the cost of plastic sheet is 4,176,000VND

Total fixed cost is 64,896,000VND if farmers use the cement ponds. If farmers use plastic sheet to build up the ponds for frog farming the total fixed cost will be saved so much. The plastic sheet costs about 7,000,000VND and the total fixed costs will turn down so much. With the plastic sheet total costs is about 17,176,000VND and farmers can save 47,720,000VND. However, practical farmers prefer cement ponds because they can culture frog with other aquatic products. Combination not only reduces the costs but also assure the budget for farmers.

Table 5.6: Frog farming budget

	Item	Quality (kg)	Price/kg	Value (VND)
1	Gross receipts	2,520	50,000	126,000,000
2	Total variable cost			90,448,108
4	Total fixed cost			64,896,000
5	Total cost			155,344,108
6	Net returns above all specified expenses			-29,344,000
7	Breakeven price			
	To cover specified variable expenses			36,000
	To cover specified total expenses			62,000

In 2012, the price of frog has been increasing since the push of cost and the pull of international demand. The value is updated in 2011 when the cost of feed has been increasing so much compared with 2010. Moreover, the inflation rate is high due to the increasing of power costs lead to the increase of CPI (consumer price index) thus most of the prices increase rapidly.

If the farmers can seedling for themselves, they can save 25,800,000VND in the variable cost and the budget will be adjusted like this.

Table 5.7: Frog enterprise budget

	Item	Quality (kg)	Price/kg	Value (VND)
1	Gross receipts	2,520	50,000	126,000,000
2	Total variable cost			64,648,108
4	Total fixed cost			64,896,000
5	Total cost			129,544,108
6	Net returns above all specified expenses			-3,344,000
7	Breakeven price			
	-To cover specified variable expenses			25,654
	- To cover specified total expenses			51,400

The old hands in farming frog can acquire cost leadership. They have the cost advantage since they can reduce their costs and always get benefit from selling frogs. However, in the prosperous season, frog price can be lower than the cost since frogs are imported from Thailand in very low price. The Thailand frog farming industry has been developing for a long time so they can product frog in a very comparative price lead to the reduction of frog price in Vietnamese market.

5.4. Price transmission

Through various actors of the supply chain, price transmission in agricultural market is concerned for a long time. Empirically, price transmission can be analysed both in vertical and horizontal direction. The horizontal price transmission is concerned about the substitute products. This analysis states the competitive potential of a product in the market while the vertical price relationships evaluate the links between stakeholders following the product line. In this study, vertical price transmission has concentrated on three objects: the farmers, the whole salers and the retailers. The downstream prices are always higher than the upstream price in theory but the magnitude of the defference is characterized by the power of the actors. Theoretically, price is balanced by the invisible hands of the market, yet the price can be control by other powers. The asymmetry price transmission will appear if there are linkages having enough power to impact

the rest of the chain. Vertical price relationships will assess the interaction between actors and the effect of the upstream actor to the downstream actor.

The price of frog is unstable and the fluctuation of frogs' price depends on the farming season.

Table 5.8: The price of frog in 2010-2011

Month/ Year	Farmer		Whole saler		Retailer	
	2011	2010	2011	2010	2011	2010
January	110,000	60,000	118,000	70,000	125,000	75,000
February	100,000	50,000	105,000	55,000	110,000	65,000
March	90,000	50,000	100,000	60,000	110,000	65,000
April	70,000	40,000	80,000	50,000	90,000	60,000
May	30,000	30,000	35,000	35,000	45,000	45,000
June	30,000	30,000	40,000	40,000	50,000	50,000
July	25,000	25,000	35,000	35,000	45,000	45,000
August	30,000	25,000	40,000	35,000	45,000	35,000
September	36,000	20,000	40,000	24,000	50,000	32,000
October	39,000	35,000	45,000	41,000	55,000	49,000
November	42,000	45,000	55,000	58,000	60,000	65,000
December	45,000	43,000	50,000	48,000	60,000	55,000
Average	53,917	37,750	61,917	45,917	70,417	53,417

[Source: Collected from the survey of author]

Price of frog is always low in the “prosperous season” because frog is easy to spawn in this period. The prosperous season starts in March and ends in October of the year. This is also the rainy season of tropical region. At this time, frog spawns naturally because the weather is warm and humid so the quantity of frog in the market is abundant lead to the fall of frog's price. Conversely, the price of frog climbs up in the reverse season. The fluctuation of frog's price is periodic and effected by the quantity of frog imported from Thailand. In the turn of the year 2011, there are some troubles with Thailand's agriculture so they don't export frog to Vietnam lead to the escalation of the frog's price in Vietnamese market. Moreover, Frog's price is also depended

on the market's demand thus it is fluctuated daily. The price is down in the full moon and new moon because the Buddhists abstain in these days.

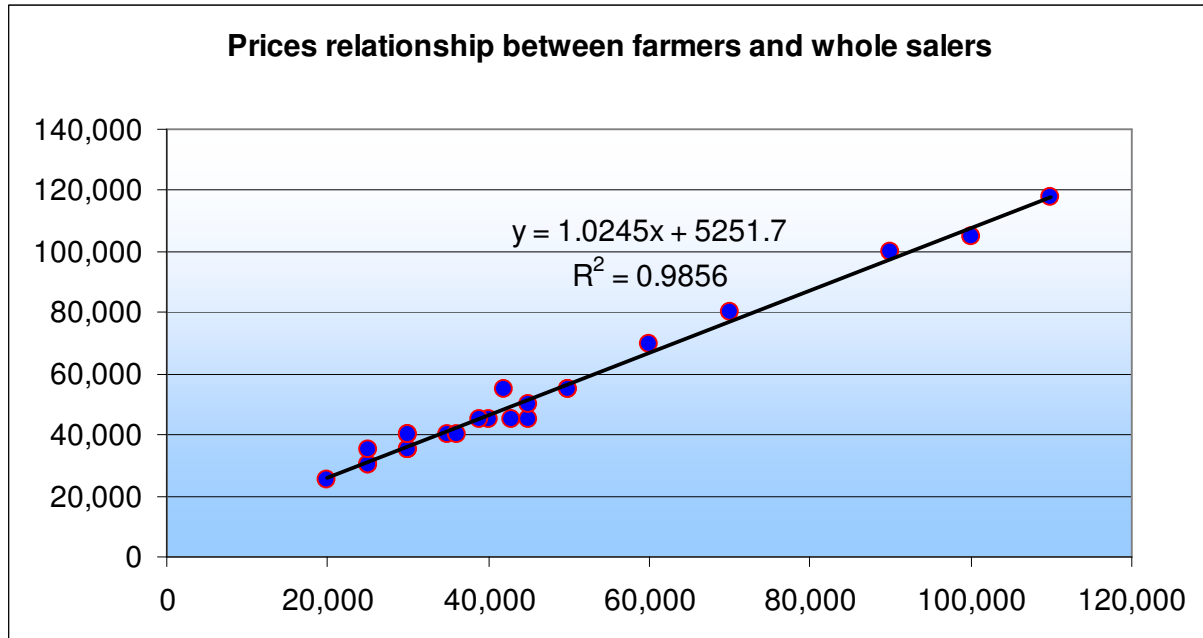


Figure 5.4: The price transmission between farmers and wholesalers

The result implies that wholesalers get benefit from selling frogs. The added value is the extra amount for wholesalers to classify the frogs. The price that wholesalers or collectors decide to buy the frogs of farmers bases on the rank of size but the the frogs from farmers have never been same in size. However, consumer's demand requires frogs in the same size. The processors need standard frogs to assure the homology in their final product since they supply processed frogs for foreign markets. Retailers also need the frogs in the same size to sell for higher price thus power to supply in high quantity.

Look at the function $y = 1.0245x + 5251.7 \Leftrightarrow y = x + A$

The equation indicates that the price that wholesalers sell the frog to the retailers always higher than the price the buy them from farmers. The selling price (y) is approximate to the buying price (x) plus an extra amount (A). (A) is the excess money wholesaler get from collecting frog and distribute to retailers but it is not the net profit of wholesalers. For every kilogram of frog, wholesaler have to pay about 2000VND for transportation and other costs hence, the net profit must be recalculated:

$$\text{Net Income} = (A - 2000) \times Q$$

Where

Q is the quantity of frog that wholesaler have dealt in (kg).



Figure 5.5: The price transmission between wholesalers and retailers

In the mean time, the retailers are more flexible in the price. They can adjust the price according to the demand of the market. The output of retailers is fluctuated thus flexible price is clever strategy to acquire highest profit. From the early of 2012, pork is black banned in Vietnam market since the abuse of chemicals in pig raising. Thus the price of frog has been climbing up in the retailing market. Consumers tend to use others protein sources as the substitutional food hence the price of frog is raising. Being the final actors in the frog supply chain, retailers can obtain higher profit than wholesalers.

The function $y = 0.9576x - 1,1922 \sim y = x + 1,1922 \Leftrightarrow y = x + B$ ($B = \text{const}$)

The average profit of retailers is higher than the wholesalers but the total profit of retailers is less than wholesalers due to the quantity (Q) of retailers is much less than wholesalers.

Net profit = $(B - \text{Cost}) \times Q$

The average costs of retailers is around 3,000VND so the average profit of retailers is about 9,000VND.

From the data analysed above, there is no evidence of the power market in the frog supply chain and there is no shock price along this chain. The downstream price reacts immediately when the upstream price changes. The change of price is not controlled by any actors from the chain. The external demand lead to the change of final price.

5.5. Discuss about the fluctuation of price

Most of the risk that farmers have to suffer is the fluctuation of the output price. This graph illustrates the effect of the fluctuation price on the profit of farmers. This is the profit of farmers hatching the frog for themselves.

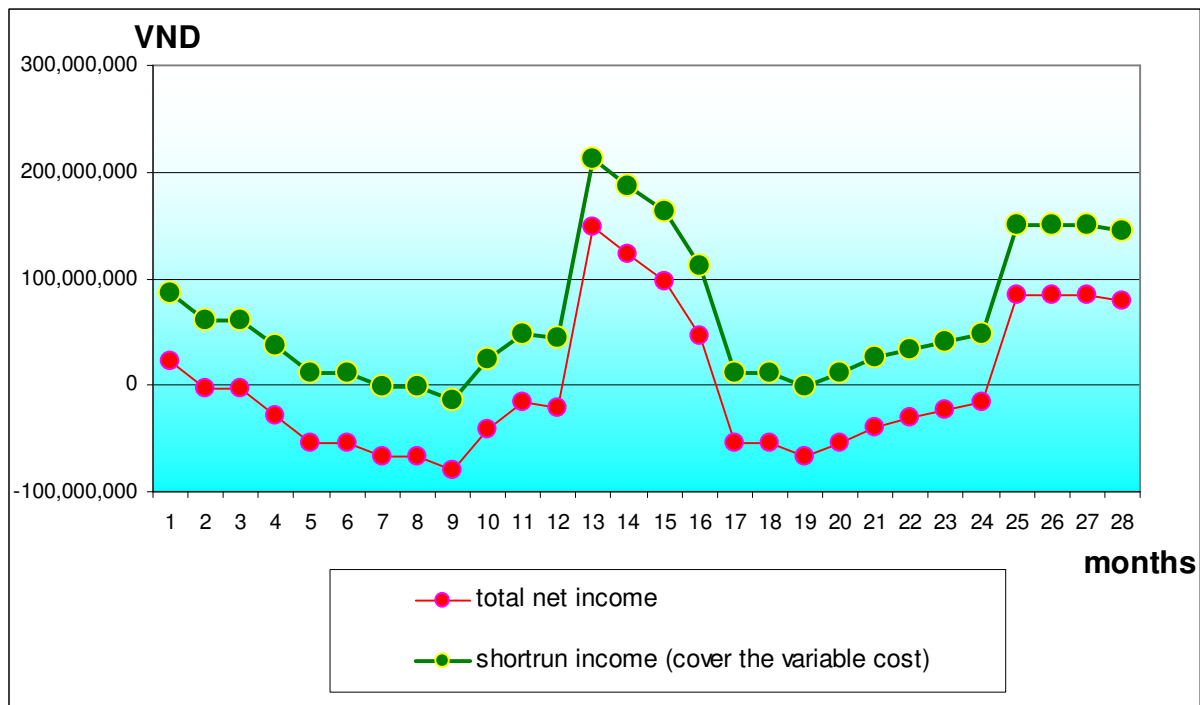


Figure 5.6: The impact of price on the net profit of farmers

If the farmers can self-supply the juvenile for their market culturing they can cover the variable cost easily and in the long-run, they will accumulate enough capital to cover the fixed cost. The horizontal axis is the months statisticed from January 2010 to April 2012. However, it is harder for new comers to get benefit from farming frog. New comers can not self supply the seeds thus the variable costs and total cost of them would be higher and the profit would be smaller.

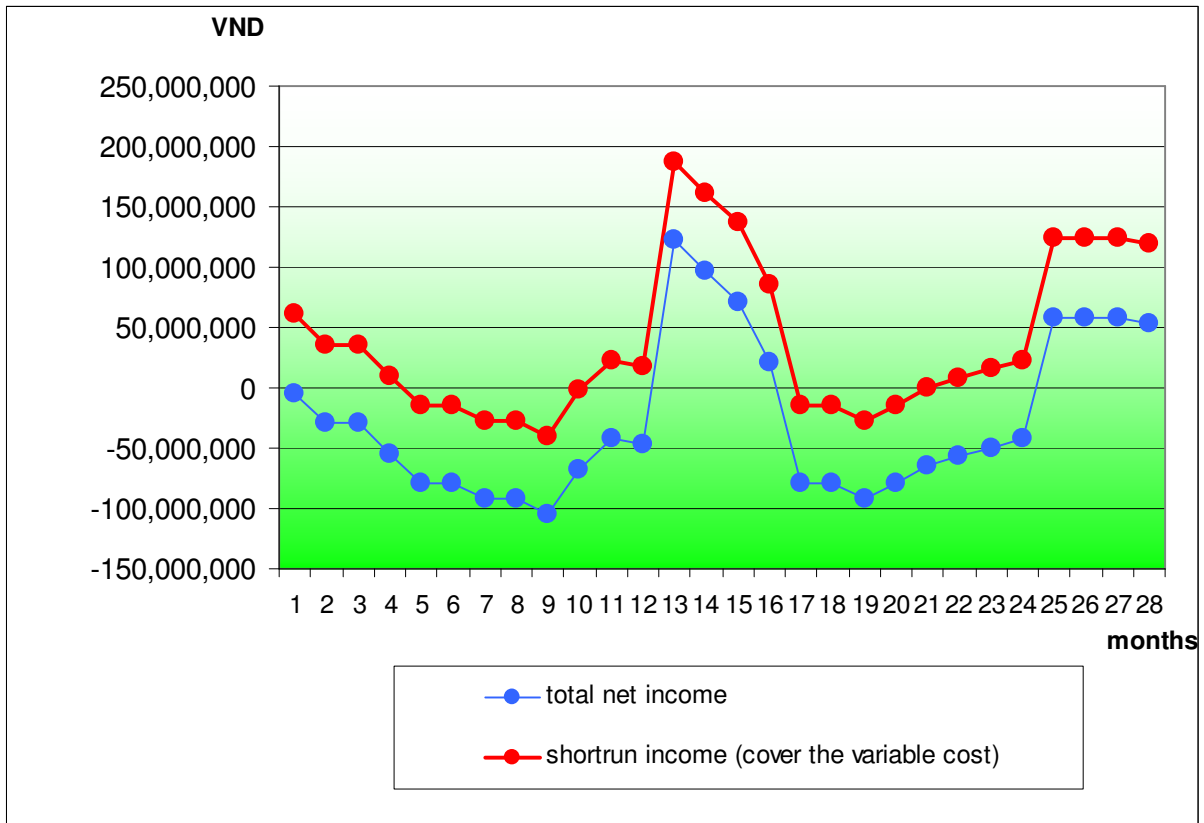


Figure 5.7: The impact of price on the net profit of new farmers

New comers can be ruined if they culture their frog in the rain season when the frogs are abundant. They should start to raise frog in the end of the wet season to get higher profit. However, raising frog in the reverse season is not easy and all the costs is higher than the prosperous season. Frogs are easier to get pathogen in the dry season and they are also need more HCG to spawn. Frog’s resistance is weak in the reverse season as well. Moreover, new comers do not have the cost leadership advantage to compete with the experienced famers.

6. CONCLUSIONS

Frog farming has been developing in Vietnam from 2000. This industry has earned a lot of money for some farmers but has crashed the other farmers. Recently, this industry is promising for sustainable development. There are more and more foreign partners come and discuss about frog supply chain. The frog processing development also balances the price of frog. This industry need pioneers who dare to upgrade the scale of farming. Farmers can not warrant the stable yield of frog in the year thus they miss many chances to develop their scale. It is very easy to supply frog in the prosperous season, but in the other season, no one can assure about the output. In the middle of the last decade, many farmers have to quit out of this industry due to the low price of the market.

The four actors in this chain are farmers, wholesalers, retailers, and processors. The processors are weak because the small scale of quantity. Not enough yield to product leads to the capital loss thus processor have to shut off frog processing to switch another product. The fact that price of processed frozen frog climbs up recently promises a new horizon for frog industry, especially the processors

Recently, the new markets promise the continuously production for processors and the farmers also have promotion to improve the yield and scale of their farming.

Hatchery farm achieves more than 100% profit from selling juvenile for farmers. The farmers can obtain a profit of 0% to 250% per kg of frog. The superprofit and low cost attract many farmers join in frog industry but the risk of unstable price let them give up quickly. The wholesaler and retailers do not sustain the fluctuation of price as the farmers. They are price-takers thus their risk is less than farmers. Their profit is more stable. About 11% of the frog value is added by the wholesalers. Retailers' average profit is higher than the wholesalers' average profit. They add 17% value in every kilogram of frog.

Supporting agents such as the feed, the veterinary medicine enterprises and chemical/medicine companies also get benefit and the added value they create is the quality of product. The spontaneous development of the agriculture, particularly aquaculture, causes many negative effects to farmers and the environments. Department of Agriculture and Rural Development Department HCMC should govern the farmers and support them to control the spontaneous development and accommodate the agricultural market.

Risk insurance policy has to be conducted and developed in Vietnam more and more and the crisis of liquidity loss or bankruptcy will be overcome easier.

Frog industry needs innovation to improve their scale. The pioneers are very needed to set up the new structure for this industry. All the actors along this value chain can work harmoniously if they link up with contracts reduces risks from the market prices.

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8. APPENDIX

Appendix 1: The data of production function of frog

Day	Weight	Cost of feed/one frog	Revenue	Net income
1.00	0.00	0.00	0.00	0.00
2.00	0.14	0.21	7.14	6.94
3.00	0.29	0.41	14.29	13.87
4.00	0.43	0.62	21.43	20.81
5.00	0.57	0.83	28.57	27.74
6.00	0.71	1.04	35.71	34.68
7.00	0.86	1.24	42.86	41.61
8.00	1.00	1.45	50.00	48.55
9.00	1.14	1.66	57.14	55.48
10.00	1.29	1.87	64.29	62.42
11.00	1.43	2.07	71.43	69.35
12.00	1.57	2.28	78.57	76.29
13.00	1.71	2.49	85.71	83.23
14.00	1.86	2.70	92.86	90.16
15.00	2.00	2.90	100.00	97.10
16.00	2.14	3.11	107.14	104.03
17.00	2.29	3.32	114.29	110.97
18.00	2.43	3.53	121.43	117.90
19.00	2.57	3.73	128.57	124.84
20.00	2.71	3.94	135.71	131.77
21.00	2.86	4.15	142.86	138.71
22.00	3.00	4.36	150.00	145.64
23.00	3.14	4.56	157.14	152.58
24.00	3.29	4.77	164.29	159.52
25.00	3.43	4.98	171.43	166.45
26.00	3.57	5.19	178.57	173.39
27.00	3.71	5.39	185.71	180.32
28.00	4.00	5.60	200.00	194.40
29.00	6.80	15.12	340.00	324.88
30.00	9.61	28.58	480.71	452.13
31.00	12.44	46.00	622.14	576.14
32.00	15.29	67.40	764.29	696.89
33.00	18.14	92.80	907.14	814.34
34.00	21.01	122.22	1,050.71	928.49
35.00	23.90	155.68	1,195.00	1,039.32
36.00	26.80	193.20	1,340.00	1,146.80
37.00	29.71	234.80	1,485.71	1,250.91

38.00	32.64	266.79	1,632.14	1,365.35
39.00	35.59	301.66	1,779.29	1,477.63
40.00	38.54	339.44	1,927.14	1,587.70
41.00	41.51	380.12	2,075.71	1,695.59
42.00	44.50	423.73	2,225.00	1,801.27
43.00	47.50	470.28	2,375.00	1,904.72
44.00	50.51	519.78	2,525.60	2,005.82
45.00	53.54	572.25	2,676.80	2,104.55
46.00	56.57	627.69	2,828.60	2,200.91
47.00	59.62	686.12	2,981.00	2,294.88
48.00	62.68	747.54	3,134.00	2,386.46
49.00	65.75	811.98	3,287.60	2,475.62
50.00	68.84	879.44	3,441.80	2,562.36
51.00	71.93	949.93	3,596.60	2,646.67
52.00	75.04	1,023.47	3,752.00	2,728.53
53.00	78.16	1,100.07	3,908.00	2,807.93
54.00	81.29	1,179.73	4,064.60	2,884.87
55.00	84.44	1,262.48	4,221.80	2,959.32
56.00	87.59	1,348.32	4,379.60	3,031.28
57.00	90.76	1,437.27	4,538.00	3,100.73
58.00	93.94	1,529.33	4,697.00	3,167.67
59.00	97.13	1,624.52	4,856.60	3,232.08
60.00	100.34	1,722.85	5,016.80	3,293.95
61.00	103.55	1,824.33	5,177.60	3,353.27
62.00	106.78	1,928.97	5,339.00	3,410.03
63.00	110.02	2,036.79	5,501.00	3,464.21
64.00	113.27	2,147.80	5,663.60	3,515.80
65.00	116.54	2,262.00	5,826.80	3,564.80
66.00	119.81	2,379.42	5,990.60	3,611.18
67.00	123.10	2,500.06	6,155.00	3,654.94
68.00	126.40	2,623.93	6,320.00	3,696.07
69.00	129.71	2,751.05	6,485.60	3,734.55
70.00	133.04	2,881.42	6,651.80	3,770.38
71.00	136.37	3,015.07	6,818.60	3,803.53
72.00	139.72	3,151.99	6,986.00	3,834.01
73.00	143.08	3,292.21	7,154.00	3,861.79
74.00	146.45	3,435.73	7,322.60	3,886.87
75.00	149.84	3,582.57	7,491.80	3,909.23
76.00	153.23	3,689.83	7,661.60	3,971.77
77.00	156.64	3,799.48	7,832.00	4,032.52
78.00	160.06	3,911.52	8,003.00	4,091.48

79.00	163.49	4,025.97	8,174.60	4,148.63
80.00	166.94	4,142.82	8,346.80	4,203.98
81.00	170.39	4,262.10	8,519.60	4,257.50
82.00	173.86	4,383.80	8,693.00	4,309.20
83.00	177.34	4,507.94	8,867.00	4,359.06
84.00	180.83	4,634.52	9,041.50	4,406.98
85.00	184.33	4,763.55	9,216.50	4,452.95
86.00	187.84	4,895.04	9,392.00	4,496.96
87.00	191.36	5,028.99	9,568.00	4,539.01
88.00	194.89	5,165.41	9,744.50	4,579.09
89.00	198.43	5,304.31	9,921.50	4,617.19
90.00	201.98	5,445.70	10,099.00	4,653.30
91.00	205.54	5,589.58	10,277.00	4,687.42
92.00	209.11	5,735.96	10,455.50	4,719.54
93.00	212.69	5,884.84	10,634.50	4,749.66
94.00	216.28	6,036.23	10,814.00	4,777.77
95.00	219.88	6,190.15	10,994.00	4,803.85
96.00	223.49	6,346.59	11,174.50	4,827.91
97.00	227.11	6,505.57	11,355.50	4,849.93
98.00	230.74	6,667.09	11,537.00	4,869.91
99.00	234.36	6,831.14	11,718.00	4,886.86
100.00	237.97	6,997.72	11,898.50	4,900.78
101.00	241.57	7,166.82	12,078.50	4,911.68
102.00	245.16	7,338.43	12,258.00	4,919.57
103.00	248.74	7,512.55	12,437.00	4,924.45
104.00	252.31	7,689.17	12,615.50	4,926.33
105.00	255.87	7,868.27	12,793.50	4,925.23
106.00	259.42	8,049.87	12,971.00	4,921.13
107.00	262.96	8,233.94	13,148.00	4,914.06
108.00	266.49	8,420.48	13,324.50	4,904.02
109.00	270.01	8,609.49	13,500.50	4,891.01
110.00	273.52	8,800.95	13,676.00	4,875.05
111.00	277.02	8,994.87	13,851.00	4,856.13
112.00	280.51	9,191.23	14,025.50	4,834.27
113.00	283.99	9,390.02	14,199.50	4,809.48
114.00	287.45	9,591.24	14,372.70	4,781.46
115.00	290.90	9,794.87	14,545.10	4,750.23
116.00	294.33	10,000.90	14,716.70	4,715.80
117.00	297.75	10,209.33	14,887.50	4,678.17
118.00	301.15	10,420.13	15,057.50	4,637.37
119.00	304.53	10,633.31	15,226.70	4,593.39

120.00	307.90	10,848.84	15,395.10	4,546.26
121.00	311.25	11,066.71	15,562.70	4,495.99
122.00	314.59	11,286.93	15,729.50	4,442.57
123.00	317.91	11,509.46	15,895.50	4,386.04
124.00	321.21	11,734.31	16,060.70	4,326.39
125.00	324.50	11,961.47	16,225.10	4,263.63
126.00	327.77	12,190.91	16,388.70	4,197.79
127.00	331.03	12,422.63	16,551.50	4,128.87
128.00	334.27	12,656.62	16,713.50	4,056.88
129.00	337.49	12,892.86	16,874.70	3,981.84
130.00	340.70	13,131.35	17,035.10	3,903.75
131.00	343.89	13,372.08	17,194.70	3,822.62
132.00	347.07	13,615.03	17,353.50	3,738.47
133.00	350.23	13,860.19	17,511.50	3,651.31
134.00	353.37	14,107.55	17,668.70	3,561.15
135.00	356.50	14,357.10	17,825.10	3,468.00
136.00	359.61	14,608.83	17,980.70	3,371.87
137.00	362.71	14,862.73	18,135.50	3,272.77