

NAME:

Beekeeping Economics

Uniting Beekeeping, Economics, Business, and Mathematics

Part 1: You Don't need to be a Prophet to Profit.

Part 2: Shopping for Equipment and Estimating Cost and Revenue.

Part 3: Loans and Interest

Part 4: The 3-year Business Plan.

(Developed by Stan Yoshinobu)

Introduction to Beekeeping Economics

The goal of Beekeeping Economics is to have you develop a **3-year business plan** for a beekeeping business. To start the business, you need money in the form of a business loan. To get the business loan, you need to present a 3-year business plan to a bank. On the last day of BK Economics, you will present your group's final 3-year business plan as if you were presenting your plan to a bank. If you have a solid 3-year business plan and present it clearly, the chances of having your loan approved are higher.

Part 1: You don't need to be a prophet to profit.
You just need a little math!!

Profit

Why do companies go out of business? The answer is simple. It is because they either do not make enough money or spend too much money. If you do not plan your finances carefully, your business will not survive. To ensure that your business has the best possible chance of surviving, you must understand cost, revenue, profit, loans, and of course beekeeping (or whatever particular business you want to get involved with). It is not enough to have a good or cute idea for a shop. The hard part is making your ideas work in a practical setting. Although we will concentrate on beekeeping, all the skills presented in BK Economics can be used for other businesses.

The first step towards your 3-year business plan is to understand a simple concept that you are probably familiar with.

$$\text{PROFIT} = \text{REVENUE} - \text{COST}$$

Revenue is the amount of money your company collects from selling products or services. For instance, if you sold shoes at a shoe store, the revenue for your shoe store would be the number of dollars your company collected from selling shoes.

Cost is the amount of money your company requires to operate. The shoe store doesn't get shoes from thin air. Shoes need to be purchased from shoe factories. Workers need to be hired. Rent must be paid. Then there's health insurance, taxes, cash registers, storage, electricity... the list goes on and on.

The key to making money is to know exactly what your cost is and to know as best you can what your revenue is now and what your revenue will be in the future. Now it's time to look at some problems.

Problem 1 *What is the difference between PROFIT and REVENUE?*

Problem 2 *Can PROFIT be a negative number? Explain your answer using complete sentences.*

Problem 3 *Can REVENUE or COST be a negative number? Explain your answer using complete sentences.*

Problem 4 *Calculate the revenue of the following business. Suppose a store called "Beyond Pastry" sells pastries. There are several kinds of pastries, which are categorized according to different prices. The three categories are basic pastries, deluxe, and deluxe with fruit. The basic pastries cost \$1.19. Deluxe pastries like ones with cream filling or chocolate glazes cost \$1.79. Deluxe with fruit, such as fruit tarts or raspberry tarts, cost \$2.69. On an average day "Beyond Pastry" sells about 100 basic, 75 deluxe and 45 deluxe with fruit pastries.*

Problem 5 *Calculate the cost of running a bike shop for 1 week. You need to hire 2 store clerks at \$9 per hour, one mechanic for \$12 per hour, plus fixed costs of \$500 dollars a week, which includes gas, electricity, rent, materials, insurance, and other small costs. The store is open from 9AM to 8PM, Monday through Friday, 8AM to 5PM and Saturday, and 12 noon to 5PM on Sunday.*

Problem 6 *Assume the bike shop above has revenue of \$5000 per month. Determine if the bike shop will make or lose money.*

Problem 7 *Now suppose the bike shop described above can sell a bicycle for \$250, but it costs the shop \$200 to purchase the bicycle from the factory. How many bicycles must the bike shop sell to avoid losing money?*

Problem 8 *Besides selling bicycles, what are other ways a bike shop can make money?*

Problem 9 *What is the goal of BK Economics?*

Problem 10 *How do PROFIT and COST relate to the goal of BK Economics?*

Beekeeping

In order to run a beekeeping business you need to know how to be a beekeeper. Read the following text called *An Introduction to Beekeeping*, and answer the questions at the end. The text was adapted from the Beekeeping 4H's Member Manual.

An Introduction to Beekeeping

A beekeeper is someone who keeps bees either for pleasure or profit. Currently there are an estimated 125,000 beekeepers in the United States, of which the majority keep bees as a hobby.

There are several different ways of getting started in beekeeping. Many beginners buy established colonies from other beekeepers. The beginner should be aware that purchasing secondhand equipment can lead to problems because the equipment might be contaminated with a bee disease or it may not be a standard size which could be a problem when you need to replace hive components. Beginners can also purchase from suppliers of bee equipment, the necessary pre-cut materials and assemble their hives. After doing so, one can buy and install packaged bees which is more desirable than trying to collect wild swarms.

Starting small keeps the beginner from being overwhelmed by the new undertaking. It is best to start with a small number of colonies. It is not uncommon for a new beekeeper to accidentally lose or kill a queen. Should this happen, the beekeeper with at least two colonies can exchange a frame with eggs from the colony with the queen with the queenless colony. The queenless colony can then rear another queen.

Choosing an Apiary Site

Selection and care of the apiary is an important consideration for successful beekeeping. Hill sides with southern exposure and protection from prevailing winds are best. Ideally, the hives should receive early morning sunlight to stimulate the workers to forage early in the day.

Avoid placing hives where grass or weeds obstruct the hive entrances or where flood or irrigation water is likely to cover the hive entrance and smother the bees.

Bee hives, especially in southern Arizona should be shaded when temperatures exceed about 95° F. When the temperature is high the bees expend a lot of energy carrying water to air-condition the brood nest. Shading hives relieves bees from this chore so they can collect nectar. Shade is less important in cooler, higher elevations where partial sun can be beneficial. Here, especially in winter, the hives should be exposed to the sun.

Honey bee colonies require a permanent source of water nearby. Bees use the water to prevent dehydration, maintain humidity in the brood nest, and cool the hive.

Installing Packaged Bees

Bees can be purchased as a package consisting of 2-5 pounds of bees, a queen, and a sugar syrup feeder in a screen cage. The best time to start with a package of bees and new equipment is in the spring, when blossoms will supply much of the food needed for brood rearing and for adult bees. However a package of bees placed in a new hive has no combs to store food in until the bees build them. Hence, you will need to feed the colony sugar syrup until it builds combs and begins to store honey.

Managing Honey Bee Colonies

There is no single correct way to keep bees. Your approach will depend upon your personality and the climatic constraints of your geographic area. Aspire to make your beekeeping a science by attempting to understand not only what the bees are doing but why they are doing it. General management goals should be to:

1. Assure the presence at all times of a healthy queen.
2. Provide unrestricted room for brood rearing.
3. Ensure that the colony has ample reserves of pollen and honey at all times, especially during times of the year when shortages of supplies are common. It may be necessary to supplement the food once in a while.
4. Try to coordinate colony population development with the seasonal availability of pollen and nectar.
5. Provide unrestricted room for honey storage.
6. Prevent swarming.
7. Keep complete records of each colony.

The Cycle of the Year

In a multistory colony, the brood is in the lowest part. In older colonies, the queen and her brood nest may move slowly upwards during the winter and early spring as the bees consume the honey stored above them, leaving the lower combs empty. The bees will not store honey below the brood nest so, in the spring, the beekeeper should transfer the brood to the bottom of the hive by moving all of the empty combs above the brood. This process is called reversing the brood chambers.

When the flowers bloom in the spring and the bees collect pollen and nectar, brood rearing begins in the center of the bee cluster, which consists of the queen and a few thousand worker bees. When the brood emerges, the cluster of new bees increases faster than the older bees die. With this increase in cluster size, and storage of honey, the brood chamber can become crowded. The bees will prepare to swarm. The first evidence of an inclination to swarm is the formation of queen cells along the bottoms of the brood chambers. More worker bees remain at home, and frequently a large cluster will have several hundred drones, and thousands of worker bees. One objective of good colony management is to prevent colonies from swarming. This can be done by reversing the colonies and by providing additional space for brood rearing or honey storage.

Bees do not hibernate, as do many other insects, but as the days grow colder in the fall they become less active. They gather together and form a tight cluster to conserve their heat when the temperature drops below 57° F. On dry, cool winter days in southern Arizona valleys the temperature is usually higher than 57° F, so the bees do not cluster but rest on combs. Here, the bees are able to fly year round except when it is cold and rainy. At higher elevations in Arizona bees form and stay in a tight cluster. They remain clustered for several weeks, unable to fly because of the cold.

Opening the Hive

The key to good colony management is knowing what is going on inside the hive. Since the normal temperature of the brood nest is about 92° F, and the relative humidity is high, you must be careful not to expose the bees to extreme heat (or cold) for long periods of time. Therefore when temperatures are extreme, do not keep the hive open for more than a small amount of time. The best time to open the hive is during the warm part of a calm sunny day when the bees are actively flying. Be sure to wear your complete bee suit and use a smoker. Always move in a slow, deliberate way and never swat at bees around you.

Checking on the Queen

One of the main reasons to inspect the hive frequently is to check on the queen and her activities. It is not necessary to see the queen each time the colony is inspected. The presence of eggs and brood in all stages in sufficient quantity for the season, and a solid pattern in the combs, indicates that she is doing a good job.

Requeening a Colony

If a queen has been injured, killed, removed or lost, the colony can be given another one. Requeening can be done almost any time of the year. Ideally beekeepers should requeen toward the end of the major honey flow. However, many beekeepers requeen during the spring.

Buy your queen from an established queen breeder, unless you have enough experience with bees to know how to rear your own. Remove the old queen three days before you introduce a new one into the colony. The now queenless colony will accept the new queen more readily. You may wish to cage and feed the old queen until you are sure the new one is accepted.

Preparing the Colony for Winter

When flowers are not blooming in abundance, the colony lives on its reserve stores of honey. If these stores are depleted, by either the bees or the beekeeper, the colony can starve. This can happen any time but is most likely during the late winter and early spring. Never remove all the honey from the hive. In the fall leave about 50 pounds (enough to fill most of the combs in a 9-frame-deep box), primarily above the compact brood nest. A comb or two filled with stored pollen on each side of the brood nest will foster rearing early in the spring and should assure good, early buildup of the colony.

If the colony has sufficient stores of both honey and pollen, and a compact brood nest indicating that a productive queen is present, it need not be disturbed during the winter months. Gently lifting the back end of the hive to estimate its weight periodically will give you an idea of how fast the stores are being consumed. If it seems no heavier than an empty hive, feeding might be necessary. Otherwise, all should be well.

Answer the following questions.

1. Where should a beekeeper place his or her hives?
2. How does temperature affect the bees?
3. Describe ways that a beekeeper should prepare a colony of bees for winter.
4. Name five important management goals of maintaining an apiary.
5. Do bees store honey below the brood nest?

6. Name three ways that bees use water.

7. What are some signs that a beekeeper should look for to be sure that the queen is doing a good job?

8. What is one clue that a beekeeper may have to notice that his/her bees are about to swarm? How can you try to prevent bees from swarming?

9. Write down three questions that you have about beekeeping. Save these questions for later.

Part 2: Shopping for Equipment and Estimating Cost and Revenue

Knowing how much it costs to start a business is a critical step. Today you will shop for various beekeeping equipment, set wages, and more to determine the cost of starting and owning a business. Keeping costs down and earning a profit go hand in hand.

Collecting Data

One of the tools at your disposal today is the internet. Finding prices online can save time and money. Several search engines exist that are quite useful. Visit www.yahoo.com or www.google.com to start your searches. What keywords would you use to search for beekeeping equipment?

Below is a list of items you need to find prices for or gather information about. Make sure you find prices for all items you need to run a beekeeping business. You are encouraged to work together to find the best prices. Make sure you record where you found the prices.

Product/Equipment Item	Price
Hive stand	
Hive covers	
Deep boxes	
Excluders	
Foundation	
Deep frames	
Shallow boxes	
Pollen traps	
Bottom boards	
Shallow frames	
Hive tools	
Helmet	
Bee suit	
Smoker	
Gloves	
Package of bees	
Queen	
Sugar (as food)	
The necessary parts for a hive	
Price of honey per pound	
Price of wax per pound	
Price and size of a honey stick	
Price of pollen per pound	
Price of renting a hive for pollination	
Quantity of honey or wax or pollen from a hive	
Cost of extraction of honey and bottling	
Amount of time it takes to care for 10 hives	

Use a Spreadsheet

Enter the prices you found above into your Microsoft Excel **cost worksheet**. You will be given instructions on how to obtain this file. From the excel spreadsheet determine the cost and revenue possible with your business during the first year. Do all your calculations on your spreadsheet. You may not use a calculator, except to check your answers. A glossary of the equipment can be found at the end.

To help you start, consider the following questions.

- Which products do you plan to sell (honey, pollen, rent for pollination etc.)?
- How many additional workers will work in your beekeeping business if any?
- What wage will you earn per hour and per year?
- Is your beekeeping business full-time or part-time?
- Which costs are "one-time" costs and which are recurring?
- How large will your business be (that is, what number of hives will you own)?
- Will you get a work vehicle?

Reporting Your Results

Make a chart of your initial findings on paper and present the chart to the class. You may work in groups. Include as much data as is necessary for your calculations of cost and revenue. Your chart should include

- Total start-up cost
- Recurring costs
- How many hives you start with
- Estimated revenue from your first year
- Which goods you plan on selling
- Estimated price or prices at which you plan to sell your goods
- Price of adding additional complete hives (for future business growth)

Part 3: Loans and Interest

Businesses are difficult to start, because starting a business requires lots of money. If you do not have the cash when you start your company, you must seek funding in the form of a loan. A lender will let you borrow money to buy equipment and pay workers so that you can sell your beekeeping products and services. The catch is that you have to pay interest.

Interest

Banks will not let you borrow money for free. Banks charge interest. If you borrow \$10,000 from a bank you will have to repay the bank the \$10,000 dollars plus interest. How do banks calculate interest?

Interest is the amount you have to pay in addition to the money owed, and is calculated in several ways. The first number you need to understand is the **interest rate**. Interest rate is given as a percentage of the amount borrowed. Banks compute interest by calculating a percentage of the amount borrowed over a certain period of time. This process is called **compounding**. Interest can be compounded annually, monthly, daily and continuously. We will only study the first two cases.

Interest can work in your favor. If you deposit money into a savings account, money market account, or other investment fund, the bank or investment company will pay you interest.

Interest Compounded Annually

The first case is **interest compounded annually**. When interest is compounded annually, banks charge a percentage of the amount borrowed after each year.

Problem 11 *Suppose \$1,000 are borrowed and the interest rate is 5%, compounded annually. What is the interest after 1 year? How much total will you owe after 1 year?*

Problem 12 *If \$500 are deposited into an investment account with an interest rate of 6.75%, compounded annually, then how much money will be in the account after 1-year? After 2-years?*

Problem 13 *What is the difference between INTEREST and INTEREST RATE?*

Problem 14 *What is the effect on interest if interest rates rise? Explain your answer by using concrete examples.*

Problem 15 *What can you conclude if interest rates decrease? Explain your answer by using concrete examples.*

Problem 16 *What is an excluder?*

Problem 17 *What is a shallow box?*

Interest Compounded Monthly

When banks compute interest compounded monthly banks charge one-twelfth of the interest rate every month. Why one-twelfth? Because there are 12 months in a year. In one year, interest is calculated 12 times at an interest rate equal to $\frac{1}{12}$ the annual interest rate.

For example, suppose I borrow \$1000 from a bank, at a rate of 7%, compounded monthly. Then after 1 month, the interest I have to pay is

$$\$1000 \times \frac{.07}{12} = \$5.83$$

Why did we round to 2 decimal places?

Problem 18 *Suppose you have \$3000 total charged to a credit card, which carries a 19% interest rate, compounded monthly. How much interest will accumulate in one month? (Hint: You will have to do something different than annual interest.)*

Problem 19 *Suppose you have accumulated \$4,000 on your credit card that charges 19% interest, compounded monthly. If you only pay the minimum monthly payment of \$20, will your next credit card bill be larger or smaller?*

Problem 20 *Explain what will happen if you continue to pay the minimum monthly payment of \$20 every month. Use complete sentences.*

Problem 21 *What is the difference between compounding annually and compounding monthly?*

How large of a loan do you need for your beekeeping business?

Using your calculations from part 2, you should be able to determine how large a loan you need to start your beekeeping business. The amount you need is at least as large as your total start-up cost. You may want some extra money for emergencies and unforeseen costs. Assume interest rates for a business loan are 9.5% compounded annually.

Problem 22 *Calculate using your excel cost worksheet how large of a loan you need. Use the supplied cost worksheet to calculate your costs.*

Problem 23 *What could your annual payments be if you want to pay off your loans after 3 years? (Hint: Use the table below. You may need to try this several times.)*

Year 1 Principal	
Interest on year 1 principal	
Total amount owed after year 1	
Year 1 loan payment (subtract)	

Year 2 Principal	
Interest on year 2 principal	
Total amount owed after year 2	
Year 2 loan payment (subtract)	

Year 3 Principal	
Interest on year 3 principal	
Total amount owed after year 3	
Year 3 loan payment (subtract)	

Problem 24 *How do loans relate to the goal of BK Economics?*

Problem 25 *Suppose you invest \$2000 into your retirement savings account (an IRA or 401k). Retirement accounts cannot be accessed without penalty until you are 59.5 years old. Assume that your account earns 8% interest annually. How large will the \$2000 grow to, if you leave the money in the account for 10 years? 20 years? 40 years?*

Part 4: The 3-Year Business Plan

The final step and the ultimate goal of BK Economics is for you to come up with a 3-year business plan. You have completed most of the hard work already. Now you will have to plan for the future. Will you grow your business? Will you keep your business as a part-time venture? Will you diversify into different products or will you concentrate on a winning formula?

Profit is the heart of the matter. Banks want to see profit in the near future. Otherwise your business will most likely fail, and you will not be able to repay your loan. Everyone loses when your business fails. Thus you should show in your 3-year business plan how much money you will make in the future with as much supporting evidence as possible.

A typical hive can produce about 60-80 pounds of honey per year, 1-2 pounds of pollen per year, and 2-4 pounds of wax per year. Use these values to determine your revenue.

Extraction and bottling of honey costs money. Assume that it costs 10% of your yield to extract and package your products. Extraction costs must be included in your cost.

Problem 26 *What is the cost of purchasing one complete hive with bees, queen, etc.?*

Problem 27 *How many hives will your group operate initially?*

Problem 28 *What are items that are not included in the cost of a hive?*

Year 1 Revenue

Sources	

Total revenue

Year 1 Cost

Loans	
Employees (include self)	
Extraction	
Other items	

Total Cost for year 1

Year 1 Profit (loss)

Year 2 Revenue

Sources	

Total revenue

Year 2 Cost

Loans	
Employees (include self)	
Extraction	
Other items	

Total Cost for year 2

Year 2 Profit

Year 3 Revenue

Sources	

Total revenue

Year 3 Cost

Loans	
Employees (include self)	
Extraction	
Other items	

Total Cost for year 3

Year 3 Profit

Making Your Proposal

In your business proposal include the following details grouped in a way that is easy to understand. Use a large sheet of paper and make a clear presentation of your 3-year business plan.

- Title or name of your company

- The number of hives you have every year
- A breakdown of your cost by year
- A breakdown of your revenue by year
- A breakdown of your profit by year
- Explain how you will grow your business
- Explain the amount you need to borrow and how the loan will be spent.
- Any other information you believe is important to convey.

Glossary

- **Barrels:** Metal containers used to store the honey once it has been extracted from the combs.
- **Deep box (Brood chamber):** This wooden box is used to house up to nine frames. The deep box contains the brood.
- **Excluder:** The queen excluder is a wood-framed grill placed on the deep box for the purpose of preventing the queen from entering the shallow boxes which contain the surplus honey.
- **Extracting:** This is the process of removing liquid honey from the comb.
- **Extractor:** A cylindrical machine which is used to extract the honey from the uncapped frames. The uncapped frames are placed radially in the extractor. As the extractor rotates, the honey leaves the cells and is forced against the walls of the extractor. The extractor also contains a hole at the bottom which allows the “freed” honey to be dispersed.
- **Foundation:** Foundation is a thin sheet of beeswax imprinted with hexagonal cells. It is placed in the center of a frame. The bees draw up the walls of these hexagonal cells.
- **Frame:** Rectangular structures made of either plastic or wood used to hold wax foundation or honeycomb in hives. Typically, nine frames are placed in either deep or shallow boxes.
- **Hive bottom:** This is the wooden board which sits on the hive stand. The bees enter the hive through an opening in this board.
- **Hive cover:** A wooden rectangular covering which sits on top of the highest shallow box.
- **Hive stand:** This is used to keep the hive off of the ground. The stand serves a dual purpose; it prevents the boxes from rotting and it keeps unwanted insects out.
- **Hive tool:** A tool which is used to pry apart the hive components or frames which have become stuck together.
- **Hot knife:** A tool used to remove the thin layer of wax which coats the combs, thus exposing the honey beneath.

- **Lift:** A piece of equipment which is used by a beekeeper to move the deep and shallow boxes from one location to another.
- **Pollen trap:** A mechanism which is attached to the beehive for the purpose of collecting pollen pellets from the pollen baskets of incoming foraging bees. The pollen trap is placed near the entrance to the hive. The bees pass through a grid before entering the hive. The dimensions of this grid allows the bee to enter the hive only after her pollen has been stripped off.
- **Seperator:** A device used to purify the honey after it has been extracted.
- **Shallow box (Shallow super):** This wooden box is typically used for storing the surplus honey. It is possible to have many shallow boxes per hive.
- **Smoker:** The smoker is used when a beekeeper wants to enter the hive. It is a metal cylinder with bellows in which a fire is lit. When a beekeeper enters the hive, he or she uses this tool to blow smoke which in turn causes the bees to gorge honey, thus keeping them more docile and less likely to sting.
- **Tank:** A metal container used to store the extracted honey.
- **Uncapper:** A device used to remove the wax cappings from the combs.