Essentials of management and economic decision tools for vegetable agribusinesses

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AVRDC
The World Vegetable Center

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AVRDC – The World Vegetable Center is the leading international nonprofit institute committed to alleviating poverty and malnutrition in the developing world through the increased production and consumption of safe vegetables.

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PREFACE

This book has been developed from material used by the author for the Vegetable Production and Marketing Training Course at AVRDC – The World Vegetable Center, Regional Center for Africa, and from many other short courses offered by the Center. There was a consensus among the training curriculum team that a manual was desirable to support the management and economics training course. This publication has been produced to address that need.

The book aims to equip vegetable farmers and small and medium size agribusiness managers with the basic managerial skills. The most fundamental farm management concepts and skills are covered in a concise manner, written in a simple, easy-to-understand format. Economic concepts are introduced and illustrated using basic examples to ease comprehension for readers with no background in economics.

Aspiring and practicing agribusiness managers and trainers conducting vegetable production, marketing, and agribusiness courses will benefit from this book. Agricultural extension agents, NARES personnel, NGOs, agricultural training institutions, and small agribusinesses will find it essential for their agribusiness and farm management training programs.

The book is organized in three separate sections to cover the full range of tools required to be a successful agribusiness manager. Section I covers the fundamentals of basic management and leadership concepts. Section II investigates the concept of planning and analyzes the tools necessary for successful planning and control. Section III covers several economic concepts generally used in business and management decision making.

ACKNOWLEDGEMENTS

INTRODUCTION

The United Nations projected that by 2020, close to half of the population (46.2%) of African countries will be living in cities (UN-Habitat, 2001), which will be challenged to provide food and income-generating opportunities for their residents. Vegetable production in Africa is important for its contribution to food security, income, health, and employment; horticulture creates on and off-farm jobs for the poor in urban and rural areas. Vegetables provide two times more job opportunities and have a longer and more complex value chain than other crops (Temple, 2001; Ali et al., 2002; Joshi et al., 2003). Vegetable production and horticulture can help provide solutions to many of the issues arising from increased urbanization.

The production of vegetable crops and seed in most sub-Saharan countries has been either stagnant or declining. Reasons include the marginalization of horticulture in national agricultural policies, which have emphasized the production of field crops to address food security concerns, and the lack of technical and managerial skills required for this activity. Vegetable crops and seed production, therefore, have been conducted mostly at a subsistence level. According to Mwandila and Mnzava (1990), the seed industry in Africa is rudimentary at best, and commercial production of vegetable seeds is still in its infancy. Similarly, vegetable crop production is limited, concentrated in exotic vegetable production for the export market, and usually undertaken by foreign companies. Vegetable production for domestic use has yet to be developed. However, the demand for high quality vegetables in domestic markets is increasing due to greater awareness of food safety issues and the rise in supermarkets as important outlets for produce.

Complexities associated with vegetable crops and seed production account for the industry's slow development in the region:

- Vegetable crop seed production is a highly technical and skilled operation similar to a manufacturing process.
- Producers lack experience in vegetable production, mostly because agricultural policies in sub-Saharan African countries focus mainly on field crops such as wheat, maize, and sorghum, and industrial crops such as cocoa, coffee, tea, and cotton.
- All types of vegetables require a specific microclimate, making seed production of all vegetables impossible in one climatic zone.
- Vegetables can be produced as a crop or for seed. Although all vegetable seeds are edible, the majority are not accepted as food. Excess production is either rejected or a total loss if not properly stored.
- The vegetable production cycle is much shorter and much more input intensive than other crops.
- Substantial initial investments for storage, transportation, and distribution may prolong the time needed before the breakeven point is achieved.
- Seed production and trade is often subject to complex regulations, which increase the risk associated with such an activity.

The precautions required for postharvest handling of vegetable crops and seed multiplication further complicate the situation. For seed multiplication, cross-pollination, mechanical admixture, disease and pest control, and seed storage are required. High temperatures and humidity accelerate seed deterioration and lead to loss of seed viability. Vegetable crops are highly perishable, making them unfit for transportation over long distances without proper infrastructure and equipment. Given the complexities involved in production and the resources required, the production on vegetable crops and seed is considered a high-risk enterprise.

Local vegetable production is bound to evolve towards the use of modern farm management techniques to satisfy the increasing demand from urban markets. Decision making in business implies that management has a choice among alternative actions. The alternative actions could be different combinations of crops to produce, alternative production systems for crops, or different marketing and financial strategies (Nkengoum, 2003; Nkengoum et al., 2004). Decisions concerning vegetable production should be considered with care; the potential producer should have the technical and managerial skills required to ensure the enterprise can grow and develop over time.

Few vegetable producers have time to consider economic and managerial principles in running their enterprises. More emphasis is placed on the technical aspects of the production. This is due in part to the fact that most agribusiness managers are highly skilled scientists with little to no training in management and business administration techniques. The economic principles presented here, if carefully interpreted, provide guidelines to help the producer make the necessary decisions for a successful vegetable production enterprise.

This manual presents the fundamental decisions that a producer has to make when establishing vegetable crop and seed production, and outlines the necessary underlying economic principles. Section I of the book aims to give agribusiness managers the necessary management and leadership tools needed for success. Section II presents the basic financial management skills necessary to maintain the farm business in good financial health, including the rudiments of planning and recordkeeping. Section III covers the essential economics tools available for making business decisions.

SECTION I

EFFECTIVE LEADERSHIP AND MANAGEMENT

Chapter 1: Basic management and leadership concepts

I   Management: a definition

Management is the process of successfully pursuing desired results with the resources available to the organization.

1.1   An art and a science

Management is both an art and a science. Because management deals with people, management principles should be regarded as imperfect at best. At the same time, management principles help us make decisions in an imperfect world. Management principles help foster continual growth and progress for managers and their businesses.

1.2   Resources and success

Resources: Each organization possesses a variety of resources: financial, human, facilities, equipment, patents, etc. Successful managers get the highest potential return from the resources they have at their disposal.

Success: Good management must meet desired and predetermined goals or results. Managers must know where they are headed to achieve such success.

II   Role of the manager

The manager's role is to organize and combine resources in a way that will help the organization reach its goals. There is, however, a danger that a manager may not discriminate between different types of resources, and may treat people just as interchangeable inputs in the production process. Good managers are more effective in an environment that permits creative change. They live to make things happen. An effective manager should possess leadership skills that will allow him/her to integrate change in their management practices. Success for a manager requires being comfortable with the managerial role, to accept responsibility, and to provide leadership for change.

2.1   The manager's specific tasks

Managers must execute four principal tasks in their work:

- Planning
- Organizing
- Directing
- Controlling

Each of these tasks deals with a specific aspect of what managers must do when they manage.

2.1.1 Planning

Planning can be defined as forward thinking about courses of action based on a full understanding of all factors involved and directed at specific targets and performance objectives. This implies developing alternative methods of achieving those specific targets and objectives. They are three main types of planning: strategic planning, tactical planning, and operational planning.

Strategic planning deals with developing courses of action for the long term. Long-term may be two or three years for a small firm, while a very large or multinational firm may be looking at 15-20 years. Strategic plans tackle the broadest element of the firm's strategy. The first step of strategic planning is the development of a mission statement. The mission statement spells out the purpose of the organization, and how it is part of a larger world. It shows the direction for a firm and describes its destination. When developing a mission statement, the manager must think strategically about the firm's business in the future. The mission statement must include in a very clear and concise fashion:

- a description of the company
- what it does
- where it is headed

The mission statement usually has three parts:

- key markets (who we serve)
- contribution (what we do)
- distinction (how we do it differently)

The mission statement should be unique to a firm. General, generic statements that could apply to any firm are not useful. Such weak statements do not offer mental guidance on which activity to pursue or on how the firm should be different from other firms in the industry. Mission statements should be expressed in language that attracts attention, creates a vivid image, and provokes emotion and excitement to inspire those involved. Some mission statements include both the firm's goal and its vision. Others are simple, short phrases that explicitly or implicitly integrate the three parts. Here are two examples[1]:

> Syngenta: *Bring plant potential to life*. Syngenta plans to achieve this through innovative technology and sustainable agriculture.

> Bayer CropScience: *Science for better life*. Bayer CropScience adds that "science is at the heart of what we do," which is "working to create value through innovation and growth."

Management should be focused on some identified end point called a "goal." A goal is an overall target the organization is trying to reach. Strategic planning represents the

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[1] Missions and vision for Syngenta and Bayer CropScience from their respective websites (http://www.syngenta.com and http://www.bayercropscience .com)

preparation of the firm for future business conditions, and should help develop the organization's vision. The vision is the ideal image of the organization's future. Bayer CropScience's vision is "to be a leading partner in providing innovative products and combined solutions for the production of quality food, feed, and fiber to meet global challenges of tomorrow."

Tactical planning involves the formulation of specific goals and short-term activities relevant for specific farm units and consistent with strategic plans. Tactical plans are crucial for the implementation of strategic plans. The tactical plan's time horizon is shorter, generally from a few days to a few months, and focuses on specific action steps to be taken to achieve the goals.

Operational planning focuses on the specific processes and actions required to complete the specific activities necessary to achieve the organization's goals. Mr. Obama wants to produce 300 kg of tomato seed. He needs to plan how to achieve this goal by deciding on how much land, foundation seed, and other resources will be needed to reach this target.

Contingency planning is the development of alternative plans for various business conditions. It is part of the strategic and tactical planning process for a firm. Contingency plans provide guidance during crises and times when things may go differently than expected.

2.1.2   Organizing

Organizing represents the systematic classification and grouping of human and other resources in a manner that is consistent with the firm's goals. It is the responsibility of the manager to design a structure that allows employees to accomplish their own work while working toward the organization's goals at the same time. Organizing is done continuously during the course of a firm's life and helps establish accountability for the results achieved. The manager must develop an organizational structure before he or she can implement the strategies needed to achieve the goals developed in the planning task.

Organizing involves:

- setting up the organizational structure
- determining the job to be done
- defining lines of authority and responsibility
- establishing relationships within the organization

The **organizational structure** is the framework of a company. It provides the beams, braces, and supports to which the appropriate "building materials" are attached. Different jobs are grouped, coordinated, and further defined. Coordinated communication and cooperation between workgroups is essential.

An **organizational chart** is a graphical representation that shows the formal organizational structure of a company. It helps capture some important ideas, including the division of labor, the chain of command, bureaucracy, and organizational design.

The **division of labor** is the manner in which jobs are broken into components or activities, and then assigned to members or groups. The objective of the division of labor is to accomplish what one group or individual could not successfully and

efficiently accomplish alone. It is done by delegating specific smaller tasks to many staff members without any of them shouldering the burden or the immensity of the job.

The **chain of command** is illustrated in the organizational structure by the authority-responsibility relationships or links between managers and those they supervise. This continuum exists throughout the company. The chain of command should be very clear. This way, employees will know to whom they report and are accountable. It is also important to note that an employee should not report to several people at the same time, because it may create a loop within which the employee receives contradictory directions from different people and becomes unable to efficiently perform his/her task.

2.1.3 Directing

Directing is guiding the efforts of others towards achieving common goals. It is accomplished by:

- selecting, allocating, and training personnel
- staffing positions
- assigning duties and responsibilities
- establishing the results to be achieved
- creating the desire for success
- seeing that the job is done and done properly

Directing involves leading, supervising, motivating, delegating, and evaluating those whom you manage. Managers are directing when they make sure that the efforts of each individual are focused on accomplishing the common objective of the organization. Leading is at the very heart of the management process and is founded on a good organizational plan or structure that provides for responsibility, authority, and evaluation.

2.1.4 Controlling

Control complements the other three tasks of management. It compensates for misjudgments, the unexpected, and the impact of change. Proper control offers the organization the necessary information and time to correct programs and plans that have gotten off-track.

III Differences between the manager and the supervisor

It is important to make a distinction between the attitudes a manager should adopt from those expected of a supervisor.

A supervisor is the lowest management position in a firm. The supervisor is responsible for the day-to-day performance of a small group. It may be a team or a shift. The supervisor has a lot of experience in what the group does, but is not necessarily better at it than everyone he or she supervises. The supervisor's job is to guide the group toward its goals, see that all members of the team are productive, and resolve problems as they arise. The supervisor makes sure the procedures are followed; the goals are met, and does not deal with excuses.

A manager, on the other hand, is a goal-oriented supervisor who also ensures the emotional well-being of the group. A manager that does not consider the employee's emotional well-being when evaluating and analyzing the situation at hand, but only discusses results compared to goals, is stuck in the mindset of a simple supervisor. The manager has to be more of a leader, motivating and inspiring the members of his staff, rather than an enforcer. A supervisor that exhibits exceptional leadership and motivational skills is a good candidate for promotion to management positions. Table 1 summarizes the tasks of managers and supervisors.

Table 1. The manager versus the supervisor (common tasks are set in bold)

	Manager		**Supervisor**
Tasks	**Supervises**	Decides	Enforces
	Evaluates	Monitors	Controls
	Encourages	Hires	Punishes
	Motivates	Fires	**Encourages**
	Inspires	**Communicates**	**Evaluates the work done**
	Empowers	Organizes	**Supervises**
	Provides	Controls	**Implement Goals**
	Teaches	Plans	Implement Target
	Leads	**Directs**	Oversees Tasks
	Listens	**Manages**	See to Completion
	Set Goals		Threatens
	Define Missions		Recommends
	Delegates		**Communicates**
	Is pro-active		**Directs**

Figure 1 shows the planning activity.
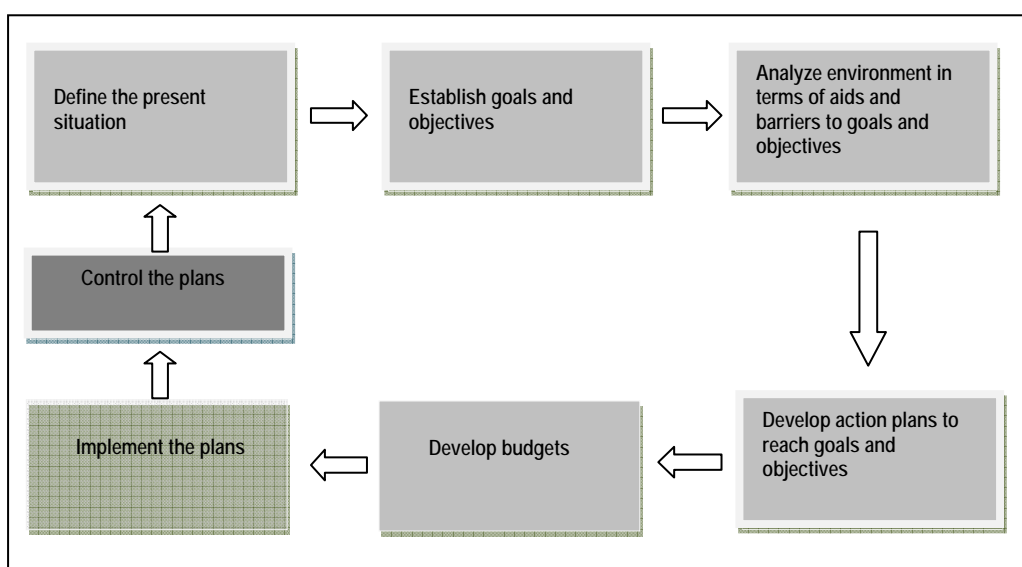
Figure 1. Planning the agribusiness

Chapter 2: Structuring the farm business

The first step towards structuring the farm business is to decide on the form it is going to take. Boehlje (1992) outlined a number of criteria that should be considered when choosing an organizational structure for the farm business, which include: (1) control, (2) cost, (3) risk of financial loss, and (4) maturity/permanence/liquidity.

Maintaining control, the desire for independence, and the focus on individual decision making dominates business organizational and financial structures. These factors explain in large part why many agribusiness ventures are sole proprietorships. Accessing resources and funds at the lowest possible **cost** to implement the chosen set of activities and farm enterprises influences the type of organization structure adopted. Costs to be considered include not only the cost of inputs, but also administrative and legal costs (taxes, licensing fees, etc.)

The **risk of financial loss** is one of the most important aspects to be considered when deciding on the form of the farm business. This risk is comprised of the claims of various parties on the farm's income/revenues, assets, bankruptcy/legal liability, and failure of the venture.

Maturity (permanence/liquidity) of the business refers to the ease with which the business can be closed. While some venture arrangements are needed only for a short period of times, other are structured to last much longer. The expected lifetime of the business arrangement will dictate which form the farm business will take.

After the business form has been chosen and established as an entity, the managers must build the team that will perform the operational activities of the farm business. The choice of organizational structure will help the firm define the task of each potential staff member that will make up the operational team of the farm business.

I The farm business form

To register the farm business as a legal entity, the owners must decide on a form. Many forms exist out of which the sole proprietorship, the partnership, the limited liability company, the corporation, and the cooperative are the most common. Because each of the form presents unique characteristics, owners must choose the form that fits their objectives, the environment, and their specific circumstances. Factors to consider include but are not limited to: how much capital is available for the farm startup, what type of business will be conducted, how much capital is needed to support the business operations, how easy it is to secure additional capital, how much privacy do owners want, how much risk do they want to bear, how much personal involvement do the owners want in the business, how important are stability, continuity, and transfer of ownership, etc. To briefly review the different forms:

1.1 The sole proprietorship

The sole proprietorship is a business owned and controlled by one single person. Under this form of organization, the owner has unlimited liability, which means he/she is fully responsible for the company's debts. In other words, the owner's personal assets and his business are legally the same. Any part or all of his personal property may be used to pay the company's debts if necessary. Advantages of sole proprietorship include the full

control of the business by the owner, and the ease of formation and management. Disadvantages include unlimited personal liability and limitations to raising funds.

1.2   The partnership

Partnerships are businesses owned jointly by two or more people. A partnership can either be exactly similar to a sole proprietorship, in that the partners are fully liable for the company's debts, or it can be limited. The form of partnership where members are fully liable to the firm debts is called *general partnership*. It is similar to sole proprietorship, with the only difference that instead of a single owner, they are two or more owners sharing the business' liability. A second type of partnership where some owners are fully liable while others have limited liability is called *limited partnership*. In this case, there must at least one general partner, who is fully liable, and some other partners, who can contribute to the capital and have their responsibility limited to their contribution to the business. Advantages of partnerships include the ability to share work among the partners and the ability to share risks as well as the ease of formation. Disadvantages include unlimited personal liability for general partners and the limited ability to raise funds.

1.3   The limited liability company (LLC)

A limited liability company is a hybrid form of business that falls in-between a partnership and a corporation. It is as easy to form as a partnership, but the owners' liability is limited to their share in the company's assets. Unlike a corporation, the LLC does not pay taxes as an entity, even though the LLC is required to pay an annual franchise tax. Profits and losses are reported on the individual members' income tax returns. Creditors may pursue the limited liability company's assets to have their claims paid for, but cannot pursue the individual owners' personal property to satisfy this need. To form an LLC, owners, called "members," file a document with authorities called the Articles of Organization and draft an operating agreement. Advantages of limited liability companies include the higher number of members, which translates to a greater ability to share risks, work, and raise equity capital. There is no limit to the membership, which may include individuals, corporations, other LLCs, trusts and pension funds, etc. LLCs can run their businesses just as partners do in a partnership, but also can hire professional managers to run their operations, unlike partnerships. The transfer of ownership is limited. Disadvantages include the risk of termination in case of the death of a member, and the inability of its members to deduct the cost of fringe benefits such as insurance and the use of personal vehicles for business purposes from individual taxable income. LLCs are also more complex to manage than partnerships.

1.4   The corporation

A corporation is a form of business endowed with a special legal status similar to that of a person. The corporation has thus the same powers, rights, and obligations as a person. Because of this endowment, the corporation's liability is limited to its assets. Corporation members are shareholders, and their liability is limited to their contributions (shares) to the business. The advantages of the corporation include the limited personal liability and the greater ability to raise funds. Disadvantages include

higher organizational costs, the possibility of double taxation of income for shareholders, and the potential conflict in goal setting and understanding between shareholders and the managers. Shareholder goals may be profit maximization, while the corporation's manager may seek to expand company growth. This is often referred to as a *principal-agent problem.*

The principal-agent problem occurs when the agent (i.e. the manager) hired by the principal (owner or group of owners) to manage a corporation pursues goals and activities that will maximize the agent's personal benefits. For example, a Chief Operating Officer (COO) may pursue personal goals, alter financial statements to show outcomes that maximize his/her bonuses, or opt to reinvest the entire amount of the firm's profit instead of redistributing it to shareholders. In this situation, the agent's objective is in direct conflict with the principal's objective, which is profit maximization. Shares of the firm's common stocks can be offered to the firm's executives as part of the compensation of their effort in an attempt to eliminate the principal-agency problem.

1.5   The cooperative

Cooperatives are very popular in the agricultural sector. A cooperative is a business or service organization that is owned and democratically controlled by the people who use its services and receive the benefits (services and earning allocations), which are distributed on the basis of how much they use it. As a self-help business form, agricultural cooperatives were designed to move product to market and influence price and other terms of trade while providing fair treatment and other benefits to members. The cooperative concept was developed so that farmers could exert market power and raise the total returns to their activities.

Traditional cooperatives face numerous limitations, mainly organizational, caused by vaguely defined property rights, which lead to free-rider, portfolio, horizon, agency, and influence-cost problems (see Cook 1995 or Fulton 2001 for more detailed explanations). Solving these problems requires a clear specification of each member's property rights.

New Generation Cooperatives (NGC) attempt to create investment incentives for producers to avoid these problems. Also called value-added cooperatives, NGCs are the result of a paradigm shift from a mentality of producing and then selling an agricultural commodity to that of manufacturing a food product with characteristics consumers or other buyers have identified as important (Fulton, 1997). As the production of agricultural food products becomes more industrialized, control and associated power shifts to market actors who have access to the raw material inputs, the genetics, and the final consumer (Boehlje, 1992). NGCs allow farmers to add to their farming operation some manufacturing capability via a cooperative, and potentially increase their revenues while maintaining their power through the control of their product from the seed to the finished product.

NGCs operate under a set of rules different from those of traditional cooperatives. While the latter acts as a clearinghouse for products, a NGC is restricted to only accepting a predetermined amount of product from its members. Membership is closed and members have specific delivery responsibilities and rights that are tied to the level of equity invested. According to Stefanson et al. (1995), a "two-way" contract exists

between the members and the NGC that requires the member to deliver a certain amount of product to the cooperative and requires the cooperative to take delivery of this product. Cook and Iliopoulos (1999) describe the following organizational characteristics as providing the skeleton of NGCs:

- A minimum up-front equity investment required from members
- Equity shares are transferable once the cooperative and membership is closed
- Equity shares that members own may appreciate with development of the NGC
- Membership is limited to a certain number
- Members are linked to the NGC by a legally binding delivery contract or a uniform grower agreement, under which they have legal obligation to deliver a certain amount of their produce to the processing facility.

However, NGCs keep some similarities with traditional cooperative structures (Stefanson et al. 1995):

- Democratic tradition is maintained through a policy of one member, one vote
- Excess earnings are distributed among the members as dividends
- Members elect the Board of Directors from the membership

II   Building a team

The agribusiness firm is comprised of people working together toward a common purpose. As soon as an agribusiness involves more than one person, a variety of organizational, personnel, leadership, and motivational issues inevitably arise. The larger the organization, the more complex and critical these issues become. One of the fundamental responsibilities of management is to acquire, organize, motivate, lead, and manage people to accomplish business objectives as effectively as possible. This means building a team: **T**ogether, **E**ach **A**chieves **M**ore.

A great team is not always a collection of all the brightest minds in the business. A team made of geniuses may fail to meet goals and expectations if interpersonal relationships were not considered when the team was being built. How different personalities fit together is just as important as how an individual's expertise will complement the organization.

Building a good team (a team that achieves expected results) is just like fitting the pieces together in a puzzle. A team made of somewhat ordinary members can achieve unprecedented results if chosen carefully and led properly.

III   The farm business organizational structure

The organization depends on two kinds of structures to operate: A formal structure and an informal structure.

3.1   The formal structure

The formal structure serves as a foundation to all activities in the firm. The owners of the firm provide the firm with financial resources with which it operates. They also set the general direction for the organization, either directly or through elected representatives (the board of directors). The board in turn delegates to managers the authority to make decisions, and management is held accountable for the business. Management then develops an organizational structure specifying the various responsibilities, authority, and accountability of employees. Employees help develop and execute plans for accomplishing business objectives.

Responsibility is the obligation to see a task through to completion. It may be a contractual obligation, or voluntarily assumed, but it cannot be given away. It can be shared with another person or group, but it cannot be passed downward with no further obligation.

Authority is the right to command or force an action by another. Authority allows instructions to be given to another individual with the expectation that they will be carried out explicitly. Authority is a derivative of responsibility.

Accountability means being answerable to another for performance. Associated with accountability is the notion of a reward for acceptable behavior or a penalty for unacceptable results. Accountability is also derived from responsibility.

The formal organizational structure of an agribusiness defines areas of responsibility and authority, and delineates who is accountable to whom and for what. The larger the agribusiness firm, the more formalized and structured its organization is likely to be.

3.1.1   Principles of organization

There are several key principles useful in developing an effective organizational structure: The span-of-control principle, the minimal layer principle, the delegation downward principle, the parity and authority principle, and the flexibility principle.

The *span-of-control principle* states that the number of people who can be supervised effectively by one individual is limited. This maximum number depends on many factors, including the frequency of contacts that must be made, the type of work, the level of subordinates, and the skill of the supervisor. In military organizations the number of supervised varies between four and seven. In assembly lines, that number reaches 40 or 50 people.

The *minimal layer principle* states that the number of levels of management should be kept as low as possible. This is consistent with the goal of maintaining an effective span of control. As organizations grow, there is a tendency for the levels of management to proliferate, but each additional level increases the complexity of communications and the opportunities for breakdowns.

The *delegation downward principle* states that authority should be delegated downward to the lowest level at which the decision can be made competently. This allows upper management to concentrate on more important decisions. At the same

time, delegation of authority never relieves the delegator of the original responsibility. The supervisor always remains responsible for everything that happens under his or her supervision.

The *parity of responsibility and authority principle* states that a person should have enough authority to carry out assigned responsibilities. It would be totally unfair to hold employees accountable for areas in which they have not been granted enough authority to make the decisions that affect the outcome.

The *flexibility principle* states that an organization should maintain its structural flexibility so that it can adjust to its changing internal and external environments. Organizations are always changing. Changing the organizational structure can be very disruptive and take people's focus off day-to-day operations. Changing the power structure can be very delicate, since organizational structure involves people that may feel threatened by change and tend to resist it.

3.1.2   Types of formal organizational structures

There are three basic types of organizational structures: the line organization, the line and staff organization, and the functional organization.

A *line organization* is a structure in which there is one simple, clear line of authority extending downward from the top management to each person in the organization. Each subordinate reports to only one person and everyone in the organization is directly involved in performing functions that are primary to the existence of the business. The weaknesses of this type of structure are that not only is it very rigid, but it has no provision for specialists. Figure 2 depicts the possible line organization structure of a seed company.

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                    ┌─────────────────────┐
                    │       Manager       │
                    └─────────────────────┘
                               │
                    ┌─────────────────────┐
                    │  Assistant Manager  │
                    └─────────────────────┘
                               │
         ┌─────────────────────┼─────────────────────┐
┌──────────────────┐ ┌──────────────────┐ ┌──────────────────┐
│  Nursery Manager │ │Retail Store Manager│ │Greenhouse Manager│
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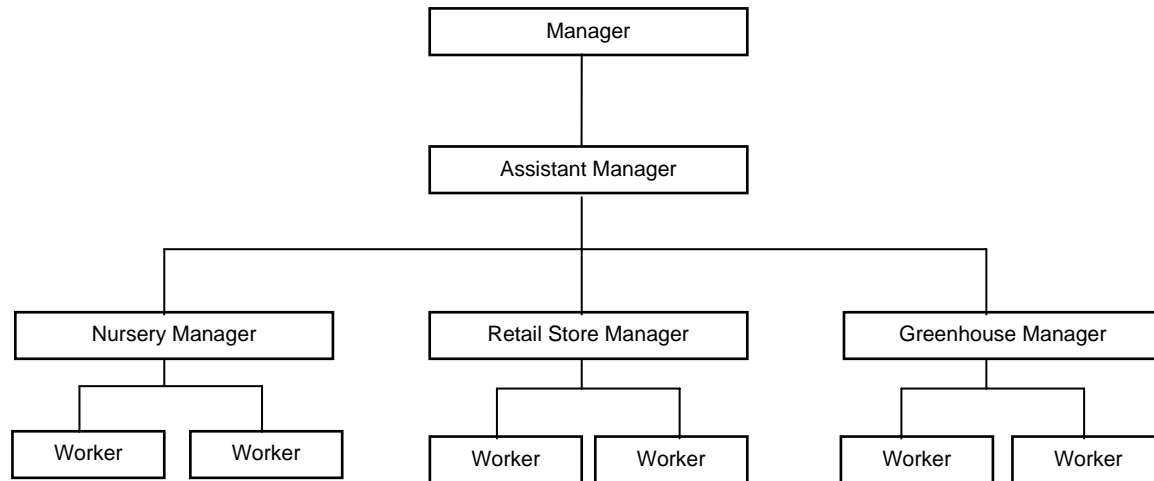
Figure 2. Line organization structure

The *line and staff organization* is a variation of the line organization, with the difference that it includes a place for specialists, sometimes known as staff (Fig. 3). In this type of organization, staff personnel have direct accountability to key line managers and are responsible for offering advice on problems or providing services in area of specialization. Typically, these specialists have no authority except over assistants who may be assigned to them. Their advice can be accepted or rejected by line managers, who retain responsibility for all decisions.
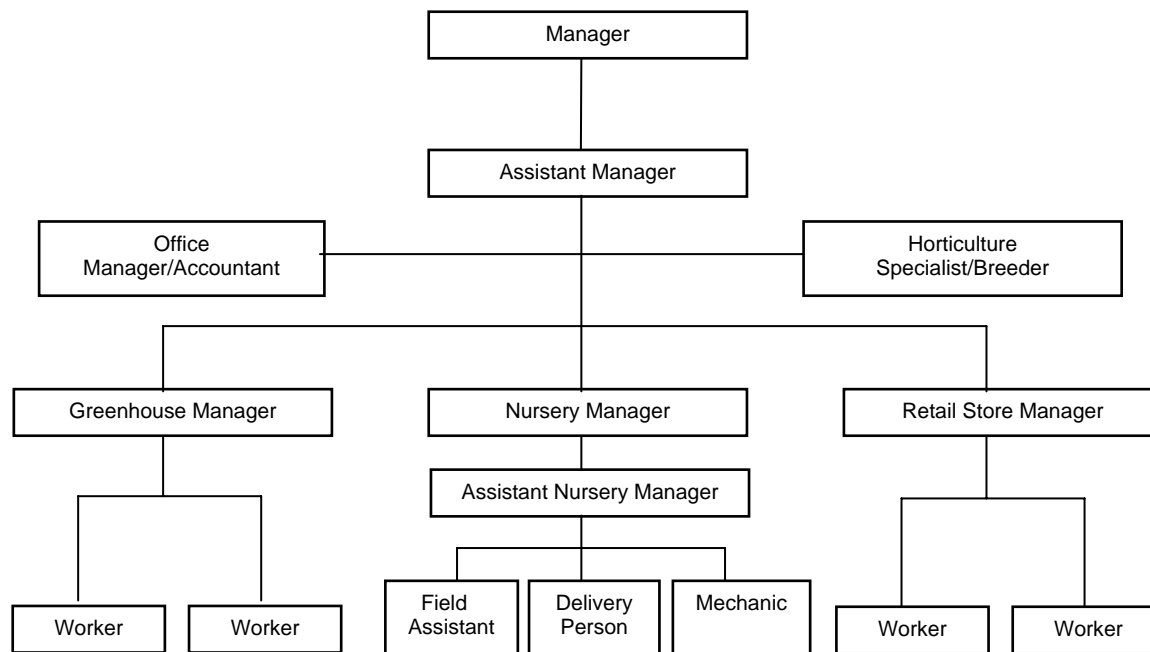
Figure 3. Line and staff organization structure

A *functional organization* structure meets the problem of staff specialists' authority head-on by granting them authority in the areas of their specialty. The horticulturist/pathologist who sees the need for immediate insecticide treatment of bedding plants has the responsibility and the authority to command workers to make the application. In this type of organization, there is a huge potential for conflict and confusion. Who has the highest authority? From whom should workers really take orders? These are common questions in firms using a functional structure. The key to making this structure work is coordination of staff and line management efforts. Cooperative attitude and good communication are absolutely essential for this organizational structure to work. Because the advantages outweigh its disadvantages, this structure is very common with agribusiness firms. Figure 4 shows an example of functional organization structure.
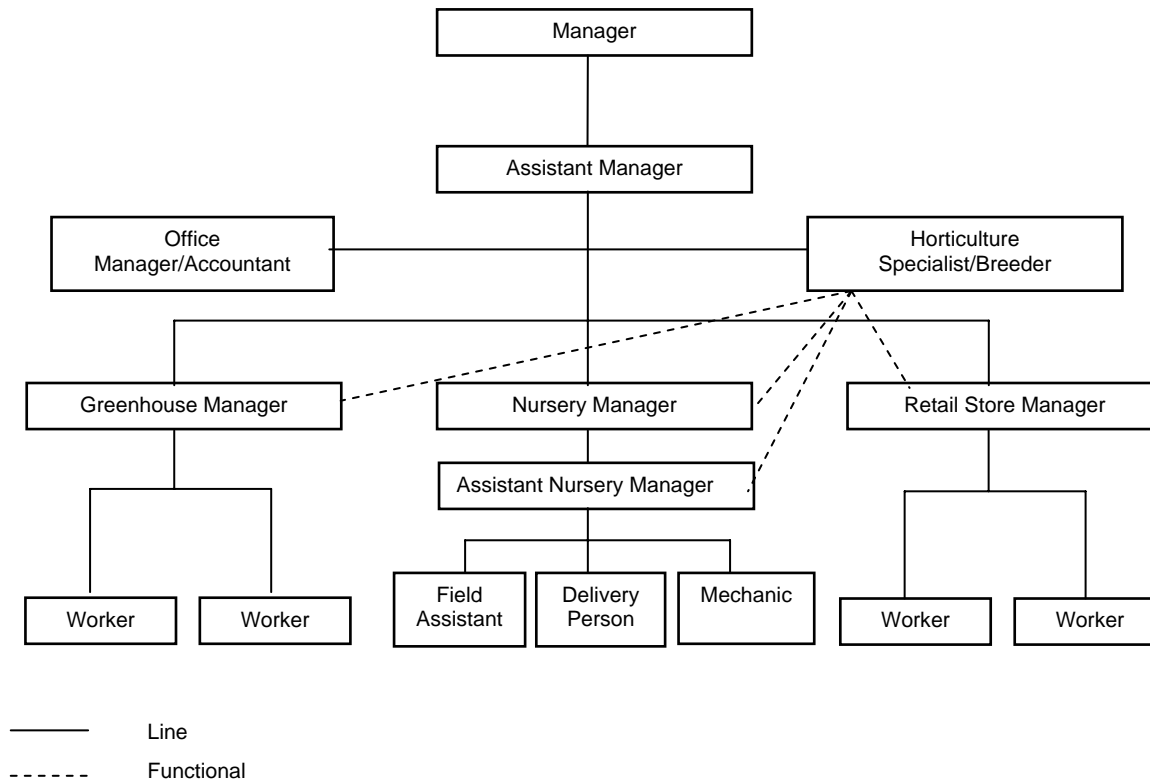
Figure 4. Functional organization structure

3.2   The informal organizational structure

The informal organization is primarily concerned with the interpersonal relationships among people: their emotions, feelings, communications, and values. This informal organization is an important part of the organization's culture. The informal organization is crucial to the success of any firm, since it contributes greatly to the fulfillment of individuals' personal needs. Most professionals spend as many or more hours on the job as they do with their families. For some, the hours spent on the job maybe the primary source of ego fulfillment and social relationships. Their role on the job, their status among peers, and their personal feelings about their jobs are critical to their well-being; therefore, all these factors directly affect how well the formal organization works. Personal lives of employees can affect an organization's efficiency positively or negatively. Companies with informal organizational structures are much more productive, because of the added desirable fringe benefits. Gaps caused by unexpected situations are handed more easily, and communication is facilitated through informal channels. More work gets done better as people feel commitment to the common goal.

Where informal organization is lacking, results are less predictable, people are less flexible, and they may spend considerable more time on activities that are counterproductive to company goals.

Status symbol exists in every group. Symbols include: title, age, experience, physical characteristics, knowledge, material possessions, authority, location, privileges, acquaintances, and more.

Chapter 3:   Leadership and management failures

As much as many authors link leadership closely with management, many others consider that the two concepts are totally different. The first category of authors considers management a subset of leadership. Hersey et al. (2008), according to whom "leadership occur anytime one attempts to influence the behavior of an individual or a group," claim that management is leadership applied to business situations. The second category consider leaders as aspiring visionaries, concerned with substances and people, while managers are planners that concern themselves with processes and tasks (Zaleznik, 1977; Bennis, 1989; Birch, 1999).

   The manager's duties include efforts to perform various management tasks and functions, whereas a leader influences the attitudes and behavior of followers and motivates them to do their best work. Leadership involves not only providing instructions on how to complete a task and information on the desired results, but also includes providing incentives to complete tasks correctly and in a timely manner.

   An important aspect of leadership is the motivation of employees. Motivation is creating a vision for the organization or the group, which can create excitement in the group. Motivation also can be done through delegation of authority by assigning more responsibility to employees, which encourages them to take more pride in their jobs and raise their self-esteem. Such assignments should be combined with monetary incentives that are tied to organizational goals and individual performance objectives determined in the planning task. Leadership attempts to unleash each person's individual potential as a contribution toward the organization's success, and recognizes that the results of a person's activities count for more than the activities themselves.

   For managers to be effective leaders, they need initiative, which is the willingness to take action. Some managers who recognize the need to enact change are unwilling to take action because making change requires more effort than maintaining the status quo.

I   Leadership

1.1   Leadership vs management

Defined as one's ability to get others to follow willingly, leadership is a necessary quality for good management. While management relies more on procedures and a set of tools such as plans and budgets that have been tested over the years, leadership requires a vision of the organization for the future. Managers will achieve the organization's goals through others; leaders help people achieve goals and accomplish the organization's vision. Over the years authors have identified many styles of leadership, corresponding to different types of personalities or environmental situations. Table 2 lists the most popular leadership styles encountered in the literature. The table also identifies the different tasks of leaders and how they relate to their subordinates. Finally, the situations in which these styles may apply are identified.

Table 2. Leadership styles

Leadership style	The leader	Subordinates	Situations in which this style applies
Autocratic (Lewin et al., 1939)	• makes all the decisions • alone has a required experience and ability • has overriding authority • focuses exclusively on the company's objectives	• lack experience and ability • don't care about business goals • are immature • constitute large groups • have poorly defined and unstructured tasks	• calls for firm decision making • requires strict control • involves considerable variation • calls for high productivity
Bureaucratic (Weber, 1905)	• work by the book • is all about the procedures • everything is part of a well-established routine/ structured process	• just follow the procedures • don't care about business goals • become and expert in filing papers	• jobs involving high safety risk • situations involving large sums of money • government jobs
Charismatic (Weber, 1905)	• injects huge dose of enthusiasm in the team • is energetic in driving others forward • success is tied up to the presence of the leader • inspirational • believes more in himself than in his team	• committed to the leader • achieve excellent results and goals • highly motivated • can't work independently	• calls for high motivation to keep the team focused • requires a lot of creativity • requires courage
Participative (Democratic)	• has few responsibilities • doesn't have all the required knowledge and skills • is concerned with reaching the company's and employees' goals	• are involved in decision making • show concern for the group's objectives • have to be motivated to do their work	• isn't urgent • has built in controls • can be corrected • calls for gradual change
Task-oriented (Fielder, 1967)	• focuses on getting the job done • can be quite autocratic • actively defines everyone's work and role • puts structure in place, plans, organizes, and monitors • Power is given to the leader to correct	• lack experience and ability • don't care about business goals • are immature • have clearly defined and structured tasks • difficulty keeping motivated • don't feel he/she belongs	• the jobs are routine • no special expertise needed • employee turnover is not a concern

Leadership styles (continued)

Style	The leader	Subordinates	The situation
Transformational (Burns, 1978)	• inspires the team constantly with shared vision of future • is highly visible, and spends a lot of time communicating • tends to delegate responsibility through the chain of command • possesses infectious enthusiasm • needs to be supported by detail people (transactional leaders)	• are inspired by the leader • take ownership of the group's missions and goals • find creative solutions to complex tasks • show concern for the group's objective • are highly motivated to do their work	• corresponds to almost all types of situation
Transactional (Burns, 1978)	• give team members some control over their income by using an incentive system • sets predetermined goals • practices management by exception • takes corrective action if standards are not met • uses reward/punishment as mode of management	• agree to obey the leader totally • execute the defined tasks • try to exceed goals to reap rewards • are fired when goals are not met • are only motivated by their own gains • care very little about the mission of the group	• the jobs are routine • special skills needed • employee turnover is not a concern • predetermined goals are critical to the groups survival • corresponds to mid-management positions in larger organizations
Servant (Greenleaf, 1977)	• plays the role of facilitator • leads by virtue of meeting the needs of their team • involves the team in decision making	• committed to the leader • achieve excellent results and goals • highly motivated • can't work independently	• strong leadership is lacking/or not necessary • results are achieved at a slower pace
People-oriented (Fielder, 1967)	• focuses on organizing, supporting and developing the people in the leaders' team • increases job satisfaction • allows members to participate in decision making	• are involved in decision making • show concern for the group's objectives • have to be motivated to do their work • usually exceed teams goals	• team work is highly desired and researched • creative collaboration is a must
Laissez-faire (Lewin et al. 1939)	• has no power • lacks know-how • has concern only for the employee's well-being • focuses on employee's objectives	• has more power than the leader • highly experienced and skilled • prefer their own methods and goals • constitute a small group	• requires no control • doesn't involve time constraints • requires few changes • involves no danger

1.2   Situational leadership: adopting the right leadership style

While leadership approaches such as transformational and charismatic leadership often are considered highly effective, there is no one "right" way to lead or manage that suits all situations. Some authors suggest variables to consider when trying to choose the most effective leadership approach (Vroom and Yetton, 1973; Hersey et al. 2008). In this case, the manager must consider:

- the skill level and experience of his/her team
- the nature of the task involved (routine or new and creative)
- the organizational environment (formal or informal, stable or radically changing, conservative or adventurous)
- the manager's personality traits and preferred or natural management style
- the expectations of peers
- the preferences of the eventual leader's superiors
- the reciprocal response of followers
- the requirements for accuracy
- the acceptance of an initiative
- time and costs constraints

Situational leadership advocates that leaders adopt the style that matches the situation at hand based on an assessment of the variables listed above.

Effective and successful leaders usually combine different styles of leadership based on personal and external factors to reach their team members. Effective leaders create results, attain goals, and realize visions. For agribusiness managers, this should equate to creating an organization where visions are shared and objectives are met. This means building an organization people will want to associate with by creating an enticing working environment, getting the team members (workers) to embrace the organization's vision and goals, and transforming the organization into a big family where everyone understands how their activities contribute to the overall success and how that success serves them in return. Burman and Evans (2008) developed a "charter" of leadership outlining the golden rules every successful leader should follow (Table 3).

Table 3. Leaders' charter (Burman and Evans 2008)

Burman and Evans leaders' charter
1. Leading by example in accordance with the company's core values.
2. Building the trust and confidence of the people with which they work.
3. Continually seeking improvement in their methods and effectiveness.
4. Keeping people informed.
5. Being accountable for their actions and holding others accountable for theirs.
6. Involving people, seeking their views, listening actively to what they have to say, and presenting these views honestly.
7. Being clear on what is expected, and providing feedback on progress.
8. Showing tolerance of people's differences and dealing with their issues fairly.
9. Acknowledging and recognizing people for their contributions and performance.
10. Weighing alternatives, considering both short and long-term effects and then being resolute in the decisions they make.

Source: Adapted from Burman, R. and Evans, A.J. (2008). Target zero: a culture of safety.

II   Leadership and motivation

Motivation is a stimulus that produces action, and directed action is a primary function of management. Management is responsible for results and must somehow stimulate, encourage, or coerce employees to behave in ways necessary to accomplish organizational goals and objectives, or else it must create an environment that will produce the same effect. Most researchers believe that motivation comes down to rewards and punishments. By controlling rewards and punishments, the management of the agribusiness can significantly affect employees' performance. A table of motivation styles is presented in Table 4.

Table 4. Motivation styles

Leadership Style versus Motivation				
Leadership style	Motivation type	Motivation is based on	Personality type	Efficiency
Limited supervision of workers with decision making responsibility	Self-motivated	Creativity	Leader of Ideas or people. Independent Achiever Thrives on change	High
	Team motivated			
Mixed styles	Goal motivated	Opportunity	Personality type and efficiency depends on leader's skill and/or the work environment he has created.	
	Reward motivated	Materialism		
	Recognition motivated	Social status		
High level of supervision Command and control	Peer motivated	To be like others	Status quo Dependency Resist change	Low
	Authority motivated	Follows policy		
	Threat, fear motivated	Reacts to force		

Source: Adapted from Webb, R.L. (2006). Motivation and Leadership Styles

Motivation focuses attention on the personal needs of human beings. Maslow (1943) developed a widely used model of human needs known as Maslow's needs hierarchy (Fig. 5). This model is based on the idea that different kinds of needs have different levels of importance to individuals, according to their current level of satisfaction. For each individual, the current level of needs must be met at least partially before the next level becomes a motivating force. Physiological needs, basic to human survival, take priority over other needs, but only until survival has been assumed. After this point, other needs form the basis for the individual's behavior and could be used as a motivating force.
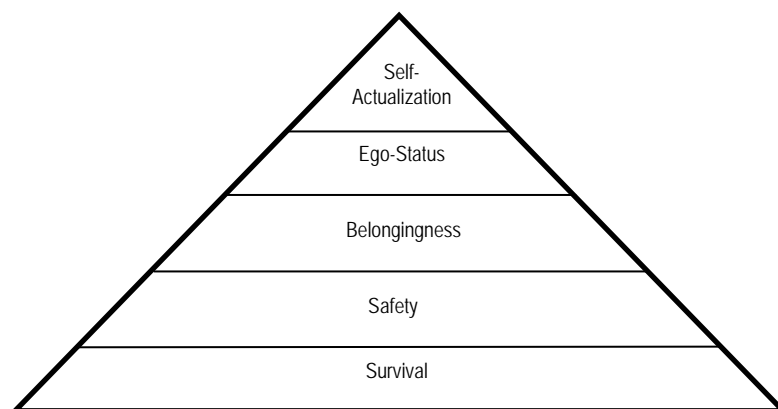
Figure 5. Maslow's hierarchy of needs (1943)

Suppose that the individual is at level one (survival, which includes sleep, food and health), and we assume that the survival need is met. The individual's next priority will then be safety. Safety here means shelter, clothing, job security, etc. Anything that can help the individual achieve those priorities at this level will motivate them to work harder.

The next level is belongingness. At this point the individual wants to associate with others sharing the same interests. Feelings such as friendship and love are important. Visions and goals here can create common interests for staff. It is the manager's job to win them over. The manager has to take on the task, knowing that staff still fighting for survival will not respond to a belongingness stimulus, because they have a higher priority (survival). If the manager really wants to have them focused, he/she should try to satisfy their survival needs first, before attempting to motivate them further by using belongingness stimuli.

Once the belongingness equation is solved, next is the status question. A staff that has already been won over (considers the organization as close as family) will only respond to a stimulus enhancing his/her status. Achievement, self-esteem, confidence, respect from others are important here. Staff at this level will ask: "Given where I am at, careerwise, do I have the status that I deserve?" "Am I being treated the way I should be?" If the staff member cannot give a positive answer to this question, he/she will look to move where those questions can be answered affirmatively.

Self-actualization concerns those people who have satisfied every need there is and are thinking about re-inventing themselves. It is a rebirth or renewal process. At some point in a career, one has the feeling that all has been done that could possibly have

been done, to have achieved all, and that there is nothing left to fix in the present situation. At this point, the person will get excitement only from a different type of challenge involving creativity, morality, spontaneity, and lack of prejudice. He/she would like to morph into a different type of character.

Managers need to understand that staff members are all at different levels on this hierarchy, with each of them needing to be evaluated individually at the time they are hired. The model shows how important emotional factors are to the success and survival of the organization. The acceptable minimum should have all staff of the organization at his/her own level, satisfied with their belongingness needs. If staff members do not feel they belong entirely to the organization, their productivity will not be optimal. Staff members on average spend most of their days preparing for, going to, coming from, or being at work. All this time, they are either physically or emotionally away from their biological or adopted families. It is important that they feel that they are cared for at this job place where they spend most of their time. An attempt should be done to organize the firm in such a way that staff members feel they are part of a family, albeit a different type. This type of organization will partially help offset all the time they spend away from their true families.

III   Why organizations fail

Longenecker et al. (1999) analyzed the most recurrent causes of business failure. Many agribusinesses are run by natural scientists who worked their way up the management ladder. They have considerable technical expertise, but little or no formal management training. Many managers may have been promoted one step beyond their level of confidence. Management mistakes are issues of communication, control, and co-operation. They can be expressed in sickness, absence, and staff turnover. It is more difficult to spot the parts of the organization that may be failing to deliver their promises or what is expected of them. Some common reasons for management mistakes:

- telling the staff exactly what to do versus asking what can be done
- lack of clarity and direction causing the staff to become anxious
- issuing orders rather than discussing the problem
- communication breakdown

Daewoo founder, Kim Woo-Choong, was reported to be contemplating suicide over his role in the organization's $80 billion downfall in 1999. Henry Ford went bankrupt five times before he ever made money from making cars. Lessons can be learned from business failures in other sectors, and practices developed that prevent failure from repeating itself. Pan American World Airways, better known as Pan Am, was one of the world's most famous airlines. Now it no longer exists. Although once a successful organization, it began to struggle to achieve goals; performance began to slip and bad publicity from

"I strongly believe that there is often more to be learned from failure than there is from success if we but take the time to do so."

-- Henry Ford

security scares proved fatal. In 2001 U.S. oil giant Enron went bankrupt, destroying the life savings of thousands of employees and investors. In the next three sections, areas of leadership and managerial failure within organizations will be presented.

1.1   Failure at the top

When an organization fails, it makes complete sense that the CEO and other leaders are the culprits and are the ones who must ultimately bear responsibility for failure. But *why* can they be blamed?

- Leaders can fail to create a clear vision and direction
- Leaders can fail to develop an effective business strategy
- Leaders can fail to make tough business decisions
- Leaders may have an unhealthy approach to risk taking

Therefore, leaders can fail to perform the functions that are most critical to the organizations' current needs.

1.1.1   Customer and marketing failure

Failure can also point toward shortcomings in an organization's approach to its customers and markets. It is often said that organizations are destined to fail if they do not satisfy the growing needs of their customers. The following factors are often highlighted:

- a lack of knowledge about the competition
- a deterioration of key accounts
- a lack of creativity and innovation
- a poor marketing plan

This approach believes that understanding failure involves coming to grips with customer and marketing issues because a lack of proficiency in these areas will lead to a rapid change in fortunes.

1.1.2   Financial management failure

Another area of failure involves financial management. A multitude of financial factors can be identified that can cause failure:

- excessive debt
- excessive overhead
- ineffective financial controls
- inability to control organizational spending

Financial management can have a tremendous impact on an organization's ability to compete and can serve as an early warning system of potential failure.

1.2 System and structural failure

This area of failure is concerned with internal operating systems that influence an organization's ability to compete. Failure can be caused by systems and operating practices that do not function properly—for example, a management information system that provides out-of-date information, which can then cause leaders to make ill-informed decisions. Administrative procedures also can cause an organization to fail. Suppose that purchase orders have to go through several layers of approval before anything can be bought. This type of requirement may be good for accuracy and accountability, but may cause the company to miss deadlines and ultimately lose money due to higher costs and missed opportunities. Other factors of system and structural failure include:

- technology problems
- unclear performance standards
- lack of continuous improvement
- centralized authority structures

It is argued that organizations fail when their systems fail to stay aligned with current strategies and needs. The leadership style impacts several key areas and has profound implications on whether or not an organization will succeed.

1.3 Organizational and management failure

1.3.1 Ineffective leaders

Poor leaders create tremendous stress on the rest of the management team and the workforce as a whole. They are likely to make poor decisions and organizational performance will suffer as a direct result.

1.3.2 Communication meltdown

Proper flow of information as well as useful interaction with others is critical in getting good results. Staff members perform better when they are given clear instructions/ direction, and the opportunity to feed back to management their perceptions and concerns. For example, poor bottom-up communication deprives leaders of day-to-day business information, while poor top-down communication can result in failure to understand the direction of leaders. Communication is the lifeblood of any organization, and when breakdowns occur, performance will suffer.

1.3.3 Lack of direction

A lack of focus, vision, or direction hampers goal setting and team building, and reduces the manager's willingness to take risks. In turn, this affects innovation and problem solving. It hampers motivation in the workplace, because it is difficult to stay motivated when there is no clear knowledge and a lack of goal appropriation.

1.3.4 Lack of planning

Failure to plan leads to failure to organize and control operations. This can result in every issue leading to a crisis that demands an immediate solution. The old saying goes "those who fail to plan, plan to fail." Take heed of the five P's: **P**oor **P**lanning **P**roduces **P**oor **P**erformance.

1.3.5 Inability to change or to adapt to change

Reluctance to change can produce stagnant organizations that fail to exploit new avenues of opportunity. Many organizations talk openly about change, but then fail to implement it at the workgroup and individual level. For many managers, change is only good for speeches and conversations. Leaders should embrace change, and make it work for them. Change will prevent the organization from reaching a plateau, where there is a feeling that things cannot evolve.

1.3.6 Poor customer service and relations

Organizations fail when people across all departments lose sight of who the customer is and how he/she can be reached. In fact, organizations exist only as long as they have customers. It is not enough to say or display at the building entrance that "the customer is king." The customer should be treated as such. Without customer satisfaction, the organization's long-term success is in doubt, as the customer is the ultimate judge of service. It is worth mentioning that the organization's first-line customers are its staff; only when the organization's staff members are satisfied can they help the outside customers. Customers are sources of the information that will help the organization succeed.

   Failure is difficult to experience and even more difficult to talk about. Therefore, effective leaders make things flow. A good leader may be inclined to look at the organization as a whole to determine to what extent any of the causes of failure outlined above are present within it. An even better leader would include front-line managers in the assessment process, realizing that a leadership style that encourages proactivity and involvement is one of the key ingredients of organizational success. Lack of planning will inevitably guarantee failure. For this reason, the following section will specifically focus on planning as a condition for success.

SECTION II
PLANNING AND CONTROLLING

Chapter 4: Planning and budgeting

Planning and budgeting is as important to farmers as resources. Planning refers to choosing alternative courses of action and drawing up a list of activities corresponding to those actions. Proper planning and budgeting will allow farm managers to efficiently use the resources at their disposal. Budgeting requires planning and record keeping as a prerequisite. Without relevant data, it is not possible to draw up a plan, or draft an operational budget. A small farm is relatively easy to manage, as activities are few, resources limited, and labor generally confined to family contribution. However, it is important to keep records and evaluate how much resources go into the production of all the farm's crops or seeds. Keeping records will allow the farm manager to prepare a budget for the use of the resources at his/her disposal, and evaluate the potential for expansion, or the need to reduce the farm's size. As the farm grows, the need for planning and budgeting grows as well. The bigger and the more specialized the farm, the bigger and the more complex the plan. As mentioned in chapter 1, there are two different types of plans: *Strategic* plans focus on developing courses of action for the longer term, while *tactical* plans are specific actions steps to be taken in a shorter term. Both types of plans must have contingency plans, which will be implemented in case the main plan fails.

Planning involves making decisions over things such as the goals to achieve, the personnel needed to achieve these goals (positions and responsibilities), the activities to be implemented (daily, weekly, monthly activities), the resources required to implement these activities, and how these resources will be allocated.

Planning should be done prior to the implementation of activities on the farm. Planning involves the collection of information on the farm resources and operations, as well as market conditions. The first type of information needed is an inventory of farm resources.

I   Study of farm business conditions and environment

1.1   Inventory of farm resources

A resource is anything that is used in the production of the crop or the seed. Farm resources include land, building, equipments, labor, finance, inventory (fertilizer, pesticide, stored crops) and other goods. Resources either are owned by the farmer or acquired through borrowing, hiring, or renting. All farm resources of value are called assets, while all the debts from borrowing, renting or hiring are called liabilities. In general, liabilities represent the claims against the farm's assets. All resource used in the production of crops or seeds, are called production inputs. The quantity of farm resources will change with cropping seasons. Farmers must adjust farm resources accordingly, which is why record keeping is crucial. An example of an inventory of farm resources is presented in Table 5.

Table 5. Inventory of farm resources

Resources	Total Value
I: Farm Fixed Assets	
A. Land	
1 – Sweet Corn: area x cost/ha 2 – Cabbage: area x cost/ha 3 – Multi-cropped: area x cost/ha	
B. Farm Buildings	
1 – Barn 2 – Shed	
C. Tools and Machinery	
1 – Tractor 2 – Power Tiller 3 – Irrigation System 4 – Spraying System	
II: Inventories	
D. Pesticides and fertilizer	
1 – Pesticide 2 – Fertilizer N – kg P – kg K – kg	
E. Other Inputs	
3 – Sacks 4 – Seeds	
F. Stored Crops	
1 – Amaranth 2 – Cabbage 3 – Tomato 4 – Snow peas 5 – Onion	
Total (A+B+C+D+E+F)	

1.2   Survey of farm conditions

It is essential that the farm manager has accurate knowledge of the environmental conditions of the area in which the farm is located. This information can be obtained from agricultural extension services, or other relevant agricultural services, and concerns weather conditions, soil conditions, technology and socio-economic conditions.

1.2.1   Weather and soil conditions

Weather and soil conditions will help determine which crops should be grown and when they should be grown. Weather conditions can be obtained from meteorological

stations, the local weather bureau and from some experimental stations and agricultural colleges. Soil conditions information can be obtained by having soil samples analyzed by a soil testing laboratory. Similar information also could be obtained from experiment stations or the local soil bureau, but may reflect the present condition at the proposed production plot.

1.2.2 Technology conditions

Technological conditions refer to the technologies available and readily used in the farm in order to achieve set goals. This includes improved seeds, cultural and production practices, other inputs, machinery and labor available for hire etc. Information on technologies could be gathered from extension agents, agricultural schools, and farm input traders or sales agents.

1.2.3 Socioeconomic conditions

Socioeconomic conditions include information on the source and conditions of credit, its availability and cost (interest rates); prevailing crops market prices; sources and cost of farm inputs such as fertilizer, manure, pesticides; availability and cost of hired labor; means and cost of transportation; marketing infrastructure; and eventually market information systems. Information also should be collected on the size of the potential market and estimation made of the farm share of this market. This information will allow the farm manager to determine whether the farm will be profitable or not. Farmers usually make the mistake of growing crops without putting much thought on where they will be sold and how much they will sell for. The consequences of this are markets overloaded with certain crops while others are lacking.

II   Farm recordkeeping

Record keeping involves writing down the past and present events. When the events are written they cannot be forgotten or mixed up as would be the case when they are memorized. In farm management it is advisable to keep records on a daily basis as the events occur. The daily records can be summarized into weekly, monthly, or seasonal records as needed. Both physical and financial records are kept and will help in drafting financial statements and budgets. Physical records refer to the physical quantities of resources or inputs used in the farm. This includes:

- quantities of inputs used in production, such as seeds, fertilizer, chemicals, etc.
- quantities of other resources used, including land areas, labor (man-days) and machinery (tractor hours, etc.)
- plant population and yields of crops

Physical records can be divided into crop production records, labor records, store records, and machinery records.

2.1   Crop production records

There is no strict format for recording crop production data. The format usually depends on the type of farm, the object of the data collection activity. Data collection for a research farm will concentrate on the specific information needed for research activities, and recorded following the specific methodologies adopted in the research projects being implemented (Table 6). In contrast, a pure commercial production farm will focus on collecting data, which will be used to assist the farm manager in his/her decision making process. The production data to be recorded include: field records on crops and seed production, yield data, and sales data (quantity produced and sold) (Table 7).

Table 6. Field record on crop/seed production

Year ………………………………..			Crop…..………………………………..					
Field No…………………………………			No. of hectares ……………………………..					
Date	Seed		Fertilizer		Chemicals		Machinery	
	Variety	Rate	Type	Rate	Type	Rate	Type	Hours

Table 7. Quantity produced and sold

CROP	PRODUCTION			DISPOSAL		
	Land area (ha)	Yield (kg/ha)	Total yield (kg)	Sold (kg)	Gifts (kg)	Losses (kg)
Amaranth						
Cabbage						
Tomato						
Snow pea						
Onion						

2.2   *Labor records*

Labor is used on the farm to produce crops and seeds. Labor can be casual or permanent, paid, or non-paid. Why is it necessary to keep track of non-paid labor? To determine the exact economic costs of producing the crops and/or the seed, the cost of non-paid labor (generally family labor) should be included. In economics, this is called the opportunity cost of non-paid labor or implicit costs. Even though these costs are not used to compute the accounting profit (only explicit costs are used), they will serve to help determine the farm's economic profit (Remember that the economic profit is different from the accounting profit). It is important to understand that family members offering their services to the farm for free could have been using their time and effort elsewhere for pay. To compute the economic profit of the farm, this potential labor cost should be taken into account. It also gives the farm manager an idea of how much it would cost to produce the crops and seeds, had he/she chosen to use only hired labor.

A record of the number of workers who participated in the farm activities should be kept daily (Table 8). Such labor records are useful in computing the man-days of labor used for the various activities in the farm. Man-days are a way of estimating the average amount of work an average laborer can do on a basic working day. It helps the manager determine how many laborers are needed to complete a certain activity on the farm. Daily records can be summarized into weekly or seasonal records as needed. The most common labor records are: the master roll and the labor utilization record. The master roll records are the numbers of days worked and the payment received by all workers on the farm (Table 9). The first part of the master roll is the attendance register.

Table 8. Labor attendance record

Month								
No	**Date/Name**	**1**	**2**	**3**	**4**	**5**	**6.......................31**	**Total**
1	**John**	√	x	√	s	√		
2	**Mary**	√	√	√	s	√		
3	**Halima**	√	√	√	s	√		
4	**Ali**	√	√	√	s	x		

Where √= present; x=absent; S= Sunday/Public holidays

The payment expected by each worker has to be computed given the number of days worked, and the total labor costs for the farm will be determined.

Table 9. Laborers' pay record

No	Name	Month	Period	Rate/ day ($)	No of days worked	Overti me	Gross pay ($)	Deductions	Net pay ($)	Signature
Laborers' Pay Record										
1	John	June	1-15	3.5	12	0	42	0	42	
2	Mary	"	1-30	3.5	20	0	70	0	70	
3	Halima	"	"	3.5	22	0	77	0	77	
4	Ali	"	"	3.5	20	0	70	0	70	
Total		"	"				259		259	

In the labor utilization records, the daily, weekly or total labor (man-days or man-hours) involved for each operation is recorded (Table 10).

Table 10. Labor utilization record

CROP.................................... AREA.............................

Week/ month	Land preparation	Planting and transplanting	Weeding	Fertilizer application	Spraying up to harvesting	Farm overhead
Total hours/ days						

The last column records the general farm overhead, which is an estimation of the average administrative costs of undertaking the farm activities. As such, it could be calculated for the overall operations of the farm, but a breakdown of this cost may prove to be useful when partial budgeting is retained as an option.

2.3 Store inventory records

A store inventory record is a snapshot of the situation in each store at the end of each day assessing the receipts, issues, and balance of each item. The stores records are useful to:

- show the stock (balance) of each item
- determine how much should be ordered to maintain stocks at the required level
- provide information for stock taking
- provide information on what is available in the store room

2.4   *Machinery service record*

Use a machinery service record to keep track of farm equipment and maintenance (Table 11). Data recorded include: repair and maintenance, usage and operational activities or work performed.

Table 11. Machinery service record

Machine....................... Unit No........................... Stock No......................					
Make............................. Model............................ Serial No.....................					
Date of purchase................................Source...........................					
Job No	Description	Date		Meter Reading		cost
		out	in	out	in	
1						
2						
3						

III   Controlling inventory

Inventory management is one of the most important aspects of farm and agribusiness management. Procurement and sales may rapidly become a nightmare if a proper control system is not set into place. The more the number of items that need to be purchased and sold, the more important the inventory management system is for the farm business. Inventories such as raw materials and stored crops are an asset to the farm business because they have market value. There is also an **opportunity cost** of keeping them in the warehouse, which could be quite high. From the standpoint of operations, inventories are important because the farm activities can be undertaken only if the supplies are available. The farm outlet needs an adequate supply of the relevant product at the right time. Failure to have the product at the point of sale and at the right time could result in increased postharvest loss and loss of opportunities to the farm. Inventory management helps plan delivery quantities and time, and helps minimize the farm business costs. Three different categories of inventory management are used in accounting: raw materials, work-in-progress (WIP), and finished goods.

3.1   *Inventory category*

This category includes all the inputs that are used for crop or seed production. **Work-in-process (WIP)** refers to all the products that are in the process of being converted into finished products (assembly line, packing plant, etc.). **Finished goods** are processed and packed crops and seeds that are ready for sale.

3.2   Setting up an inventory system

Several steps need to be followed to set up an inventory management system. The first step is to choose the type of inventory to use. Two choices are available: pipeline inventories and cycle (lot-size) inventories. **Pipeline inventories** require a regular and constant supply of products to the warehouse. Suppose the tomato farm requires 300 crates per week of fresh tomato packing during the harvesting season. Using the pipeline inventory, the farm manager will order and have 300 crates delivered each week. The second system, **cycle inventory**, is not very different from the first except it is used when larger and less frequent delivery loads are required. Suppose the crates that are delivered to the farm warehouse by truck could carry 600 crates. The farm manager can reduce costs by ordering 600 crates once every two weeks, using a fully loaded delivery truck. Next, the farm manager will need to set standard inventory indicators, which will serve as action cues. These indicators are the order point, the lead time, and the safety stock.

   The order point is the level at which an order needs to be placed to maintain a stock of the product. It is a quantity large enough to last the amount of time it will take to place an order and receive the new stock of goods. This amount of time is also called **lead time**. Suppose that when Mr. Obama places an order for tomato crates, it takes three days for the order to be processed and delivered at the farm packing plant. If Mr. Obama's farm uses 50 crates per day, the order point should be three times 50, plus the safety stock. **The safety sock** (or **buffer inventory**) is that level of inventory that provides security during periods of turbulence and offsets potential variations in stocks. Safety stocks are particularly important in agribusiness given the seasonal nature of the industry. In case of high variability, anticipation, or seasonal inventories can be used to alleviate the problems. A graphical representation of monitoring an inventory system is shown in Figure 6 and in Table 12.

3.3   Implementing the inventory system

The last step is the implementation of the inventory management system. Two methods are available for use: periodic and continuous. **A periodic inventory system** relies on the physical count of items at regular intervals. With this system, record keeping is minimal, but the daily status of the stock is unknown. **The continuous inventory system** is the constant monitoring of the stock at hand. Whenever items are disposed or received, the total stock is reduced or augmented to the inventory total, keeping the inventory current at all time. Automated tracking systems such as bar code scanners make the process easier, but the sophisticated computer systems used for its management may be daunting for some. All advantages will be lost if the system is bypassed by the staff in charge of its implementation. Depending on the nature of the product treated, a first in, first out (FIFO) or last in first out (LIFO) method can be adopted for product disposal. For items such as seeds and chemicals, which normally have an expiration date, the FIFO method can be used, as the oldest items in the inventory are disposed before the newly acquired ones. The LIFO method can be used with items for which age is an enhancing factor.
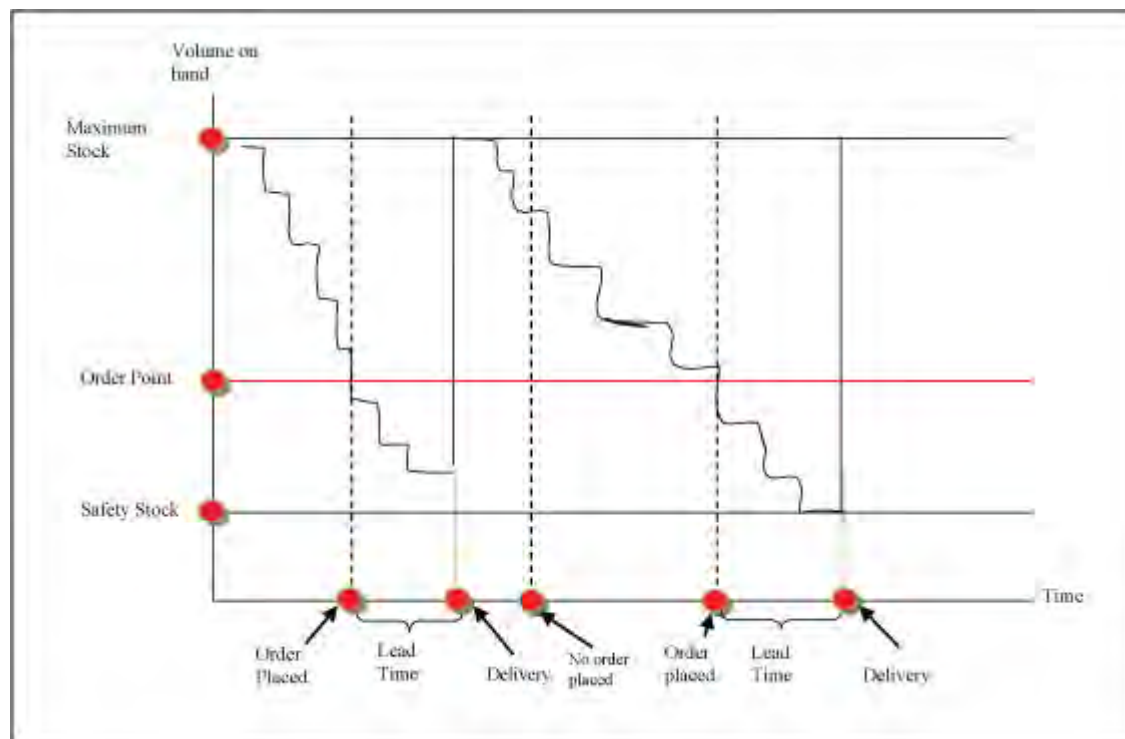
Figure 6. Monitoring the inventory

Table 12. Inventory monitoring sheet

Name: Crates		Location: Warehouse	Movement			Remark
Date	Details	Responsible	In	Out	Balance	
2-Jan	Balance	John	0	0	400	
3-Jan	To pack house	Peter	0	50	350	
4-Jan	"	Peter	0	50	300	
5-Jan	"	Peter	0	50	250	
6-Jan	"	Peter	0	50	200	Order
7-Jan	"	Peter	0	50	150	
9-Jan	"	Peter	0	50	100	
10-Jan	"	Peter	0	50	50	
10-Jan	Order Delivered	John	300	0	350	

IV   The breakeven analysis

The breakeven analysis, also referred to as *volume-cost analysis*, is a tool for examining the relationship between the costs and volume of business generated by the firm. It analyzes the costs and shows how much sales volume the farm business needs to break even (posting a zero accounting profit). In general, businesses are not profitable during their first years of existence, because of high fixed costs (investment in buildings facilities, equipment, tools, etc.) It is assumed that each time the company makes a sale, the fruit of this sale goes toward the payment of variable costs. It is only when the variable costs are paid off that the company can start making payments toward fixed costs. To use the breakeven analysis tool, the farm manager should clearly define which of his cost are variable and which ones are fixed.

Fixed costs are associated with fixed inputs, and therefore do not vary as output changes. Examples are building facilities, land, etc. Some costs are mixed (partly variable and partly fixed). Examples of such costs are the electrical and telephone bills. This bill is not only of a fixed portion (service charge) but also of a variable portion, dependent on the actual usage, which is linked directly to the level of activity in the firm. It is important for the agribusiness manager to properly split these costs so that they can be allocated to their appropriate categories.

Variable costs are associated with variable inputs. The quantity of variable inputs changes as the quantity produced changes. Examples are fertilizers, pesticides, labor, water for irrigation, etc.

Once fixed and variable costs have been defined, they should be summarized into a table to avoid ambiguity. The next step is to calculate the contribution to overhead (CTO). The contribution to overhead shows the portion of each unit of sales that remain after the variable costs are covered. To calculate the CTO, the variable costs have to be converted into a percentage of sales (cost per dollar worth of sale). The breakeven calculation can then take place.

Suppose that Mr. Obama's fixed costs are $25,000 and his total variable costs are $45,000. Mr. Obama projects $60,000 worth of sales this period. His variable costs as a percentage of sales are

$$\frac{\$45,000}{\$60,000} = 0.75 \text{ or } 75\%$$

This means that out of every $1 worth of sale that Mr. Obama makes, 75 cents goes towards the payment of variable costs. Only the remaining 25 cents will be used to pay for the fixed costs. $0.75 is called the contribution to overhead (CTO).

4.1   Calculating the breakeven point

Knowing the CTO, it is easy to calculate the breakeven point for the farm business. Remember that the breakeven point is that point at which the farm business profit is exactly zero. It shows the sales volume and value from which the farm will start making a profit. The breakeven point can be calculated in volume (number of units sold) or in sales value.

Breakeven (BE) in sales value:

$$BE = \frac{Fixed\ Costs}{1 - Variable\ Costs\ as\ a\ proportion\ of\ net\ sales}$$

$$BE = \frac{Fixed\ Costs}{CTO}$$

Breakeven in volume:

$$BE = \frac{Fixed\ Cost}{Selling\ price\ per\ unit - Variable\ Costs\ per\ unit}$$

Using our example, Breakeven in value $= \dfrac{25,000}{1 - 0.75} = \$100,000$

This means that Mr. Obama needs to reach $100,000 in sales value before he can break even.

The breakeven analysis could be used for planning purposes. In fact, the volume-cost analysis can be used to determine the level of sales necessary to achieve a certain profit level, to determine the effect of the change in fixed cost structure of the breakeven point, and the effect of a price change on the farm business sales.

4.2   Sales needed to achieve a profit goal

When the farm business shoots for a certain profit goal, it means that all fixed costs already have been paid for. In this case, the contribution to overhead (CTO) becomes

the contribution to profit (CTP), because what remains after the variable costs are covered contribute directly to the farm business' profit.

$$Additional\ Sales = \frac{Profit\ Goal}{CTP}$$

4.3 Change in fixed costs

Suppose that Mr. Obama decides to purchase a 1-axle tractor worth $2,000 for his farm. How much sales does he need to cover the cost of this new equipment?

$$Additional\ sales\ to\ cover\ the\ costs\ of\ the\ new\ tractor = \frac{Cost\ of\ New\ Tractor}{CTO}$$

$$which\ is: \frac{2,000}{0.25} = \$8,000$$

The new breakeven point is then $100,000 + $8,000 = $108,000

4.4 Change in price of the finished good

Suppose Mr. Obama is contemplating reducing the price of his product to fend off competitors. He has decided that a price reduction of 2 percent can do the trick. But how would this reduction affect his business?

The old CTO: 1-075 = 0.25
The new CTO: (1-0.02) – 0.75 = 0.98 – 0.75 = 0.23

The new breakeven is: $\frac{25,000}{0.23} = \$108,696$. The old breakeven was $100,000.

Additional sales: $108,696 -$100,000 = $8,696

What this means is that Mr. Obama needs to make an additional $8,696 worth of sales if he lowers his price by 2 percent. Competitors may follow Mr. Obama's strategy and he could end up not reaching his target, as will be discussed later on.

Breakeven can be computed in two ways: weighted and unweighted. The weighted computation calculates the yield volume needed to breakeven given that all of the crops change by the same percentage. The weighted results are specific to the particular assumptions of selling prices, variable costs, and volume produced.

The breakeven calculation for the unweighted volume has a different meaning. The unweighted figure indicates volume of production a specific crop would need to be sold for the packing facility farm to breakeven, holding the other crops constant at the "volume sold" level. The breakeven calculated in our preceding examples are all unweighted.

V   The farm budget

The farm budget is important because it helps with the allocation of farm resources to their best use. The farm manager needs to determine how the limited resources available will be used efficiently to achieve farm objectives. An example of Mr. Obama's farm resources is presented in Table 13. The budget is a summary of farm activities with respective funding requirements. Although a small farm business may only need an overall budget, larger structures usually have a budget for each department and/or operation. A budget can be short-term (covering a season or a year), or long-term, covering several years. Long-term budgets are usually reported on a short-term basis (quarterly, semi-annually, or annually). The short-term budget will then become a short-term breakdown of the long-term budget. The budget reflects the priorities and the direction of the farm business.

Table 13. Inventory of Mr. Obama's farm resources

Resources		Total Value ($)
I - Farm Fixed Assets		**4,445.76**
A. Land		
Farm land	**3846.15**	
B. Farm Buildings		
1 - Farm house	**384.62**	
C. Tools and Machinery		
1 – Power tiller	**192.31**	
2 – Sprayer (2 units)	**19.23**	
3 – Shovel (3 units)	**1.15**	
4 – Machete (4 units)	**1.15**	
5 – Hoe (3 units)	**1.15**	
Total	**4445.76**	
II- Inventories		**7.69**
D. pesticides		
E. Packaging Materials		
1 – 100 crates (disposable)	**7.69**	
F- Stored Crops		**-**
Total	**7.69**	
TOTAL		**4,453.45**

5.1   Budget development techniques

Several techniques or approaches can be used to develop a budget. Many people simply add or subtract arbitrary amounts for previous budget periods. While this method is better than nothing, a more meticulous evaluation of the change in condition is necessary to develop a more accurate budget. Approaches used to develop budgets are both qualitative and quantitative.

Qualitative approaches include consensus, intuition, logic, and scenarios. When the opinions of people knowledgeable about the business are sought separately to develop the budget, the process is termed **consensus**. With this method, the collected opinions are shared with everyone in the group. The group members make revisions to their respective opinions based on other members' suggestions, and a consensus is reached on the figures to include in the budget. **Intuition** is a technique that relies on the farm manager's knowledge and experience to develop a budget. The success of the technique depends on the ability of the farm manager to translate personal knowledge and past experience into a projection in the future. The shortcoming of the intuition method is that the projection may be based on outdated information or the farm manager's limited information or knowledge to make accurate projections. **Logic** is another technique that draws on a combination of facts, induction, and deduction to make projections. Logic as a technique needs a lot of information from record keeping or market research to be successful. **Scenarios** refer to a technique based on the development of a series of events based on variables such as sales volume, economic conditions, labor market trends, etc.

Quantitative approaches include linear projection, modeling, and simulation. **Linear projection** uses past trends data and simple mathematics to estimate future figures. For example if the price of tomato seed has been rising by 5 percent for each of the past three years, we can calculate next year's price by increasing this year's price by 5 percent. Linear projection is simple to use, but fails to incorporate anticipated change in the institutional and socioeconomic environment. **Modeling** is a technique that uses abstract representation of the farm situation to make a projection. The representation is done in mathematical terms and captures not only the factors believed to be relevant for the situation, but also the relative importance of each of the factors, which are then formulated into a model that will yield the projections. Modeling can then be combined with a trial-and-error method called **simulation**, where the model is run many times under different scenarios to produce accurate projections. This last method is somewhat complex and requires the use of computer software packages and industrial engineering techniques.

5.2   Partial budgeting

When multiple operations are conducted on the farm, such as the production of different types of vegetable crops and seeds, it is often advisable to prepare plans and budgets for each operation. The individual budgets will be aggregated into one global budget for the whole farm business. This operation is called partial budgeting. Partial budgeting is used in situations where there is a change in technology designed to improve the efficiency and profitability of farm operations, such as a change in weeding methods, crop management practices, or application of fertilizer and chemicals. Farm

activities are subject to frequent technological change, which may yield one of the following results, everything else remaining the same:

- added returns and added cost
- added returns and reduced costs
- reduced returns and reduced costs

Partial budgeting aims to determine the economic acceptability of new technology adoption by comparing reduced returns and added costs to added returns and reduced costs.

$$\textbf{Partial Budget Profit} = \begin{bmatrix} (Added\ Returns + Reduced\ Costs) \\ -(Added\ Cost + Reduced\ Returns) \end{bmatrix}$$

An assessment of all added or reduced returns, added or reduced costs, return of the activity or the new technology should be conducted before the profit is calculated. Partial budgeting can be handy, especially when the manager is exploring the feasibility of adding a new technology or operation in the farm.

5.3   Feasibility study

The plan and the budget also serve as a feasibility study if the business does not exist yet. A business that is just being put in place is also called a **startup**. Planning is more difficult for startup businesses than for existing ones. Information needed for startup businesses is usually collected from exiting business owners and experimental stations. This information is used to develop a plan for the budget, and a budget to go along with it. The plan and the budget constitute the simple form of the feasibility study. A more complete feasibility study includes additional components such as the marketing plan and pro-forma financial statements such as the pro-forma balance sheet, income statement and cash flow statements. Feasibility studies are also called *project feasibility* or *project study*.

5.4   Business planning

A feasibility study can be converted into a business plan. A business plan is a document that summarizes the operational and financial objectives. Even though many agribusinesses start and operate successfully without a business plan, this document will provide the manager with a leader board that will keep the team focused on goals and success. Lenders often require a business plan when the business seeks outside financing. The plan contains detailed strategies and budgets showing how the objectives of the business will be realized. The document is usually 25 to 60 pages long and addresses the following concerns:

- what products/services the agribusiness will offer and what needs/wants does it satisfy
- who are your business' potential customers and why should they buy from you
- how will your business reach these potential customers

- where the financial resources needed to start your business will come from
- at what point in your business life can you expect to make profits

The components analyzed above and in the other sections of this chapter are more or less compiled in a single document to form the business plan. More precisely, the business plan is organized around the following components:

- executive summary
- industry analysis
- company analysis
- demand analysis
- competition analysis

The executive summary offers a synopsis of the document, highlights key points, and includes a strategic overview. The strategic overview presents the farm business and its organization, the product and services it offers, and the uniqueness of the business vis-à-vis the competition. The industry analysis evaluates the overall sector in which the firm wishes to operate, describes potential competitors, the size of the market, and industry trends. The demand analysis assesses customers; existing market segments— especially the target segment the farm business wishes to target; how they will address the needs of this target segment; and how the farm product fits with the needs of its target customers. The analysis of the competition defines the competitive landscape of the business, identifies who the direct and indirect competitors are, their strengths and weaknesses, and delineates the farm business from these competitors.

A business plan also includes marketing and operation plans explaining how the farm will operate, a presentation of the management team, a financial plan showing how the operation will be financed, how the revenue will be generated, the revenue and cost variables, and the general assumptions concerning the business. Financial statements (income statement, balance sheet, and cash flow statements), and the curriculum vitae of key members of the management team are placed at the end in appendices.

VI   Managing business finances

Bookkeeping is the record of transactions, which involves the transfer of money or money's worth to or from the business. The primary value of any record is that it should be readily available for consultation. When the record is properly kept it should be possible to immediately find out how the business stands in relation to its customers: what is owed to the business and what the business owes to others. In addition, it should show the purchases and sales made during the production and sales period, and determine the farm's profit over this period. To keep matters simple, it is advised to use bookkeeping for financial recording and accounting.

6.1   Bookkeeping

Bookkeeping is important for recording farm operation information. The system widely used by businesses is the **double entry bookkeeping**, which requires two books for its

operation: the Journal (Table 14) and the Ledger (Table 15). The journal is ruled as follows:

Table 14. The Journal

Date	Particulars	Folio	DEBIT ($)	CREDIT ($)

The ledger is ruled as follows:

Table 15. The Ledger

Ledger							
DEBIT				CREDIT			
Date	Details	Folio	$	Details	Folio	$	

The ledger sheet is divided into two parts: The **debit** and the **credit**. The left hand side is the <u>debit side</u> and the right hand side is the <u>credit side.</u>

The ledger sheets may be bound together in a column as the ledger. Each sheet of the ledger is referred to as folio and contains an account. There is a separate account for each aspect of the affairs of business. Cash transactions are recorded in the cash account. Sales of goods appear in the sales account, purchases in the account, payment of wages in the wages account. The double entry system involves the recording in the ledger of the two aspects of every transaction. When goods are bought for cash, two things happen to the buyer: he has "lost" cash and "gained" the goods. The seller on the other hand has "lost" the goods and "gained" cash. The buyer will record his loss in the cash account by crediting that account (on the right hand side), and record the goods received on the purchase account on the debit side. Hence, whenever a debit is made in one account, a corresponding credit must be made in another account.

6.1.1 The cash account

The **cash account** is a record of money received and money paid out by the farm (Table 16). It is needed for reference purposes and for cross-checking the amount on hand.

Table 16. Example of a cash account form

Cash account							
DEBIT				CREDIT			
Date	Details	Folio	Amount	Date	Details	Folio	Amount
Day 1							
Day 2							

The items entered on the debit side of the cash account are preceded with the word "To" indicating that the amount is debited. This means the cash account is debited to the items on the right side. The items on the left side represent money received. The items on the right side are credited to the cash account. They represent money paid out. The rule is that money received is entered on the debit side while all money paid out is entered on the credit side.

From the cash account we know how much cash remains at hand at the end of the month and indicated on the right hand side as c/d. This same amount is the available balance for the beginning of the next month, entered as "balance" (b/d) on the debit side (Table 17).

Table 17. Example of cash account entries

Date	Particulars	Folio	Amount	Date	Particulars	Folio	Amount
Jan. 1	To sales		300	2-Jan	Buy seeds		5
Jan. 7	"		186	3-Jan	Buy tables		90
Jan.14	"		170	13-Jan	Buy stationery		15
Jan.21	To John		198	19-Jan	By salaries		267
Jan.24	To sales		120	28-Jan	Buy sundry purchases		240
Jan.29	"		220	31-Jan	By salaries		50
			1194		By electricity		527
Feb. 1	To balance	b/d	527		Balance	c/d	1194

6.2   The farm's financial management

Financial statements are reports that summarize the financial position, operating results and cash flow for the farm business. When investors consider investing in an enterprise, they seek answers to the following questions:

- how much profit has been made?
- where is the money invested?
- how much additional investment will be needed in the future?

These questions will get answers from the following statements:

- the profit and loss account
- the balance sheet
- the cash flow forecast

6.2.1   The balance sheet

The farm's balance sheet represents the financial summary of what the farm business owns and what it owes to its creditors. It identifies how much capital the owners have invested into the business through a certain date and how it has been invested. Resources with monetary value are **assets**, while the amounts the farm business owes its creditors are **liabilities**. The balance sheet thus has two parts (Table 18). One part indicates the assets and the remaining part shows the liabilities (and potentially the owner's equity). If the farm business were to close down, its creditors would legally have first claim on any of its assets. The owners can only claim the business assets after the liabilities have been met. The part of the assets remaining after the liabilities are cleared (also the difference between assets and liabilities) is called **owner's equity**. The owner's equity is also called *net worth*.

Note: For each asset (resource with monetary value) there is an offsetting claim again it.

Assets

Current Assets: Current assets refer to cash funds or assets that will be converted into cash during a single normal cycle of operation (usually a year). They represent the cash generation potential of the business and are considered of prime importance by lenders. Current assets are composed of cash funds, account receivable, inventory, prepaid expenses, and other current assets. **Account receivables** represent the total amount owed to the farm by its customers for past and non-paid purchases. This will exist only if the farm business extends credit to its customers. **Inventory** is made of items that are held for sale or to be used during the process of production of the crops or seed that will be sold. **Prepaid expenses** represent products and services that have been paid for in advance, but not yet used (example: insurance). **Other current assets** comprise various assets that could be converted into cash easily, such as stock and bonds.

Fixed Assets: Fixed assets are items owned by the farm with a relatively long life and that are used to produce goods and services. Fixed assets are categorized into **land, buildings,** and **equipment**, which can be further detailed into specific types. The other

important reason for tracking fixed assets is *depreciation*. All fixed assets, except land, depreciate. They lose value over time through wear and tear. The net fixed asset value on the balance sheet represents only its accounting value at the present time, and thus does not represent its real market value. This accounting value is the purchase value of the equipment less depreciation.

Other Assets: This category includes a variety of assets such as stock and bonds of other companies that are held for more than a year, intangible assets such as patents and copyrights, franchise costs, and goodwill. Items in this category are usually not subject to depreciation and have a longer life span than items in the current assets category.

Liabilities

Current Liabilities: Current liabilities represent all the claims against the farm business assets that will be due during the normal business operating cycle (generally a year). They comprise accounts payable, notes payable, accrued expenses, and advances. **Accounts payable** includes all the amounts the farm business owes to suppliers from whom items were bought on credit terms, and for which payment is due in less than a year. The items purchased can be inventory, supplies of all kinds, or capital equipment. **Notes payable** or short-term loans are loans from individuals, banks, or other lending institutions that are due within a year. Vegetable crop and seed production business is a highly seasonal business making short-term loans a crucial part of financial management. Cash needs increase during the peak season, when inventory needs are high and sales yet to come. **Accrued expenses** are the aggregation of several individual expense accounts representing obligations the farm has incurred, for which there is no formal bill or invoice (wage, tax, etc.). Although taxes and wages are paid weekly, bi-weekly, quarterly, or yearly, they are due or earned daily. **Advances** refer to the amounts that customers have paid (in advance) for goods or services that are not yet available. This makes the farm owe its customers.

Long-term Liabilities: These are claims against the farms' assets that do not come due within a year. Mortgages and long-term loans from individuals, banks and other financial institutions belong in this category. Any portion of long-term debts that are due within a year should be recorded in the current liabilities category.

*Owner's Equity***:** The owner's equity or net worth details the claims of the farm's owners against the farm's assets (showing the proportion of the farm's assets that belong directly to the owners). It includes earnings retained in the business, contributions to the farm, paid-in capital, etc. Earnings retained in the business are the portion of the profit that was not distributed to owners. Contributions refer to the value of all physical and nonphysical assets (machinery, buildings, skills and experience, etc.) donated to the farm business by its owners. The following equation is always true, as far as the balance sheet is concerned:

ASSETS = LIABILITIES + OWNER'S EQUITY

Table 18. Example of a balance sheet

Assets				Liabilities			
Current Assets:				Current Liabilities:			
Cash		110,000		Accounts Payable		200,000	
Account Receivables		240,000		Notes Payable		135,000	
Inventory		400,000		Accrued Expenses		80,000	
Prepaid Expenses		20,000		Advances		20,000	
Other		5,000					
Total Current Assets		775,000		Total Current Liabilities		435,000	
Fixed Assets:				Long-Term Liabilities:			
Land		120,000		Mortgages		220,000	
Building	440,000			Other		131,000	
Less: Depreciation	85,000			Total Long-Term Liabilities		351,000	
		355,000		Total Liabilities		786,000	
Equipment	620,000			Owner's Equity			
Less: Depreciation	135,000			Owner-invested Capital:			
		485,000		Common Stock		205,000	
Total Fixed Assets		960,000		Retained earnings		754,000	
				Total Owner's Equity		959,000	
Other Assets		10,000					
Total Assets		1,745,000		Total Liabilities & Owner's Equity		1,745,000	

6.2.2 Analyzing the balance sheet

The balance sheet can be used to measure the financial health and strength of the farm business at three different levels: Solvency, liquidity and profitability. The profitability, however, can be analyzed only if an income statement is established.

Solvency

One of the challenges of the farm manager is to keep the farm solvent. Solvency refers to the ability of the farm business to meet long-term obligations, or total liabilities. Several ratios help determine this ability, including the **debt-to-equity ratio,** the **solvency ratio** and the **debt-to-asset ratio**.

Debt-to-Equity Ratio

The debt-to-equity ratio shows how well the owner's equity covers the farm's liabilities (or total debts). Lenders get nervous when the assets acquired using borrowed funds are greater than those purchased with owners' funds. This ratio should not be greater than 1 (one). It is calculated by dividing total liabilities by owner's equity:

$$\text{Debt-to-Equity Ratio} = \frac{Total\ Liabilities}{Owner's\ Equity}$$

With our example above the debt-to-equity ratio is $\dfrac{786,000}{959,000} = 0.81$

This result shows that the farm's liabilities are equivalent to 81% of owners' equity. In other words, if the firm were to close down today, owners' investment would pay off all liabilities and there will be some leftover equity.

Solvency Ratio
The solvency ratio shows how owners' investments contribute towards the farm's total assets. The general rule is that owners should contribute more than 50 percent to the business's total assets in order to avoid solvency problems. The solvency ratio is found by dividing the owner's equity by the total net assets.

$$\text{Solvency Ratio} = \frac{Owner's\ Equity}{Total\ Net\ Assets}$$

The total net assets are found by adding up the net working capital and the net fixed assets. They can also be found using the following formula:

$$\text{Total Net Assets} = \left[\begin{array}{l} (Total\ Current\ Assets - Total\ Current\ Liabilities) \\ + (Total\ Fixed\ Assets - Total\ LongTerm\ Liabilities) \end{array} \right]$$

Using our example, that makes [(775,000 – 435,000) + (960,000 – 351,000)] = 949,000

our Solvency Ratio is then: $\dfrac{959,000}{949,000} = 1.01$

The solvency ratio needs to be greater than 0.5. In the case of our example, the ratio is 1.01 which is very satisfactory.

Debt-to-Assets Ratio
The debt-to-assets ratio is used to determine the proportion of borrowed funds in the farm's capital. It is determined by dividing the total liabilities by total assets. This ratio should not be greater than 0.50, meaning that lenders contribute less than 50 percent to the farm's capital.

$$\text{Debt-to-Assets Ratio} = \frac{Total\ Liabilities}{Total\ Assets}$$

Using our example, the Debt-to-Asset Ratio is $\frac{786,000}{1,745,000} = 0.45$

Liquidity
Liquidity refers to the ability of the farm business to generate enough cash in order to pay bills as they come due to avoid disrupting its production activities. The liquidity ratio allows the farm manager to identify short-term cash flow problems before they impair business operations. The liquidity ratio of relevance is the **Current Ratio**, which is found by dividing **Current Assets** by **Current Liabilities**. A figure between 1 and 2 is preferable as it indicates the availability of ample liquidity to cover short term liabilities.

$$\text{Current Ratio} = \frac{Current\ Assets}{Current\ Liabilities}$$

Using our example, the Current Ratio is: $\frac{775,000}{435,000} = 1.78$

It shows that there is $1.78 of current assets for every $1.00 of the farm's short-term liabilities. In other words, the farm manager should be able to clear all short-term liabilities without the need of a short-term loan.

6.3   Income statement

The income statement is a simple report of the farm's financial performance. The income statement shows the profit (or the loss) earned by the farm business, which is either distributed to the farm owners, or used to:

- increase the working capital
- buy more fixed assets
- invest outside the business

The profit therefore does not always mean more cash, because it could be invested elsewhere. Profit makes the business grow. Without profit the business will either remain the same in cash terms, or even shrink in case of successive losses.

Losses in a business will cause all of the following:

- working capital will shrink
- fixed assets will wear out and will not be replaced
- the value of investment will decrease

The income statement for new businesses is generated monthly for the first year, quarterly for the second year, and annually each year there after. Table 19 shows an example of a monthly income statement.

Table 19. Example of income statement

Income Statement for the year ending 1988				
A. Sales				1000
	Less	Materials	400	
		Labor	300	
		Overheads	200	
		B. Total Costs	900	900
C. Gross Profit (C=A-B)				100
	Less	D. Taxes		50
E. Profit after taxes (E=C-D)				50
	Less	F. Dividends		25
G. Retained Profits (G=E-F)				25

6.4   The cash flow statement

The cash flow statement is one of the most important financial reports for the farm manager. It shows how much cash will be needed to clear the farm's obligations. It also shows when the cash will be needed and where it will come from, which makes the farm cash inflows and outflows schedule. The cash flow statement result is the farm profit (or loss) at the end of the month, quarter, or year. A loss on the cash flow statement indicates that the farm will need additional cash to meet planned expenses. The cash flow statement includes the following items:

Cash receipts
cash from credit sales and cash sales
cash from sales of fixed assets
cash from sales of scrap
refund of tax paid and other government grants/subsidies

Cash payments
cash paid for supplies of materials, labor and overheads
cash paid for fixed assets
cash paid for investments
dividends and interest payments
tax payments

Note: The problem in preparing the cash flow forecast is that it requires estimation of what will happen in the future, and it is easy to make mistakes. However, due to the necessity of this forecast one has to do it several times to acquire experience and accuracy.

6.5   Dealing with the depreciation of durable assets

All the farm's fixed assets (except land) suffer cumulative losses over the years of normal use through wear and tear, or just become obsolete, and will need to be replaced at some point in time. The farm manager needs to put aside a certain amount of money that will help finance the replacement of these outdated and/or disposed assets. Depreciation is the accounting procedure by which the loss of value of an asset that has an economic life of more than a year is recorded gradually over its useful lifetime.

Depreciation calculated on assets is considered an expense, increasing the farm costs and reducing its profit. Even though costs are increased and profit is reduced, the amount of cash available is increased because the incurred costs do not translate into monetary payment to outside creditors. Depreciation is tax deductible; the amount marked as depreciation is deducted from the farm taxable income.

5.5.1   Methods used in computing depreciation

Several methods exist for the calculation of depreciation among which are the straight line method, the double declining balance method and the sum of year's digit method, all of which will be explained in this section. Normally, the method used to calculate depreciation depends on the type of asset, its use and lifespan, and is determined by the tax authorities.

Straight line method
This method provides the same amount of depreciation in each year of the useful life of the asset. Using the straight line method, depreciation is found through the following formula:

$$DSL = \frac{OC - SV}{N}$$

Where: OC = original cost of the asset
                SV = salvage value of the asset
                N = number of years of useful life of the asset
                DSL= annual depreciation using the straight line method

Or $DSL = BV \times \left(\dfrac{1}{YOS}\right)$

Where: BV = depreciable base (which is equal to original cost of the equipment minus the salvage value, or OC-SV)
                YOS = years of useful service

Example:
Mr. Obama owns a tractor purchased at \$35,000 with a useful service life of 10 years and a salvage value of \$10,000. Using the straight line method, the depreciation of this asset will be calculated as follow:

$$DSL = \frac{35,000 - 10,000}{10} = 2,500$$

A deprecation table can then be drawn as shown in Table 20:

Table 20. Straight line depreciation table

Year	Depreciation Base BV	Rate 1/YOS	Depreciation Amount DSL
1	25000	0.10	2500
2	25000	0.10	2500
3	25000	0.10	2500
4	25000	0.10	2500
5	25000	0.10	2500
6	25000	0.10	2500
7	25000	0.10	2500
8	25000	0.10	2500
9	25000	0.10	2500
10	25000	0.10	2500
Total			**25000**

Every year, the farm manager should charge $2,500 to the farm's account for the tractor's depreciation. The advantage of this method is that it is simple and straight forward. But it will a take longtime before the amount needed to purchase replacement equipment is raised. Accelerated depreciation methods can be used to account for the fact that equipments lose most of their value in the early years of their usage. A double declining method or sum of the year's digit method can be used.

Double declining balance method
The double declining balance method is an accelerated method which allows the equipment to depreciate twice as fast as the straight line. The yearly amount of depreciation is calculated as follow:

$$DDBM = BV \times R$$

Where:

DDBM = annual depreciation using the double declining balance method

BV = Depreciable base of the asset at the beginning of a year

R = two times the straight line percentage rate, or $\left(2 \times \dfrac{1}{YOS} \right)$.

Before using the formula, the depreciation rate has to be determined using the straight line method (in our example, it will be $\dfrac{2,500}{25,000} = 0.10$ or 10%). The depreciation is then calculated using this rate up to the year where the amount of this

depreciation is lower than the depreciation amount using the straight line method. From that year, the amount of depreciation using the straight line method is used.

If we consider our previous example:

$$BV_1 = (35,000 - 10,000) = 25,000, \text{ and } R = 2 \times \left(\frac{1}{10}\right) = 0.20$$

Year 1: $\quad\quad DDBM_1 = 25,000 \times (0.20) = 5,000$

Year 2: $\quad\quad BV_2 = 25,000 - 5,000 = 20,000$

Year 2: $\quad DDBM_2 = 20,000 \times (0.20) = 4,000$

Year 3: $\quad\quad BV_3 = 20,000 - 4,000 = 16,000$

Year 3: $\quad\quad DDBM_3 = 16,000 \times (0.20) = 3,200$

$\quad\quad\quad\quad$ Etc.

The depreciation table is as follows in Table 21:

Table 21. Double declining balance depreciation (1)

Year	Depreciable Base BV	Rate R = 10%x2	Depreciation Amount DDBM	
1	25000	0.2	5000	
2	20000	0.2	4000	
3	16000	0.2	3200	
4	12800	0.2	2560	
5	**10240**	**0.2**	**2048**	← <2,500
6	8192	0.2	1638	
7	6554	0.2	1311	
8	5243	0.2	1049	
9	4194	0.2	839	
10	3355	0.2	671	

It appears that starting year 5, the depreciation amount is lower than the amount found using the straight line method. This means that from year 5, the depreciation amount should fall back to the straight line method's amount until the asset depreciation is complete, which gives us Table 22:

Table 22. Double declining depreciation (2)

Year	Depreciable Base BV	Rate R = 0.10 x 2	Depreciation Amount DDBM
1	25000	0.2	5000
2	20000	0.2	4000
3	16000	0.2	3200
4	12800	0.2	2560
5	**10240**	--	**2500**
6	**7740**	--	**2500**
7	**5240**	--	**2500**
8	**2740**	--	**2500**
9	**240**	--	**240**
10	**0**	--	**0**

Sum of the year's digit method

Using this method, the sum of the successive years of the depreciation life (SOYD) is calculated by taking the expected life of the asset in years, counting back to one and and summing up all the numbers. In our example, SOYD would be 10+9+8+7+6+5+4+3+2+1=55 (Table 23).

In the first year, the asset will depreciate by 10/55, 9/55 the second year, 8/55 the third year, 7/55 the fourth year etc.

In our example, the tractor has a depreciable base of 35,000 – 10,000 = 25,000

For the first year, the depreciation charges would be $25,000 \times (10/55) = 4,545$ (with 10/55 = 18.18). For the second year, this amount would be $25,000 \times (9/55) = 4,091$

Table 23. Example of sum of the year's digits depreciation table

Year	Depreciation Base BV	Rate	Depreciation Amount SOYD
1	25,000	0.1818	4,545
2	25,000	0.1636	4,091
3	25,000	0.1455	3,636
4	25,000	0.1273	3,182
5	25,000	0.1091	2,727
6	25,000	0.0909	2,273
7	25,000	0.0727	1,818
8	25,000	0.0545	1,364
9	25,000	0.0364	909
10	25,000	0.0182	455
Total			**25000**

SECTION III

DECISIONMAKING BASED ON ECONOMIC PRINCIPLES

Chapter 5: Basic economics for agribusiness

Managers of agribusiness firms must understand the basic economics of the farm business and related economic principles that affect the financial performance and viability of the agribusiness firm. Not only are economic concepts useful to understand better the resources flow and to predict business trends, but also, those same economic concepts serve as the basis for many management decisions.

I   Economics

Economics studies the allocation of scarce resources (land, labor, capital, and management) to meet the needs of the society. Economics of agricultural production deals with the efficient way to allocate limited farm resources to various available alternatives. The ability of a farm manager to organize and allocate resources efficiently depends on his/her management capacity and the way major decisions on production are made. Understanding of basic concept of both microeconomics and macroeconomics helps the manager to make sound business decisions.

1.1   Macroeconomics

Macroeconomics focuses on the big picture view of the economic system. General economic conditions are influenced dramatically by such factors as national income, unemployment, inflation, government policies and international developments. Macroeconomics deals with how the different elements of the total interact. The farm business is greatly affected by the general economic condition, and the agribusiness manager should pay careful attention to variables such as unemployment, national income, interest rate, monetary policy, fiscal policy etc. because they will affect his business decisions.

1.2   Microeconomics

Microeconomics is the application of basic economic principles to decision making within the firm. Managers must decide the best way to use physical, human and financial resources in the production and marketing of goods and services. This manual focuses mostly on microeconomic principles, which are the basic tools that help agribusiness managers in their daily decision making activities.

1.3   Basic assumptions of economic analysis

Economic analysis is based on the comparison of situations or variables. Even though real life situations are rather dynamic, with several things affecting each other and all other things, it is more convenient to consider comparing only a few variables of interest while holding all other potential influential factors constant. This approach, which is known as 'comparative static,' only considers the two variables of interest when analyzing the effect of the change of one variable on the other. The assumption that "everything remains constant is also referred to as '*ceteris paribus*.' Other assumptions of economic analysis which apply to this manual are:

- *Rationality*: The economic agent is rational; this means that people are self-interested and no individual would knowingly do something to harm him/herself. The farm manager will not knowingly do anything that is potentially harmful to the farm business.
- *Utility maximization:* Individuals maximize satisfaction and businesses maximize their profits.
- *Atomic behavior:* Economic agents (individuals and businesses) act independently of each other.

II   Basic economic concepts applied to agribusiness management

2.1   Scarcity and trade-off

The essence of economic analysis is to better understand scarcity and trade-off issues involved in managers' decision-making process. Because the amount of resources for production is limited (for their production, many different goods compete for the same resources), we must give up the production of some goods in order to produce more of other goods.

Scarcity refers to the condition where our wants (the goods we need) are unlimited while we only have limited resources to satisfy them. The ability to produce goods and services depends on the availability of the required resources to produce them. Resources are scarce, hence allocating resources to their most efficient use is necessary for a successful production enterprise. The producer must organize available resources and determine their priority in the best way possible.

Scarcity and trade off are illustrated by the concept of opportunity cost (refer to 2.2 for a more detailed explanation of the concept of opportunity cost) and can be modeled through the use of the production possibility frontier. A production possibility frontier (PPF) is a curve showing the maximum attainable combination of two products that may be produced with a given set of available resources. Because the resources used in the production of the two goods are limited, a certain amount of some goods must be given up if more of the other good should be produced. All combinations on the two goods that are below the PPF curve (Figure 7) are attainable but not efficient. Combinations outside of the curve are not attainable. The only attainable and efficient combinations are those that lie on the PPF curve itself. Efficient combination is combination of the two products which are obtained by optimally using the totality of the available resources.
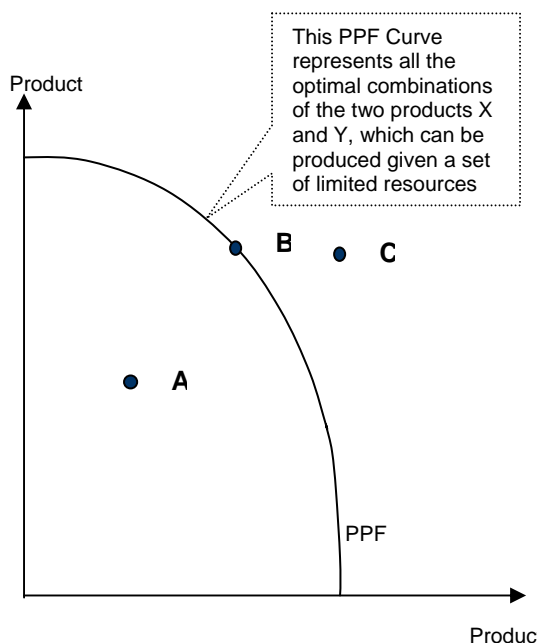
Figure 7. The production possibility frontier (PPF)

On the above PPF, combination A is attainable but not optimal; combination C is not attainable, because there are not enough available resources to achieve that level of production. Combination B is attainable and efficient.

Suppose that Mr. Obama wants to produce tomato seeds and eggplant seeds on his one hectare of land. If Mr. Obama used the totality of his land to produce tomato seeds, he will obtain 150 kg of tomato seeds. If he decided to produce only eggplant, he will obtain 100 kg of eggplant seeds on the one ha of land. Assuming that Mr. Obama is using all resources to obtain the abovementioned yield, Mr. Obama must give up some tomato seeds if he wants to produce more eggplant seeds. Since Mr. Obama produces one and half time as much tomato seeds as he produces eggplant seeds on the same area of land, he will have to give up 1.5 units of tomato seed every time he decides to produce a unit of eggplant seed. This tradeoff can be illustrated on the production possibility frontier on Figure 8.
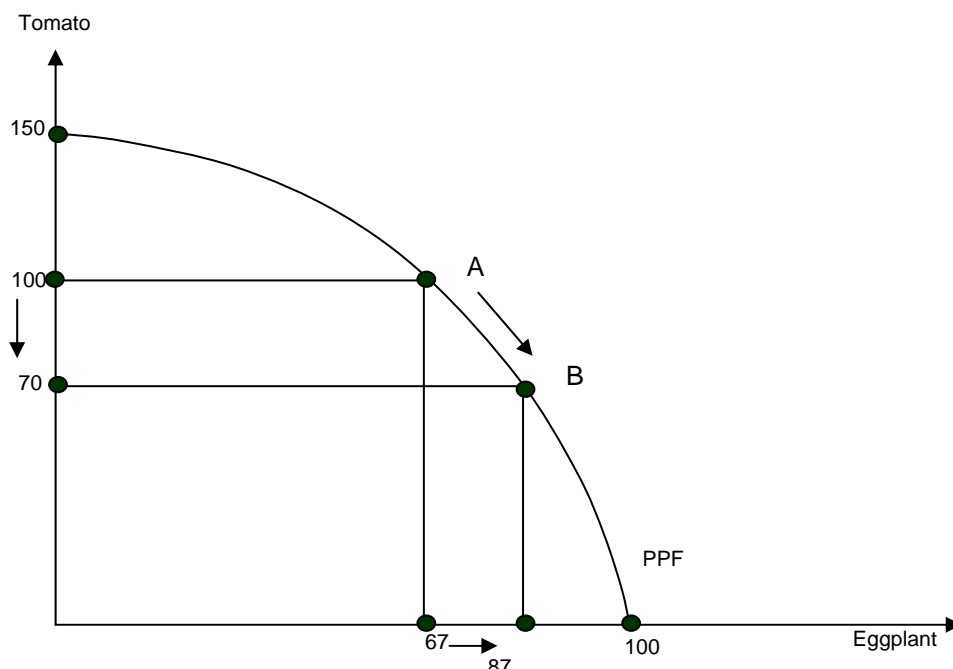
Figure 8. Scarcity and tradeoff and the PPF

To produce 20 kg more of eggplant seed, Mr. Obama must sacrifice 30 kg (which is 20 kg x 1.5) of tomato seed, everything else is kept constant. This will cause him to move from point A to point B on his PPF. In real life Mr. Obama will only make such a decision if the opportunity cost of the move (20 kg of tomato given up) is lower than the derived benefit.

2.2   Profit

Profit is a term used by both accountants and economists, but each tends to view profits somewhat differently. Economic profit is different from accounting profit. The accounting profit is the difference between total revenue and total costs (where total costs equal explicit costs). At this juncture, a difference between implicit costs and explicit costs should be made.

Explicit costs are charges incurred for which actual monetary payment is made. Examples are input costs, hired labor costs, etc. Opportunity cost of time spent by farm owner or his/her family labor on a vegetable farm is not a part of an explicit cost.

Suppose that in order to achieve his annual production, Mr. Obama's farm business spent $50,000 in labor costs (for hired labor), inputs and other service charges. These expenditures for which actual payments were made constitute explicit costs.

Implicit costs represent the value of resources used in the production for which no monetary payment is made. Implicit costs can be thought of as opportunity costs. Suppose that Mr. John Obama is a well respected scientist working for a major seed company as a breeder. Mr. Obama was earning $60,000 a year when he quit his job in

order to start his agribusiness firm. Mr. Obama has indeed decided to give up $60,000 in annual income to work in his company. $60,000 will constitute an implicit cost (or the opportunity cost of his time) when Mr. Obama decides to calculate his economic profit. To better understand the difference between those two concepts of profit, let's first examine them with more detail and with some real numbers.

2.2.1 The accounting profit

The **accounting profit** is the difference between the total revenue and explicit costs

Accounting Profit = Total Revenue – Total Explicit Costs

Suppose that Mr. Obama's firm made total revenue of $110,000 this year.

The firm's accounting profit will be $110,000 - $50,000 = $60,000; where $50,000 represents the total of all explicit costs (fixed + variable costs).

An **explicit cost** is a cost for which monetary payment is made; for example, fertilizer's costs.

Explicit costs are made of fixed costs and variable costs. Remember that fixed costs are associated with fixed inputs, and therefore do not vary as output changes. Variable costs on the other hand are associated with variable inputs. The quantity of variable inputs changes as the total quantity produced changes.

2.2.2   The economic profit

The economic profit considers implicit costs in addition to explicit costs (remember that *implicit costs are opportunity costs).*

Economic profit = Accounting Profit – Implicit Cost

or

Economic profit = Total Revenue – (Explicit Costs + Implicit Costs)

Because the calculation of economic profits takes into account both explicit and implicit costs, it will not be unusual for a firm to make zero economic profit (in some case negative economic profit will be made). A zero economic profit actually means that the accounting profit is positive. In our example, Mr. Obama may have had a positive accounting profit ($60,000). However, the economic profit for the firm is zero (0). If we consider that the opportunity cost of Mr. Obama's time for the year was $60,000, then the economic profit of the firm will be:

$110,000 – ($50,000 + $60,000) = $0

2.2.3 Profit maximization

The most agreed upon objective for the firm is to maximize profits. Following three basic concepts of economics helps to better explain a firm's objective of "profit maximization."

2.3   Opportunity cost

The opportunity cost is the income given up by not choosing the next best alternative for the use of resources. If the manager decides to choose one alternative over another, he/she is giving up the potential benefit that the alternative that was not chosen would have provided. The cost of the choice made (or opportunity cost) is the value (or benefit) of the alternative given up. This concept can best be understood through the following examples:

Example 1: consider James the entrepreneur that starts a seed company. Had he sought employment somewhere else as a manager, he could have earned $60,000 a year. He decided to start work for his own business for no pay. In so doing, he gave up $60,000 to start his company. The opportunity cost of his entrepreneurial service to his firm is $60,000 per year, even though he does not pay himself an actual salary. This opportunity cost is ignored by the accountant.

Example 2: Another entrepreneur use $500,000 of his own money to start a farm business. Had he invested that money in an interest bearing account paying 10% interest a year, he could he could have earned $50,000 a year from this money. Because he gave up this option to start his business, the opportunity cost of his money is $50,000, which is the amount he could have earned in interest on his funds, or the value of the best alternative he forwent.

2.4   The marginal principle

In economics, human decisions are analyzed at the margin. This simply means that before deciding to add a new enterprise, an economist will consider all added benefits and costs associated with the new enterprise and evaluate how they will affect the firm's economic profit. This is done by simply assessing how much more the new enterprise will cost, then comparing this added cost to the additional revenue the new enterprise will generate. In fact, everybody is making decisions at the margin. The marginal principle is the foundation of economics and firms' (investors') decision making criteria. It will be covered throughout this manual. We can also better illustrate this economic principle with three equality concepts:

Marginal cost is equal to marginal revenue
This concept answers the question "How much to produce?" One should continue adding inputs to the point at which the extra cost incurred for producing the last unit of output is just equaled by the extra revenue received from sale of that unit of output, which in many cases is just the output sales price per unit. In this case, the cost of producing the additional should equal the price at which the extra unit is sold.

Marginal rate of substitution equals the inverse of price ratio

This concept deals with the question, "What is the combination of inputs that minimizes the cost of production?" A manager should substitute input X for input Y up to the point at which the marginal rate of substitution of X for Y is just equal to the inverse of their price ratio (price of Y divided by price of X).

Equal marginal returns

This answers the question, "What combination of products should be produced, and how should limited inputs be allocated?" The variable input should be allocated among the farm production enterprises until the marginal returns from the last unit of input invested in each production enterprise are equal. This way, inputs are allocated to the enterprises with the highest marginal returns (e.g. they are allocated to their best use).

2.5   The principle of diminishing returns

It is necessary for the agribusiness manager to understand that the output obtained on the farm is a response to the application of a combination of inputs, mainly, land (soil) seeds, fertilizer, agrochemicals and labor. Output will not always respond proportionally to the increase in the required variable inputs' application. In fact, output response will be higher than proportional at the initial levels of application, then less than proportionally and it will hit a plateau at a certain level of input application. Beyond that level, output will decrease. This is usually due to the fact that while the quantity of variable inputs are increased, the quantity of fixed inputs remain exactly the same.

When the output response is more than proportional to the increase in the quantity of the variable input, output is said to be increasing at an increasing rate; when the output response is less than proportional to the increase in the quantity of the variable input, output is said to be increasing at a decreasing rate; the point where the output begins increasing at a decreasing rate, is called the point of diminishing returns or decreasing returns to scales. Diminishing returns are due to the fact that there is a maximum level of output that can be obtained at every given level of fixed inputs application or scale of production. When that maximum capacity is reached, increasing variable inputs may increase costs without having any effect on output. It could actually decrease output if the increase causes inefficiencies. Examples are the cases of overuse of fertilizer or labor. Overuse of fertilizer (increase of the fertilizer application rate on the same amount of land area) may have a negative effect on yield. Similarly, increase the quantity of labor without increasing the overall size of the farm (without acquiring more land, tools and equipments) may increase the competition for the tools/equipments use and increase the amount of idle time while increasing the costs of production The concept of diminishing returns is illustrated in Figure 9.

2.6   Economies of scale

The scale of the farm business is its size, which could be measured in terms of hectares or acres of land, the quantity of equipments and resources such as the number of laborers and staff and the volume of output produced. In general, the more specialized the farm, the larger its size, because specialized farms usually require a higher amount of investment in specialized equipments. The volume of production increases as variable inputs increase until the maximum farm capacity is reached. At a given scale, only variable inputs will need to be increased in order for the output to increase. That is until the farm has reached its maximum capacity. As output increases, the per unit cost of production will decrease due to the fact that the farm's fixed cost remains the same. The situation occurs because initially, excess capacity exists as the farm is not producing up to its maximum (potential) capacity. The reduction in per unit cost of production, which increases the farm per unit profit is referred to as economies of scale. Once the farm reaches its maximum capacity, fixed inputs such as land and machinery will need to increase, before the farm output can continue to increase.

All the principles listed above will be analyzed in the following section.

III   Understanding the production function

All production operations process and transform a variety of inputs in order to generate or produce outputs. The production function is a systematic way of modeling this relationship between inputs and outputs. The production function shows how inputs are transformed into finished goods and services, and usually take the form of a mathematical model such as $Y = f(X_i)$ where Y is the output and X_i the different inputs used to produce Y. $Y = F(X_i)$ also means that the output is obtained from a certain combination of the inputs (X_i)

Example: *Y = 10X + 6X2 - X3*

Where: *X is the input. Y is the output.*

This manual will not dwell on the mathematics on the production function any further, but will use numerical examples to show how the same principles involving the use of production function can be applied to the data obtained on the field.

3.1   Useful production function concepts

Total Physical Product
The Total Physical Product (TPP or Y) is the total output (total quantity produced) from farm operations

Average Physical Product
The Average Physical Product (APP or Y/X) is the total output divided by the quantity of input used. APP is a measure of the average amount of output produced per unit of

variable input supplied. We must consider APP to address the question of whether it is worthwhile to produce anything at all.

Marginal Physical Product
The Marginal Physical Product (MPP or $\Delta Y / \Delta X$) is the change in output brought about by an increase in the quantity of input used.

Total Revenue
The Total Revenue (TR or Y*P) is the total output multiplied by the product's price.

Marginal Revenue
The Marginal Revenue (or MR or $\Delta Y / \Delta Q$) is the change in total revenue brought about by a change in quantity sold.
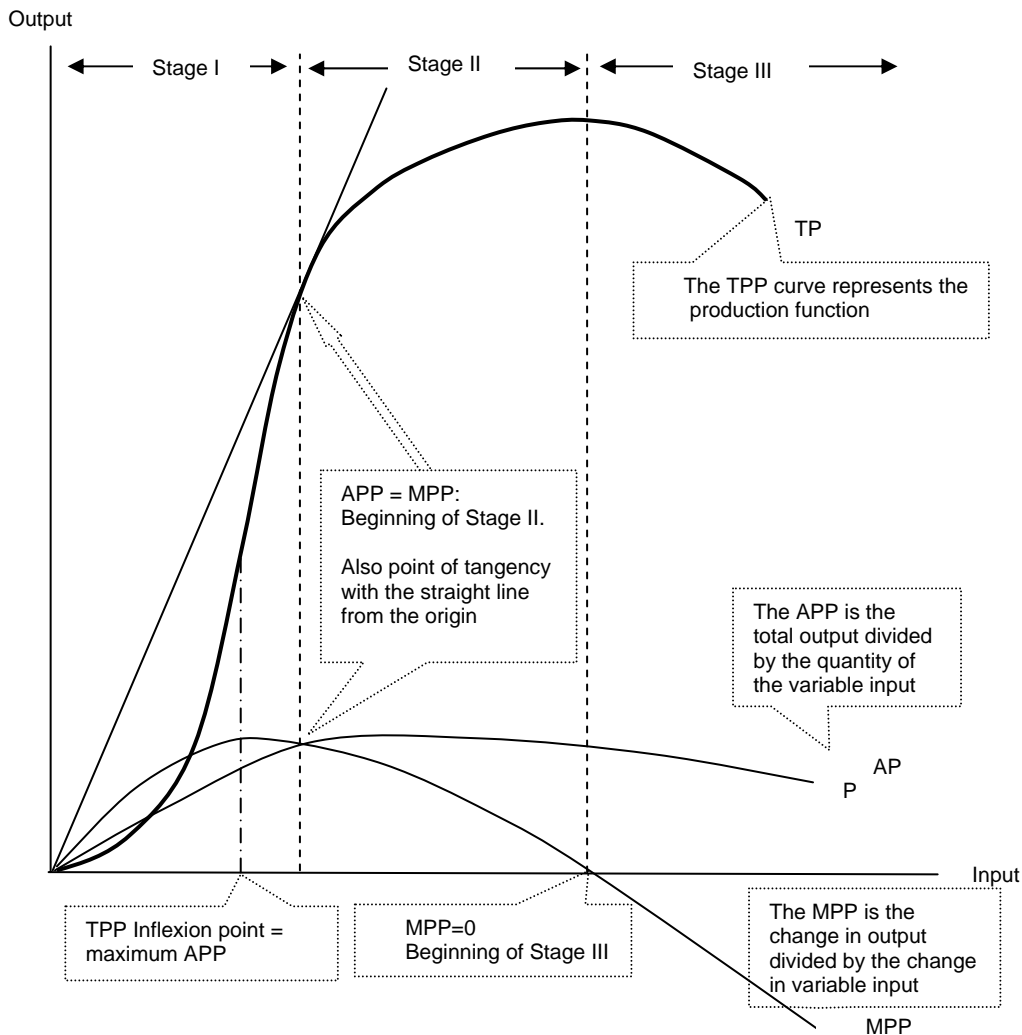
Figure 9. Total production curve and stages of production

Note:

A production function will normally go through three phases. The output starts by increasing at an increasing rate (Phase I), Then increasing at a decreasing rate (Phase II) and finally decreasing after reaching a maximum (Phase III). The beginning of phase II is the point where the economic optimum is achieved. Most businesses operate in phase II, but no business should ever operate in phase III. The physical maximum, which yields the highest output, does not always correspond to the economic optimum. The inflection point on the production curve represents the point were diminishing returns sets in. This occurs where the marginal physical product (MPP) is at its maximum.

3.2   Management decision and economic principles

In all organizations, management is concerned with how to allocate resources to their best and most efficient uses. The farm manager will be seeking the best way to allocate limited farm resources to various alternative uses.

In any economic analysis, the problem of limited resources forms a central issue of discussion because the ability of any farmer to produce seed in particular depends on the availability of resources necessary to produce seed.

Resources are scarce, hence allocating resources to the most efficient way is necessary for successful seed production. The farmer /producer must organize available resources and determine their priority in the best way possible.

Similarly, the ability of a farmer/producer to organize and allocate resources efficiently depends on his/her management capacity and the way major decisions on production are made. A farmer has to decide:

- what and where to produce
- how much to produce
- how to produce

All these are management decisions which a producer must always try to answer whenever faced with production problems on any enterprise.

3.2.1   What and where to produce

The producer must decide exactly what he/she wants to produce among the many varieties of seeds available. The type of seed to produce depends on resources available and the environmental factors around (climate factors and soil factors). A simple approach to such a decision is based on the economic principle known as *opportunity cost,* which has been discussed earlier. The opportunity cost of something is the value of the best alternative forgone. It is the benefit you give as a result of choosing one alternative over another.

In attempting to make a decision on what to produce the manager should write down all the alternative varieties of vegetable seeds that he/she would wish to produce using his/her limited resources and the type of micro- climate that favors the seed crop in question.

A farmer should then compare the actual benefits that he/she would accrue from each of the seed crops and rank them accordingly. The benefits could be income, higher yield, family welfare, traditional beliefs and customs, etc.

Ranking the Alternatives
Mr. Obama wishes to produce snow pea, carrots, broccoli, and spinach (Table 24). He has only one hectare of land. Finally he decides to grow snow pea because it gives him a higher income at the same time his family requires it for home consumption.

What is the 'opportunity cost' of producing snow peas in one hectare of land? Is the decision taken economically wise? Is it a rational one?

Table 24. Ranking the production alternatives

Variety	Expected Costs ($)	Expected Revenues ($)	Expected Profit ($)	Return per dollar invested	Rank
Snow Pea	2,000	5,400	3,400	2.7	1
Carrots	3,500	6,500	3,000	1.8	4
Cucumber	3,200	4,000	800	1.25	5
Broccoli	1,500	4,000	2,500	2.6	2
Spinach	2,500	5,000	3,500	2	3

From our example, Mr. Obama should produce snow pea, since it generates the highest return per dollar invested. Spinach, however, gives a higher expected profit, the opportunity cost of producing any other type of seed variety other than spinach would be $ 3.500, which would the value of the best alternative forfeited if spinach is not chosen. Based on the economic principle of opportunity cost alone, Mr. Obama should produce spinach. Since Mr. Obama also consumes snow pea, the decision to produce snow pea is the most rational decision to be taken, given this additional advantage. It would therefore be rationally sound and economically better to produce snow pea, which gives the highest return per dollar invested and provides food for Mr. Obama's family, instead of spinach.

Regional Comparative Advantage
Companies do operate under conditions of risks and uncertainties, the most common being the environment. The farm environment includes both natural factors such as the climate and ecology, and the man made factors such as law and regulations (i.e. land tenure.)

Region I will have a comparative advantage over Region II if a seed can be produced in Region I at a lower opportunity cost.

According to the law of comparative advantage, a product tends to be produced in areas where its ratio of advantage over other areas is higher, or its disadvantages are lower, than any other product. A region will have a comparative advantage in the production on a product if this product can be produced in this region at lowest opportunity cost. The opportunity cost in this case will be amount of resource used to produce a unit of this product in this region compared to what it takes to produce a unit of that same product in other regions. Many seed companies have their seed multiplication facilities spread out throughout the world as a consequence of this.

The law of comparative advantages requires the company to evaluate whether there are advantages of producing one crop compared to the second crop in a specified location. This helps with choosing the location where the different varieties of seed are produced.

Let's reconsider our example where Mr. Obama still has only one hectare, on which he can either grow tomato or eggplant seed. Table 25 shows the yields he will obtain, if

he chose to grow either tomato or eggplant seed only. It is assumed that both tomato seed and eggplant are sold at the same price.

Table 25. Maximum yields

Seed variety	Region I	Region II	Total
Tomato	150kg	100kg	250kg
Eggplant	100kg	100kg	200kg

According to the yield data in the table, Mr. Obama can just concentrate on producing tomato seed since it has better yield in both regions (or almost) and both products are sold at the same price. However, Mr. Obama can produce both seed varieties and still minimize its costs of production. Further examination is needed to determine in what region he should produce each one of the seed varieties. Let suppose that Mr. Obama chooses to produce tomato seed only, as illustrated in Table 26.

Table 26. Maximum yields and absolute advantage

Seed variety	Region I	Region II	Total
Tomato	150kg	100kg	250kg
Eggplant	0kg	0kg	0kg
Total	150kg	100kg	250k

The above table shows that Mr. Obama will produce 250kg of tomato seeds, which may lead him to consider totally avoiding the hassle of dealing with eggplant seeds, especially if eggplant seeds are difficult to sell. We may however consider looking into opportunity cost of producing both seeds.

Determination of opportunity costs

With one hectare of land:

Region I can produce 150kg of tomato seeds or 100kg of eggplant seeds, which is:
$$150T = 100EP$$
➔ $$T = \frac{100}{150}EP$$

Region II can produce 100kg of tomato seeds or 100kg of eggplant seeds, which is:
$$100T = 100EP$$
➔ $$T = \frac{100}{100}EP$$

Table 27. Opportunity costs

Seed Variety	Region I	Region II
Tomato	0.66 EP	1EP
Eggplant	1.5T	1T

In Table 27, the ratio of tomato and eggplant seed represents the amount of the other product that should be given up in order to produce one additional unit of the chosen seed. If it takes 1.5 units of tomato seed to produce an additional unit of eggplant seed, then 1.5 units of tomato seed represent the opportunity cost of producing an additional unit of eggplant seed. The opportunity cost of producing tomato seed is thus lower in region I than it is in region II. If Mr. Obama wanted to produce tomato seeds in region II, he would have to give up an entire unit of eggplant in order to free up the resources necessary for that operation. He can just concentrate in producing tomato seeds in this region where it is cheaper, since each unit of tomato seed will cost him just a little more than half the resources needed for producing a unit of eggplant seed. Eggplant seed is cheaper to produce in region II, since its production here costs just one unit of the resources needed to produce a unit of tomato seed (both tomato and eggplant will cost him the same amount of resources per unit of output). Region I has a comparative advantage in producing tomato seed, while region II has a comparative advantage in producing eggplant seed.

As shown in Table 28, Mr. Obama could produce tomato seed in region I, and produce eggplant seed in region II, all other factors considered constant. By doing so, he will still produce his 250 kg of seeds while minimizing the costs of doing so.

Table 18. Comparative advantages

Seed variety	Region I	Region II	Total
Tomato	150kg	0kg	250kg
Eggplant	0kg	100kg	0kg
Total	150kg	100kg	250kg

3.2.2   How much to produce

The decision on how much to produce is a cost benefit analysis:

- How much will it cost to produce more or less output?
- What will be the benefit of producing more or less output?

The producer must also solve these problems:

- What is the optimal level of input that maximizes the output?
- What is the best combination of input to achieve a desired level of output?

To answer these questions, it is necessary to revisit the marginal principle. Let us define the marginal physical product of an input (MPP) or $\Delta Y / \Delta X$ as the change in output brought about by an increase in the quantity of and input used in crop or seed production.

MPP = $\Delta Y / \Delta X$ or change in output divided by change in input used.

Note: It is assumed that the level of all other inputs required is held constant in order to determine the level of input that optimizes the output. This assumption is important because a variation in the level of other inputs can increase or decrease the quantity of output obtained.
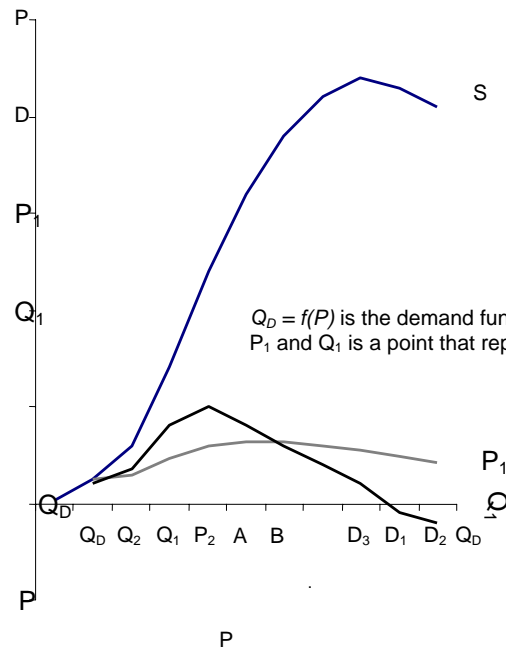
Illustration

Suppose Mr. Obama wants to find out how much fertilizer he should apply in his tomato farm in order to obtain the maximum seed yield. Table 29 illustrates the yield of tomato seed with the application of various fertilizer rates.

Table 29. Yield of tomato seed with application of various fertilizer rates/levels

Level of Input (x100 kg/ha of fertilizer application	Output (x10kg/ha of seed)	APP	MPP
0	2		
1	12	12.0	10.0
2	30	15.0	18.0
3	70	23.3	40.0
4	120	30.0	50.0
5	160	32.0	40.0
6	190	31.7	30.0
7	210	30.0	20.0
8	**220**	27.5	10.0
9	215	23.9	-5.0
10	205	20.5	-10.0

Using the data from the above table, the graph (Figure 10) can be generated.
If the price falls from P1 to P2, the quantity demand rises from Q1 to Q2. There is movement from A to B on the demand curve.

$Q_D = f(P)$ is the demand function
P_1 and Q_1 is a point that represents a price-quantity on the demand curve (D)

The demand will rise or fall and the demand curve will shift either to the right or left due to the following:

- Income
- Tastes and preferences
- Expectations
- Population or market size
- Prices of substitutes or complements.

Figure 10. Graphing the production function (TPP curve)

MPP is the change in output associated with using one more unit of input. It tells you how much extra product you get if you use one extra unit of input. MPP is important for finding the amount of input that should be used to maximize profits.

Law of Diminishing Marginal Returns
As the number of units of the variable input increases, and other inputs are held constant, after a point the MPP of the variable input starts to decline. This means the total production(TPP) will be increasing at a decreasing rate.

Note: This law refers to marginal physical product (MPP). Eventually, MPP will fall.

A production function may exhibit increasing returns (MPP rising) or constant returns (MPP steady) for a while, but eventually, MPP must fall. If MPP didn't eventually fall, there would be an incentive to produce an infinite amount of output. The inflection point on the production curve represents the point where diminishing returns sets in. This occurs where the marginal physical product is at its maximum. Note that the MPP is at its maximum at 120kg N/ha (Table 30).

Table 30. The marginal physical product of fertilizer application

Amount of fertilizer (kg N/ha)	Yields (t)	Increase in Yield (MPP) per kg change in fertilizer
60	4.9	-
90	7.6	90
120	12.1	150
150	13.4	43.3
180	13.9	16.7
210	12.7	-40
240	10.9	-60

3.2.3   How much input to use?

What exactly is the optimal amount of input to use given the diminishing returns constraint? This question can be answered using the marginal principle. Here are a few new concepts:

- *Total Value Product* (TVP) = the cash sale value of the output
- *Average Value Product* = the average revenue for the output sales
- *Marginal Value Product* (MVP) = the change in output value associated with using one more unit of input
- *Marginal Input Cost* (MIC) = the change in cost associated with using one more unit of input

Total Value Product (TVP)
To calculate TVP, multiply the output quantity amount by its selling price per unit.

$TVP = TPP \times Py$ (the TVP similar to the total revenue)

Where *Py* is the output price.

Marginal Value Product
To calculate MVP, take the change in TVP divided by the change in the variable input's quantity.

$MVP = \dfrac{\Delta TVP}{\Delta X}$, *X* being the variable input. (the MVP is similar to the marginal revenue)

Marginal Input Cost (MIC)
To calculate the marginal Input Cost, take the change in total input cost (TIC) divided by the change in the quantity of Variable input:

$TIC = Px \times X$

$MIC = \dfrac{\Delta TIC}{\Delta X}$

Decision Rule
The profit maximizing amount of input is found where the marginal value product is equal to the marginal input costs:

$$MVP = MIC$$

The firm should use the input level for which the marginal value product MVP is equal to the marginal input cost, so long as this level occurs in stage II of the production. This will ensure that each additional input used will generate enough revenue through the sale of the corresponding output to pay for its costs. If that point cannot be reached, it would be better to stop where the MVP is still greater than the marginal input cost. Table 31 demonstrates this concept.

Table 31. Economic optimum of the variable input

1	2	3		4	5		6	7	8	
Fixed Input (Qty)	Variable Input	IPP (Unit Labor Cost)	TIC	Quantity of Seed Output	Output (Seed) Price	TVP	MPP Δ(4)/Δ(2)	MVP	MIC	AVP
	(Labor)	$		(100g)	$/100g	(4)X(5)		(6)X(5)	Δ(2)x(3)	
1	0	100	0	0	10	0	0	10	0.0	0
1	1	100	100	130	6	780	130	6	100.0	130.0
1	3	140	420	280	5	1400	75	375	210.0	93.3
1	**5**	**198**	990	**500**	**4.5**	2250	**110**	**495**	**495.0**	100.0
1	7	244	1708	830	3.4	2822	165	561	854.0	118.6
1	9	248	2232	1200	2.7	3240	185	499.5	1116.0	133.3
1	11	315	3465	1365	2.5	3412.5	82.5	206.25	1732.5	124.1
1	13	380	4940	1310	2.5	3275	-27.5	-68.75	2470.0	100.8

Notes from Table 31:

The marginal input cost (MIC) is the cost of labor, which increases as more labor is used.

The marginal value product (MVP) is the market value of the additional output obtained by applying successive increases in fertilizer.

The economic optimum is found where the increase in cost of the additional labor needed to produce extra amount of seed (MIC) is just matched by the increase in the value of the seed produced (MVP). The economic optimum is achieved with five workers producing about 50 kg/ha. Above 50 kg/ha, the Marginal Cost of labor is greater than the value expected from the extra quantity of seed produced, which means that the farm manager should not hire more than 5 workers for this activity.
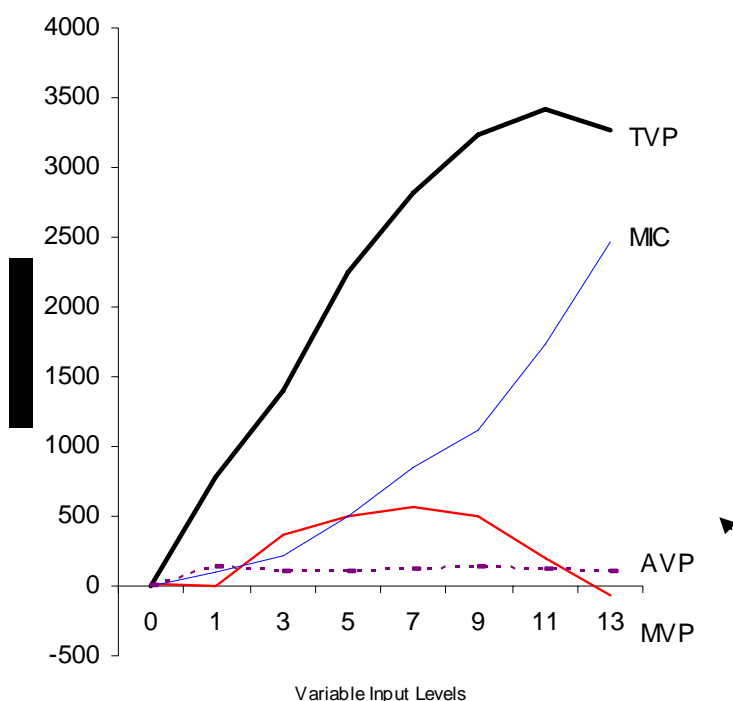

Figure 11. Plotting the TVP, MVP, AVP, and MC from Table 31

Notes from the figure:

The economic optimum of labor is attained where MVP = MIC (input level= 5), and can only be achieved in stage II of the production function (Figure 11).

The physical optimum is achieved where MVP is equal to zero (around input level= 13). It would not be logical to apply fertilizer beyond this point as yield decreases and no additional revenue will be obtained.

3.2.3 Choosing the optimal level of output

The assumption made here is that the level of all other inputs is held constant, which is required to determine the level of input that optimizes the output (Table 32).

Table 32. Economic optimum of output production.

1	2	3	4	5	6
Total Cost	Yield (g)	Selling Price $	Total Revenue (2)X(3)	Marginal Cost $\Delta(1)/\Delta(2)$	Marginal Revenue $\Delta(4)/\Delta(2)$
0	0		0		
27	15	2	30	1.8	2
50	35	2	70	1.15	2
70	60	2	120	0.80	2
93	82	2	164	1.05	2
117	100	2	200	1.33	2
142	116	2	232	1.56	2
168	**130**	2	260	**1.86**	**2**
195	**143**	2	286	**2.08**	**2**
224	150	2	300	4.14	2
256	158	2	316	4.00	2
296	149	2	298	-4.44	2

Note: The price of tomato seed is $2/g

Decision Rule

The economic optimum will be found where the increase in marginal cost of output is just matched by the increase in revenue from its sale. That is the marginal revenue from extra units of tomato seeds equals the additional cost incurred for the production of the extra units.

$$MR \; = \; MC$$

   From Table 5.9, the economic optimum point is achieved at a yield between 130 and 143 kg of tomato seed. At this point, the Marginal Cost of producing the seed sold is equal to the extra revenue derived.

3.2.4   Choosing the optimal combination of inputs for a given level of output, and the best combination of output

Managers are often interested in the combination of inputs that will yield the same level of outputs while minimizing product costs, or the optimal combination of varieties that will maximize their profit. The classic input substitution problem includes:

- Labor vs. machinery
- Tillage vs. chemical weed reduction
- Fertilizer vs. manure

To determine the appropriate level of input to use when there are two variable factors of production, a producer must know the rates at which inputs are exchanged in the market (their relative prices) as well as the rates at which they can be exchanged in production (their marginal rate of substitution). Also, to determine the best combination of varieties to produce, the manager must also set the marginal rate of substitution of the two varieties equal to the inverse of their price ratio.

Question: When two or more variable inputs can be used to produce a given level of output, what is the least-cost combination? This question involves input substitution. In order to answer this question, let's introduce the concepts of isocost and isoquant.

The isocost line

The isocost line (or equal-costs line) is a line that shows all the combinations of the two inputs (X_1 and X_2) that will cost the same amount, or that the producer can purchase with a given budget (R). iso means 'equal' or 'the same.' To construct the isocost, we need the budget amount to be used and the prices of the two inputs (pX_1 and pX_2) (Figure 12).
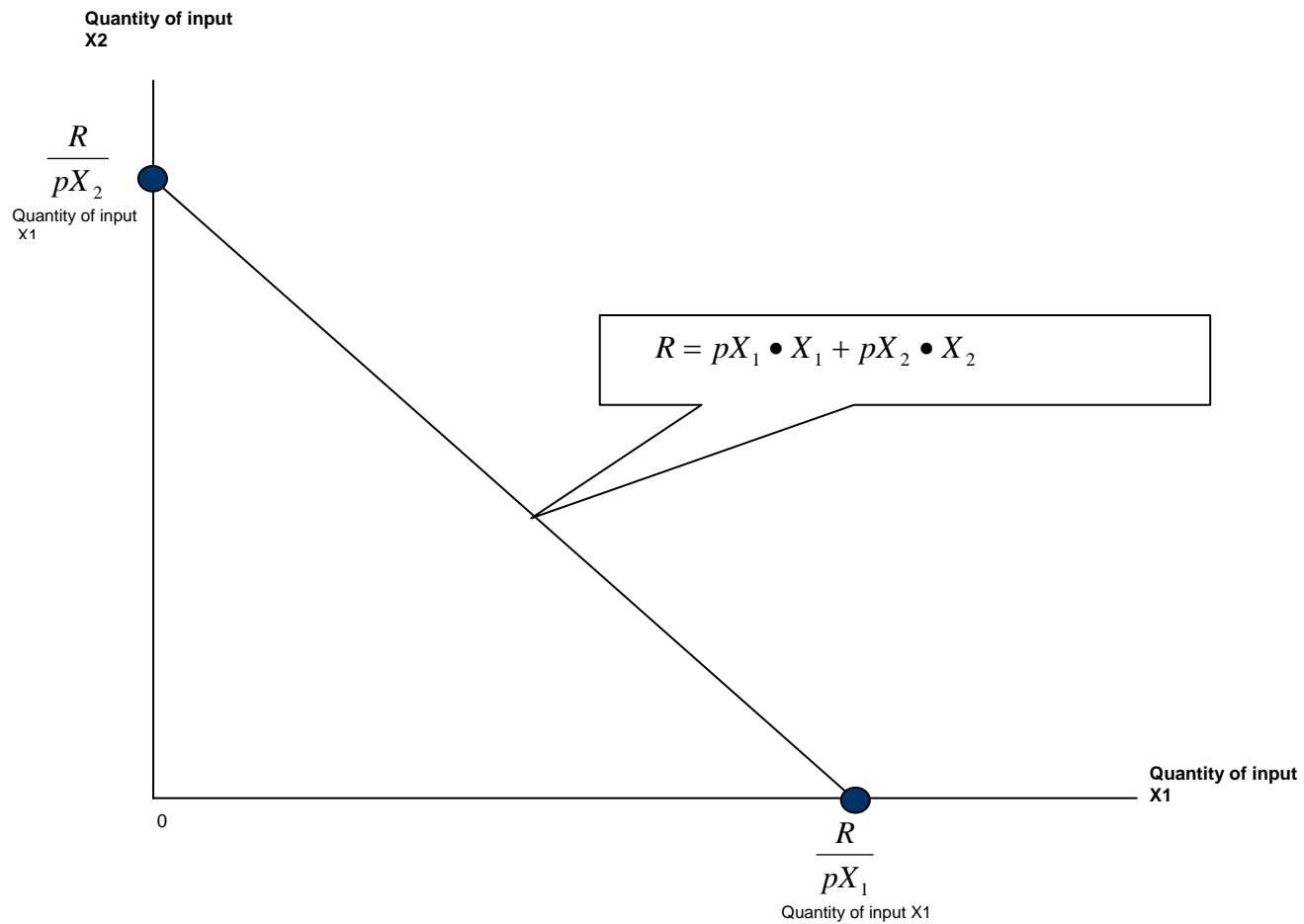
Quantity of input X2

$$\frac{R}{pX_2}$$

Quantity of input
X1

$$R = pX_1 \bullet X_1 + pX_2 \bullet X_2$$

Quantity of input X1

0

$$\frac{R}{pX_1}$$

Quantity of input X1

Figure 12. The isocost line

Note: R is simply the sum of expenditure on input X_1 (i.e. $pX_1 \cdot X_1$) and on input X_2 (i.e. $pX_2 \cdot X_2$)

Since the producer would wish the cost outlay on variable inputs to be as small as possible, we need a rule for determining the least cost combination of inputs.

The slope of the isocost line is the ratio of input prices, i.e. $-\dfrac{pX_1}{pX_2}$, which is obtained by solving the following equation:

$$R = pX_1 \bullet X_1 + pX_2 \bullet X_2$$

Suppose the prices of manure and fertilizer are respectively \$0.06/kg and \$30/kg. Mr. Obama has \$1,000 to spend on fertilizer and Manure. If Mr. Obama uses all the \$1,000 to purchase manure, he can buy exactly 16,666kg of manure (Figure 13). If he decides instead to invest all this money on fertilizer, he will be able to purchase 33.33kg of fertilizer

The slope of his isocost line is $-\dfrac{0.06}{30} = -0.002$

The marginal rate of substitution, also known as Physical Substitution Ratio is the rate at which an input or a variety can be optimally substituted for another.
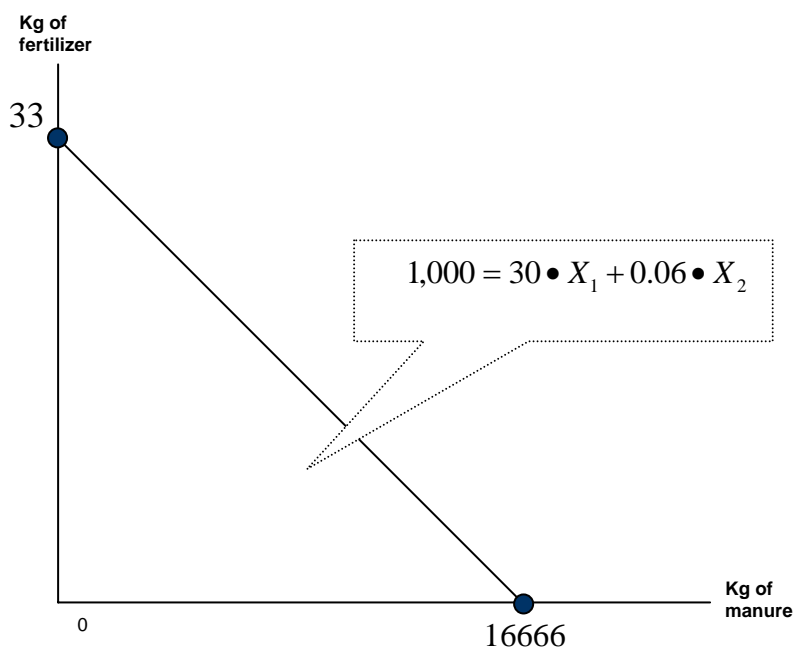

Figure 13. Mr. Obama's manure-fertilizer isocost line

Isoquant: A geometric curve representing all combinations of two or more inputs that produce a given level of output (Figure 14). Iso means equal and quant means quantity.
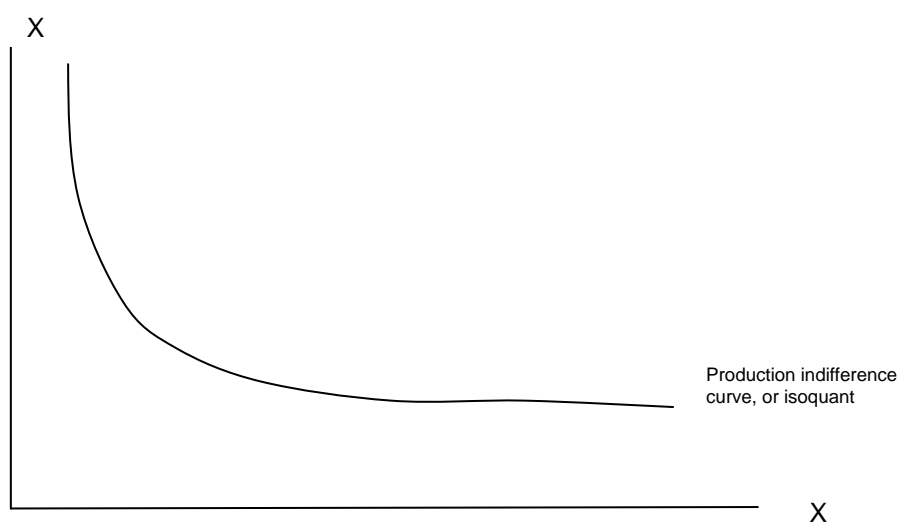
Figure 14. The isoquant

Example: What are all the different combinations of X_1 and X_2 that will produce exactly 1,000 tons of output?

The different combinations of fertilizer and manure to produce 1000 tons of crops are presented in Table 33 and plotted in Figure 15:

Table 33. Fertilizer-manure substitution

Combination	Manure (kg)	Fertilizer (kg)
A	500	61.2
B	550	54.5
C	600	49.2
D	650	44.5
E	700	40.5
F	750	37.0
G	800	34.1
H	850	31.6
I	900	29.2
J	950	27.0
K	1000	25.4
L	1050	24.0

Marginal Rate of Substitution (MRS) or Physical Substitution Ratio is the ratio of the amount of input replaced divided by the amount of input added (Table 34).

$$MRS = \frac{Input\ Replaced}{Input\ Added}$$

Table 34. Input substitution

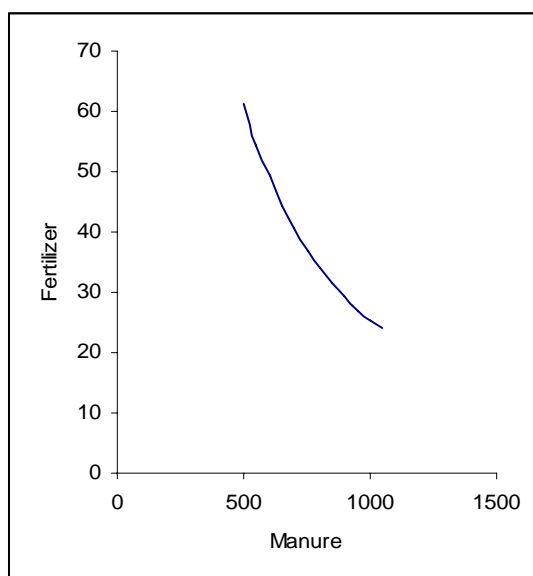| Combination	Kg of Manure	Kg of Fertilizer	Kg of fertilizer replaced	MRS
A	500	61	***	***
B	550	55	7	0.0135
C	600	49	5	0.0105
D	650	45	5	0.0095
E	700	41	4	0.008
F	750	37	4	0.007
G	800	34	3	0.0058
H	850	32	3	0.005
I	900	29	2	0.0047
J	950	27	2	0.0045
K	1,000	25	2	0.0032
L	1,050	24	1	0.0028

Figure 15. Plotted isoquant from data

Decision Rule

To find the least-cost combination of inputs, set the marginal rate of input substitution (MRS) equal to the price ratio.

$$-\ \text{MRS} \quad \frac{\text{Price of Input Replaced}}{\text{Price of Input Added}}$$

The manager should substitute the input to the point at which their marginal rate of substitution (MRS) is equal to the inverse of their price ratio (IPR).

MRS = IPR

If they cannot be made exactly equal, keep MRS higher. This rule is also called the Substitution Principle.

To understand the logic of the substitution principle, we must cross-multiply both parts of the equality.

$$\frac{Amount\ Replaced}{Amount\ Added} = \frac{Price\ of\ Input\ Added}{Price\ of\ Input\ Replaced}$$

This gives the following

$$\begin{bmatrix} (Amount\ Replaced \times Price\ of\ Input\ Replaced) \\ = (Amount\ Added \times Price\ of\ Input\ Added) \end{bmatrix}$$

Which then translates into: **Cost Savings = Additional Costs incurred**

Where:

Cost savings = (Amount Replaced) X (Price of input Replaced), and
Addition Costs = (Amount Added) X (Price of Input Added)
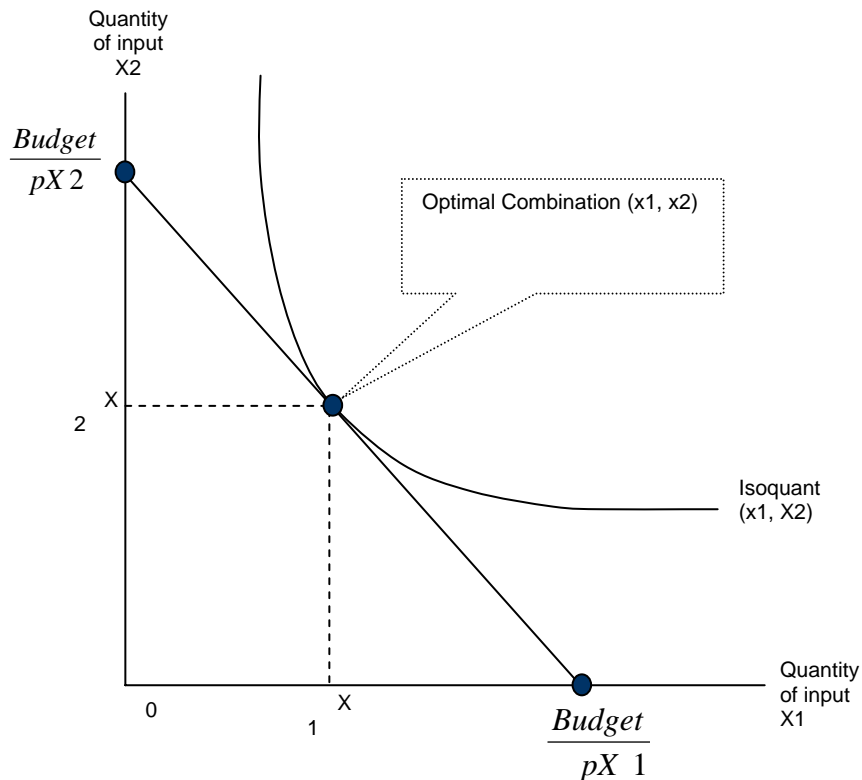
Figure 16. Costs minimizing combination of inputs

The tangent point between the Isoquant and the Isocost line represents the combination of fertilizer and manure that minimizes the firm's costs while yielding the same level of output (Figure 16).

Using our example, the combination of the two inputs that minimizes the cost of production is represented graphically in Figure 17.
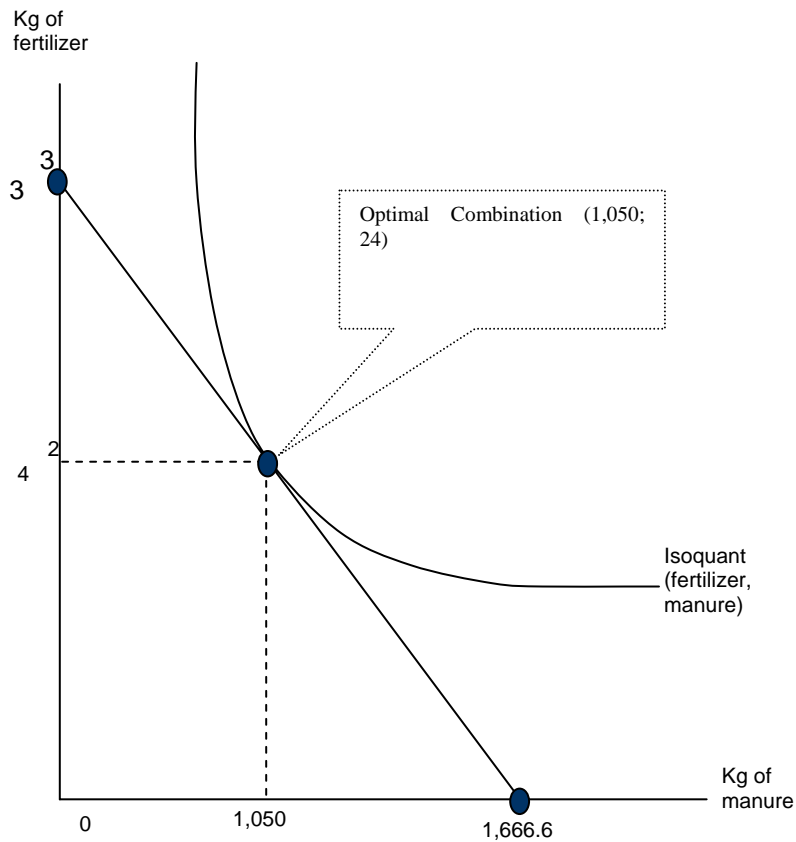
Figure 17. Example of costs minimizing combination of inputs

Numerical determination of the Product: Product equilibrium

Table 35 illustrates hypothetical data for optimum product combination.

Table 35. Optimal combination of substitutable products

Units of X_1 used in production of ?		Yield		MRS $\dfrac{\Delta Y_2}{\Delta Y_1}$
Y_1	Y_2	Y_1	Y_2	
0	30	0	46	-
5	25	7	41	- 0.71
10	20	13	35	-1.00
15	15	18	28	-1.40
20	10	22	20	-2.00
25	5	25	11	-3.00
30	0	27	0	- 5.50

It should be noted that, the maximum net revenue obtainable with a given amount of inputs is where the physical rate of substitution between two products is equal to the rate at which the products exchange in the market (their relative price) or where $\Delta Y_2 /\Delta Y_1 = Py_1 / Py_2$.

From Table 35, if the producer uses all 30 units of X_1 in the production of Y_2, he/she obtains 46 units of Y_2 but does not get any of Y_1. If he/she shifts five units of X_1 to the production of Y_1 he/she receives seven units of Y_1, again only 25 units of X_1 are available to produce Y_2. He/she can produce only 41 units of Y_2 with these 25 units of X_1.

The rate at which two products can be substituted in production shows how much one product must be reduced in order to produce one additional unit of the other product.

IV   Impact of change in production technology

Technology can be defined as a stock of available techniques, methods or a state of knowledge concerning the relationship between inputs and a given physical output.

Technological change is a change in the state of knowledge (usually a positive one) such that production possibilities are enhanced. Through technological change, the production function will shift over some range such that any or both of the following can occur:

- More output can be produced with the same quantity of inputs.
- The same output can be produced with a smaller quantity of inputs.

The impact of the technological change can be illustrated with reference to:

- factor – product
- factor – factor
- product – product

4.1   Technological change with the total product curve

Consider the introduction of a new tomato seed variety that increases the output in response to fertilizer usage. The adoption of a better quality seed input in the production process will shift the total product curve upward (Figure 18).

With fertilizer usage F_0, output can now be increased from $0Y_0$ to $0Y_1$. Alternatively, a given output level, say $0Y_0$ can now be obtained with a reduced level of fertilizer usage $0F_1$ instead of $0F_o$. In this case all inputs other than fertilizer are held constant.
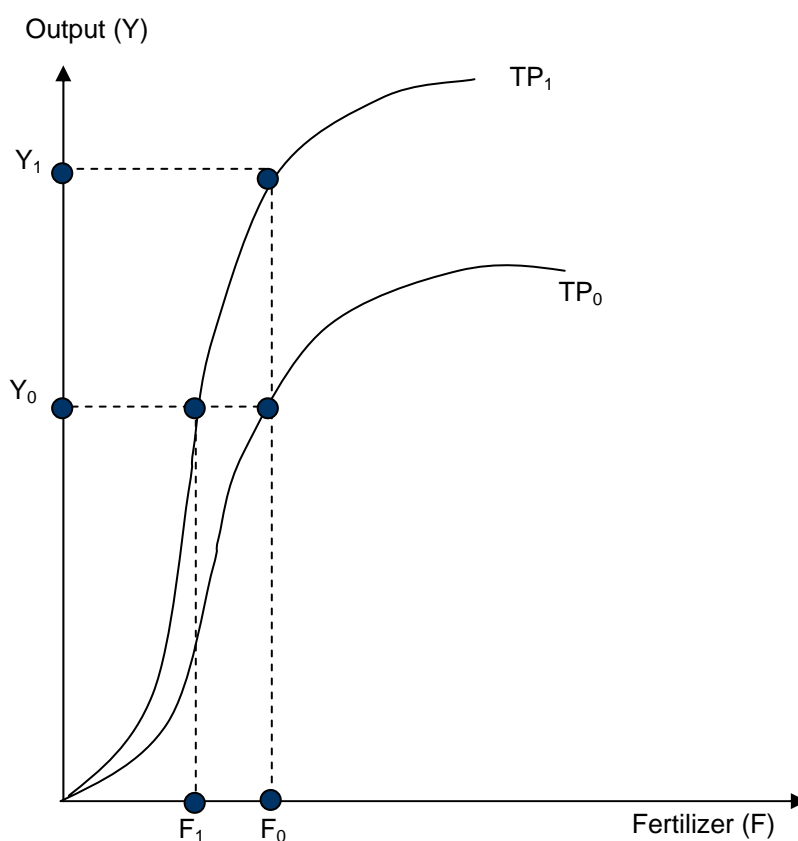

Figure 18. Technological change and the total product curve

The case of two or more variable inputs (labor, fertilizer, etc) can be illustrated by the following diagram:

Tools

Buying new tools will shift the isoquant from Q_0 to Q_1. The same level of output can be obtained with the same amount of one input and less of the other, or less of both.

B

A

T_0

T_1

C

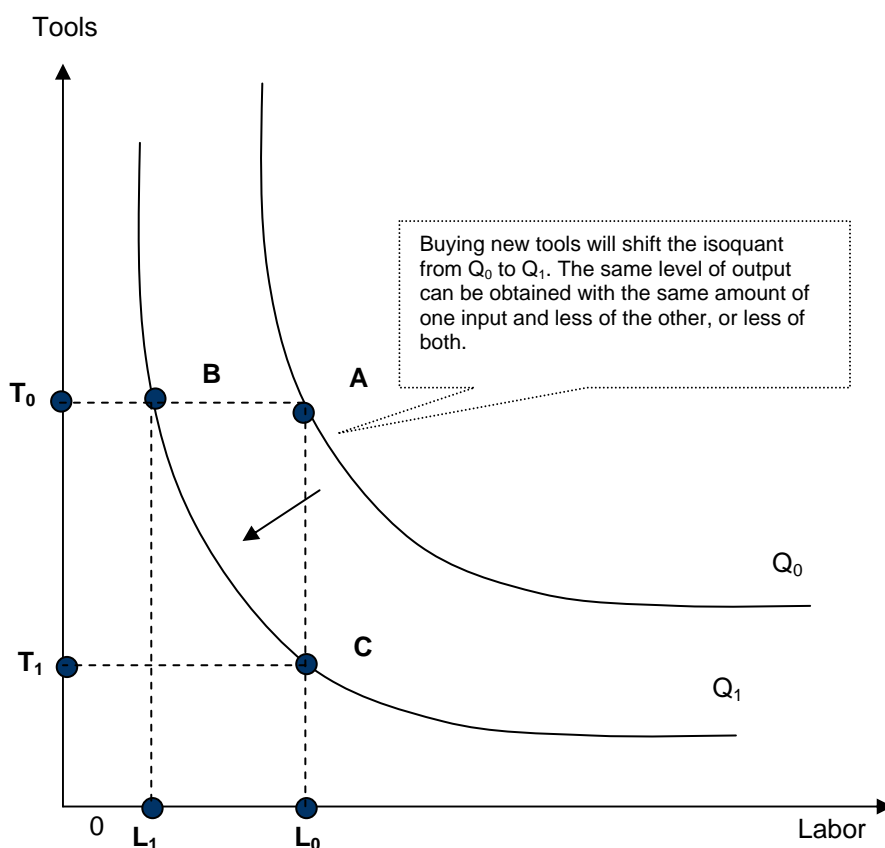Q_0

Q_1

0   L_1 L_0

Labor

Figure 19. Technological change and quantity produced

As previously defined, the isoquant is a curve representing all the combinations of two inputs that yield the same output level. Suppose that Isoquant Q_0 represents the combination of labor and old farm tools. Suppose the farm has acquired a new technology .With the new technology, the same output can be obtained with less of the variable input i.e. the new isoquant, Q_1, for output Q_0 shifts towards the origin (Figure 19).

4.2   *Technological change and the production possibility frontier*

Suppose that the farmer produces two crops, tomato and cabbage. The release of two tomato seed varieties known as 'Tengeru 97' and 'Tanya' can expand Mr. Obama's

production possibility frontier. The production possibility frontier PPF0 in Figure 20 below indicates the output combinations, which are available, given a set of inputs.
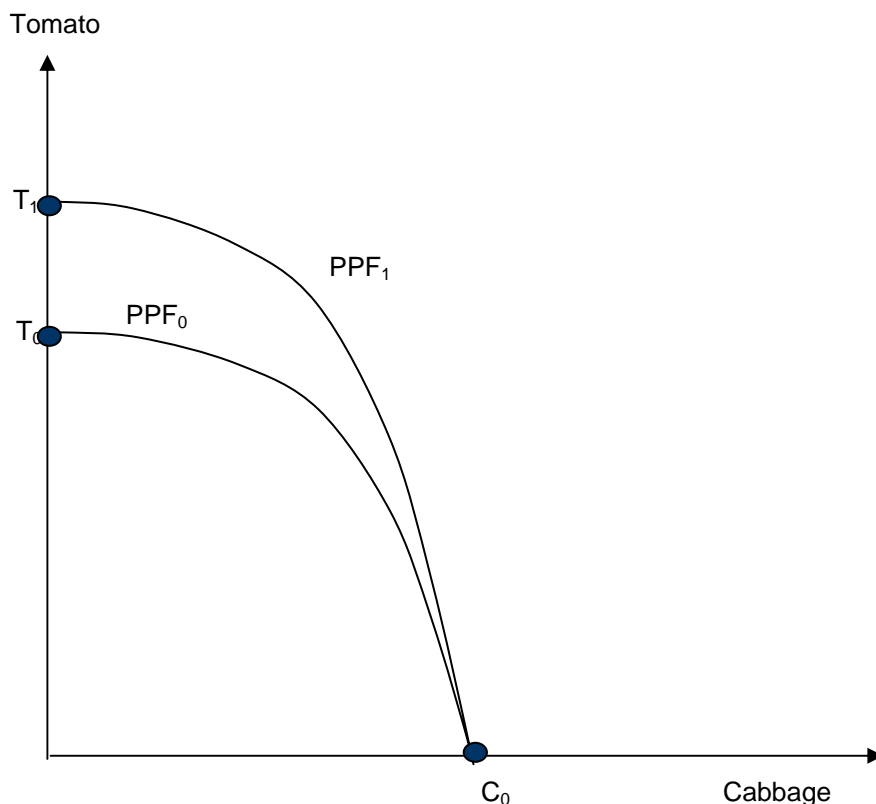

Figure 20. Technological change and the production possibility frontier

Since the introduction of improved seed varieties 'Tengeru 97' and 'Tanya,' more tomato can be grown with the same quantity of inputs, the production possibility frontier shifts to PPF_1, indicating more tomato production. Note that as inputs for cabbages have not changed in any way, the maximum cabbage outputs from a given set of inputs remain constant at C_o.

Once the optimal output has been obtained and harvested, the manager's next task is to ensure that this output is actually sold. This requires and understanding of how the market works, which is the object of the following section: understanding the market.

V   Understanding the market

5.1   Defining the market

Market is defined as an arrangement between a buyer and seller during which the seller agrees to provide a good or a service and the buyer agrees to pay the price. Defined this way, a market always has two sides: the demand side and the supply side.

Agribusiness managers need to understand the economics of the market. In a free enterprise economy, prices play a fundamental role in providing information on relative scarcity of a commodity, and in coordinating activities of different players. Not only does the price constitute the terms of trade (or the element on which the buyer and seller agree), it also conveys information about market conditions such as the quality and the volume traded, and the willingness and ability to buy and to produce. Agribusiness managers make decisions in response to market signals that are transmitted through the price of goods and services.

5.1.1 The demand

The demand is the buyer side of the market. It can be defined as all the different quantities that buyers are willing and able to purchase at various possible prices. Two elements are to be considered here: The willingness and the ability to purchase the product. The customer has to be willing to purchase (which means he/she has shown a real desire for the product); he/she should also be able to purchase the product, meaning he/she has sufficient purchasing power to be able to afford the product. Suppose Mr. Kakaya has shown interest in the new variety of tomato seed recently released by Mr. Obama's company. The seed costs $6 per 2-gram sachet. However, he cannot pay the $6 per sachet required for the seed. Because Mr. Kakaya cannot afford a $6/sachet seed for his farm, he will not be considered part of the demand for Mr. Obama's new seed variety.

The buyer side of the market can either be represented by a table of quantities and prices (the demand schedule) or a demand curve showing the combination of quantities and prices. The law of demand states that there is an inverse relationship between the price and the quantity demanded. As prices rise, buyers will be willing to purchase less. The demand relation can also be expressed in a mathematical model as a function of quantities and prices:

Example: $Q_D = f(P)$ *Meaning "Quantity demand is a function of the product's price;"*

Where: *Q_D = quantity demanded*
     P = price

The demand can also be illustrated the graph in Figure 21.

$Q_D = f(P)$ is the demand function

P_1 and Q_1 are points that represent a price-quantity on the demand curve (D)
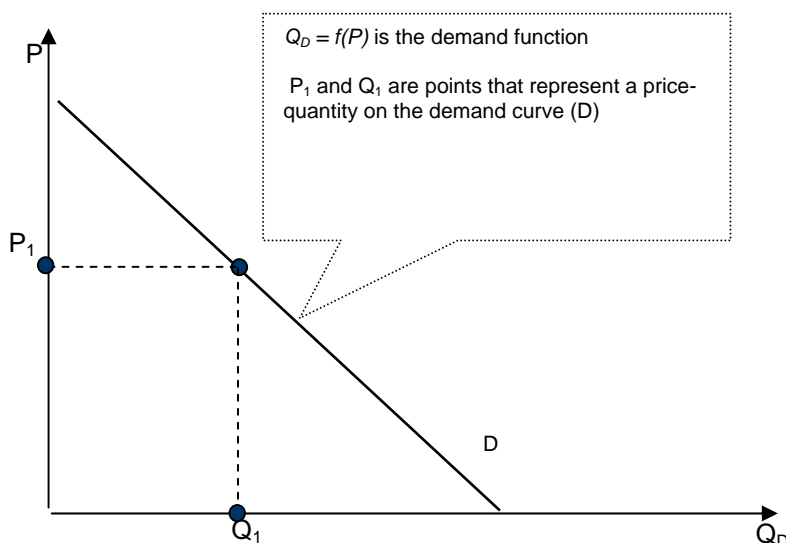
P

P_1

D

Q_1

Q_D

Figure 21. The demand curve

Demand curve always slopes downward because there is an inverse relationship between the price and the quantity demanded. When the price falls, the quantity demanded tends to rise. The quantity demanded will also fall as the product price rises. The demand will change due to any of the following factors:

Change in income: the higher the income, the higher the demand of goods and services, and vice-versa.

Change in tastes and preferences: a shift in tastes and preferences will decrease the demand for the negatively perceived product, while the demand for the new preferred products will increase.

Changes in expectations about the future: if consumers expect higher income in the future, they will increase their consumption of most products, thus the demand for goods and services will increase, and vice-versa.

Change in the population or market size: the higher the size of the population, the greater the demand for goods and services, and vice-versa.

Change in the prices of substitutes or complements: if the price of the production that can be purchased instead of the product at hand falls, the demand for the latter will fall, and vice-versa: Also, when the price of the goods that complement the product at hand increase, the demand of this product will fall

The entire demand curve will shift either to the left, or to the right in response to a change of the factors listed (Figure 22). Thereby, these above factors also are called demand shifters. A shift to the left represents a decrease on demand, while a shift to the right represents an increase in demand for a product. The change in demand is different from a change in the quantity demanded. The change in the quantity demanded is only caused by the change in the product's own price and is represented by a movement along the same demand curve.
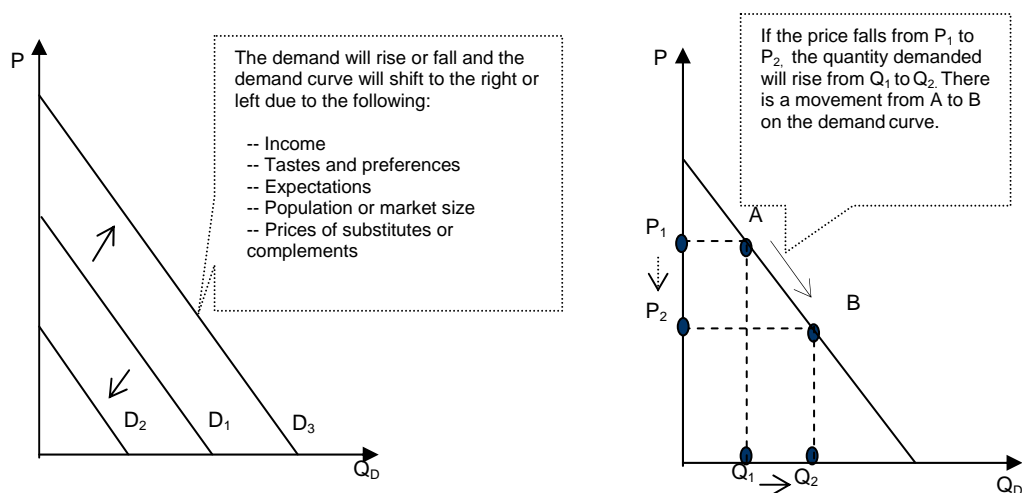
P

The demand will rise or fall and the demand curve will shift to the right or left due to the following:

-- Income
-- Tastes and preferences
-- Expectations
-- Population or market size
-- Prices of substitutes or complements

D_2 D_1 D_3

Q_D

P

If the price falls from P_1 to P_2, the quantity demanded will rise from Q_1 to Q_2. There is a movement from A to B on the demand curve.

P_1 A

P_2 B

$Q_1 \rightarrow Q_2$

Q_D

Figure 22. Change in demand versus change in quantity demanded

Derived demand

The demand of most agricultural products, including seed is a derived demand. The farmer/producer demand for tomato seed is derived from the consumer demand for tomato. When consumers demand more tomato, the price of tomato rises on the market and farmers produce more of them. To do so, they will demand more tomato seeds. Anything that significantly affects consumer demand for agricultural products will have an impact on the demand for farm inputs through the process of derived demand.

5.1.2   The supply

The supply describes the willingness and the ability of sellers to produce and sell different quantities of the product at different possible prices. Just like the demand, the supply puts an emphasis on the willingness and the ability to produce and sell. If the willingness is there, but the ability does not follow, there will be no supply. If Mr. Obama is willing to produce and sell hybrid eggplant seeds, but does not have breeding resources to produce this type of seeds, he will not be counted as part of the hybrid eggplant seed supply.

The supply relation can be described as a table, graph or as a function of quantities and prices:

Ex: $Q_s = f(P)$ or

Where Q_s = quantity supplied
*   P = price*

Because suppliers tend to offer more on the market as prices rise, there is a positive relationship between the product's price and the quantity supplied (Figure 23). This is

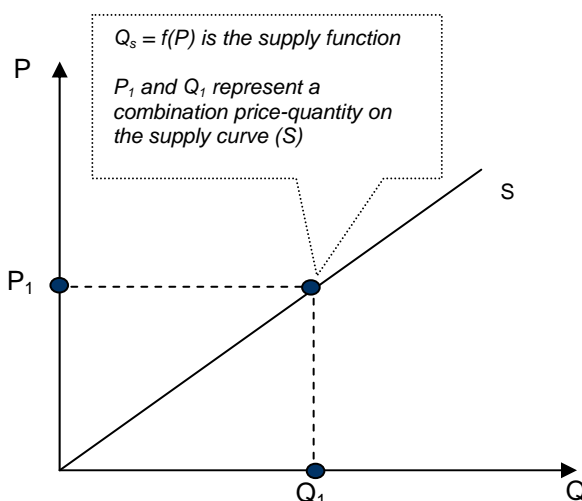why the supply curves slopes upward. As prices rise, suppliers will be willing to sell more.

Figure 23. The supply curve

Because there is a positive relationship between the price and quantity supplied, the supply curve is upward sloping. The change in supply refers to the movement of the entire supply curve. The curve will shift either to the left or to the right respectively for a decrease or an increase in supply on the market.

Several factors can cause a firm's supply curve to shift. Some of the major factors that cause the supply curve to shift (also known as "supply shifters") include:

Change in technology: Improved technology increases the efficiency of the production operations and shifts the supply curve to the right (increase in supply).

Change in the price of inputs: An input price hike will increase the total production cost, and thus causes the supply curve to shift to the left (a decrease in supply) while a price decrease shifts the supply curve to the right.

Weather: Poor weather conditions can adversely affect yields, and in so doing cause the supply to decrease or the curve to shift to the left (i.e. Tomato during wet weather condition).

Change in the price of other products that can be produced instead: If the price of another product or crop that the farm business could produce increases, the supply curve of the current crop or product will shift to the left as the result of other producers shifting to the production of the alternative crop or product.

It is important not to confuse a change in supply with a change in quantity supplied. As it was explained in the case of demand, the change in supply means that at all possible prices the quantities supplied have changed. As a consequence, the supply

curve will shift either to the right or to the left. In contrast, the change in quantity supplied is caused by the change in the product's own price, and is illustrated by a movement along the supply curve (Figure 24).
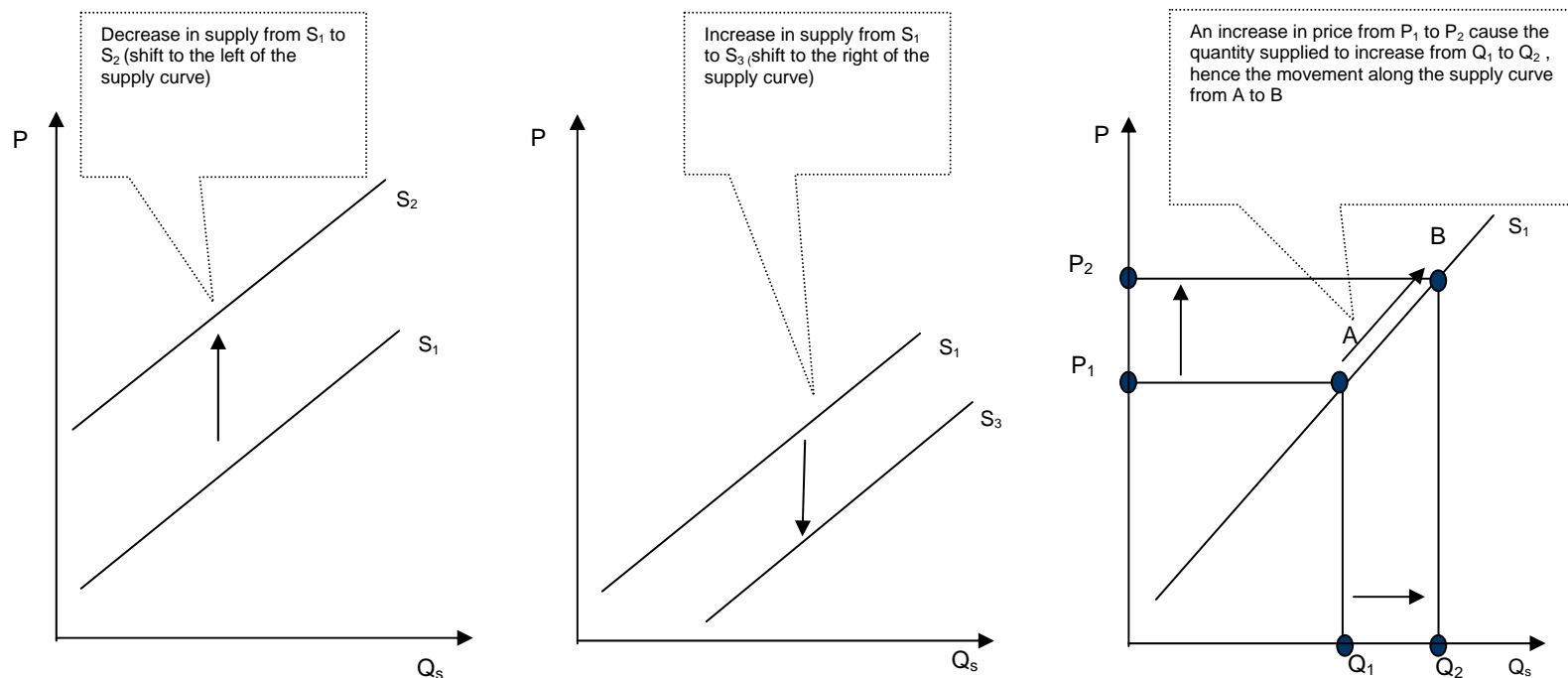
Figure 24. Change in supply versus change in quantity supplied

5.1.3 Market equilibrium and price discovery

Price discovery is the process by which buyers and sellers congregate to the market place and bid for product quantities and prices, until and equilibrium quantity and price is determined. This equilibrium quantity and price will "clear the market". It means that both buyers and sellers are satisfied with the quantity and price they will get from the market. At equilibrium, the quantity supplied is just equal to the quantity demanded. Graphically, this can be presented by the intersection of supply (S) and demand (D), which bring about the equilibrium price P_e, and the equilibrium quantity Q_e (Figure 25).
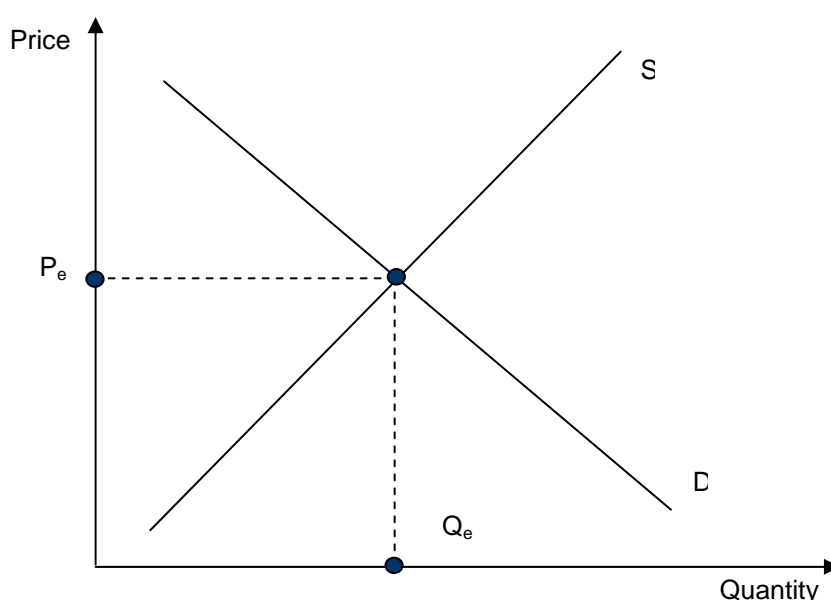

Figure 25. Market equilibrium

At the equilibrium price P_e consumers will be willing to purchase the quantity Q_e, which is the equilibrium quantity on the market.

According to Adam Smith's theory of the invisible hand (1776), the market will correct itself from disequilibrium conditions through the change of the equilibrium price and quantity. In a situation where there is an excess supply of a certain product on the market, the market price will fall to reach a new equilibrium price, which is lower than the previous one and an equilibrium quantity which is higher. Similarly, a shortage of the product will cause the equilibrium price to rise and the equilibrium quantity to fall. Thus a decrease in supply or an increase in demand on the market will cause the price to rise, while an increase or a decrease in demand would cause prices to fall. In the event that supply and demand both increase, or decrease by the same amount and at the same time, the increase in supply would just be offset by the decrease in demand and vice-versa. If the supply were to increase by a larger amount than the demand

decrease, the price will fall and vice versa. The market situation described above only concerns a perfectly competitive market which is described in the next section. In real life, most markets are not perfectly competitive.

5.1.4   Recovering from disequilibrium

The market does not remain at equilibrium all the time. Several factors can cause the market to deviate from its current equilibrium, including shortages and excess supply. When the price is too low on the market, the demand will increase faster than the supply. At all price levels, the quantity consumers are willing and able to purchase will be higher than the quantity suppliers are willing and able to sell, and a shortage will occur. The market will correct itself as the price rises as a consequence of the shortage. A response to this increase in prices will be the increase in quantity supplied. A new equilibrium will be reached were the new quantity supplied on the market will be equal to the quantity the consumers are willing and able to purchase. The reverse situation will apply when high price levels creates surpluses.
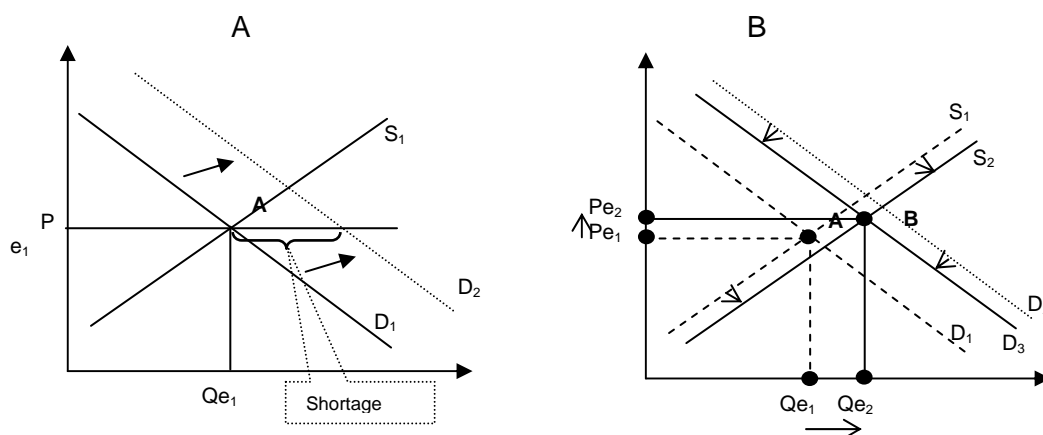

Figure 26. Equilibrium recovery from a shortage

Figure 26A shows a situation of a shortage created by a relatively low price on the market. The low equilibrium price causes the demand to rise to D_2. Figure 26B shows that when the price rises, the supplyrises to S_2 and the demand falls from D_2 to D_3 to form a new equilibrium at B (Pe$_2$, Qe$_2$).
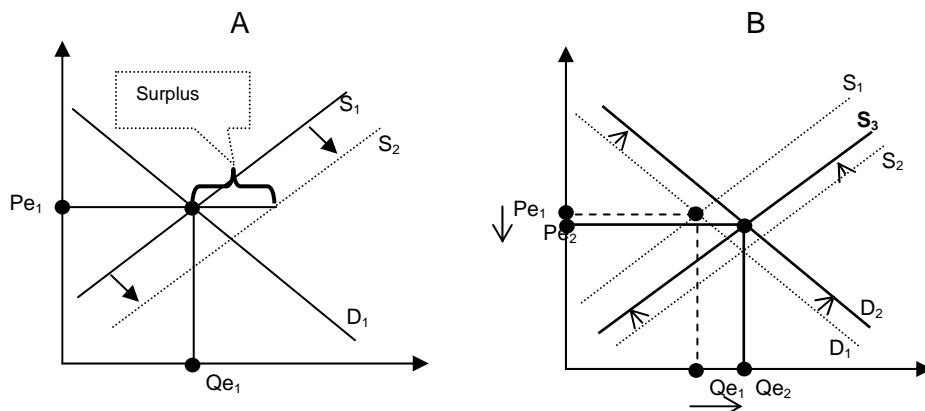
Figure 27. Equilibrium recovery from a surplus

Figure 27A shows a situation of surplus created by a relatively high price on the market. The high equilibrium price Pe_1 (at A) causes the supply to rise to S_2. On Figure 27B, the price falls, causing the demand to rise to D_2 and the supply to fall from S_2 to S_3 to form a new equilibrium at B (Pe_2, Qe_2).

5.2   *Types of market structure*

Market structure refers to the classification of markets/industries in terms of the number and size of actors operating in these markets/industries, the relationships between them, the ease of entry and exit and the type of product exchanged (homogenous or differentiated). There are four main types of market structures in which the farm business can operate: monopoly, oligopoly, monopolistic competition and perfect competition. The market in which the agribusiness operates affects the type of decision they make concerning their pricing and cost strategy.

Monopoly
A monopoly is a situation in which a single firm (one seller) supplies the entire market (a large number of buyers) with a product for which they are no close substitutes. It is characterized by a high barrier to entry on the supply side made of patents, government licenses or public franchise or high initial investments. The monopolist sets its own prices and tends to make high profit, when he/she is not tied down by inefficient management. Examples are the national power companies, national water supply companies etc.

Oligopoly
Oligopoly describes a market situation where there are few companies (few sellers) supplying the markets (many buyers) with either homogeneous (identical) or differentiated products. Just like monopoly, oligopoly is characterized by high barriers to entry. Oligopolists have some control over the price of the products that they sell. Examples are breweries, car manufacturing companies etc. A cartel is a group of firms in an oligopoly that bind together (act as one firm) in order to reduce their output and raise their prices. Example of such agreement is the Organization of Petroleum

Exporting Countries (OPEC). Seed companies typically operate in oligopolies. Just like monopolists, the oligopolist will tend to make high profits.

Monopolistic competition
Monopolistic competition characterizes a market with many buyers and sellers selling slightly differentiated products. Buyers and sellers are free to enter and leave this market. Because the products they sell are differentiated, sellers have some control over their prices and will make profit. This situation describes the market for many common goods and services.

Perfect competition
Perfect competition describes a market where there are a large number of buyers and sellers all selling an identical product. The market actors, each of which is so small that they cannot affect the market conditions, must have equal access to all markets information. There is free entry and exit on this market. Perfect competition is more of an exception than the rule. Few markets actually approximate perfect competition. Those are the markets for products traded at the commodity exchange level such as wheat, cocoa, coffee, oil and other natural resources. Businesses operating on a perfectly competitive market are not able to make profit because they have no ability to set their product's prices. They have to sell at the prevailing prices and face competition at the same time. Each firm that enters the market causes the market profit to decrease. Attracted by profit, firms will continue to enter this market until the profit disappears. The vast majority of the markets we encounter fall either into monopoly, oligopoly or monopolistic competition. This explains why many firms can make profit.

5.3   Elasticities

Agribusiness managers are often concerned with predicting the degree of customer reaction to a change in price. Elasticity is a good way to measure customer response. Through the elasticity of demand and supply, a manager has a tool that can help him/her in their pricing decision making.

5.3.1 Price elasticity of demand

The price elasticity of demand measures the responsiveness of the quantity demanded by consumers to a change in the product's price. A farm manager may wonder how his customer will react if he raises the price of his cabbage by a certain amount. Knowing the price elasticity for the demand for cabbage he can easily calculate that change, and thus determine the change in his revenues. If E_D is the price elasticity of demand,

$$E_D = \frac{\%\Delta Q_D}{\%\Delta Q_P} = \frac{\dfrac{Q2-Q1}{\left(\dfrac{Q1+Q2}{2}\right)}}{\dfrac{P2-P1}{\left(\dfrac{P1+P2}{2}\right)}}$$

In simple terms, price elasticity is the ratio of percent change on quantity demanded by one percent change on the price of the quantity. If the quantity of tomato seed increases by 5% when its price decreases by 1%, the demand elasticity for tomato seed is 5.0. This means that if the manager were to increase the price of its tomato seed by 10%, the quantity demanded for the tomato seed would decrease by 50%. However the farm manager must consider the type of market in which it operates in order to make the decision. In an oligopoly market, any attempt at a price change will be imitated by all the competitors, and will end up reducing the industry revenue as a whole without providing the expected benefit.

There are five levels of demand elasticity. Always evaluate the elasticity coefficient by considering its absolute value.

$E_D = \infty$ ➔ *Demand is perfectly elastic*. A change in price causes an extremely large change in quantity demanded

$E_D > 1$ ➔ *Demand is elastic*. A change in price causes a relatively large change in quantity demanded

$E_D = 1$ ➔ Demand is unitary. Price and quantity change is in the same proportion

$E_D < 1$ ➔ *Demand is inelastic*. A change in price causes a relatively smaller change in quantity demanded.

$E_D = 0$ ➔ *Demand is perfectly inelastic*. A change in price does not affect the quantity demanded.

Other types of elasticities of interest are the income elasticity of demand and the cross-elasticity of demand. The income elasticity of demand measures the responsiveness of the quantity demanded of the product to a change in consumer income. The cross-elasticity of demand measures the responsiveness of the quantity demand of one product to a change in the price of another product. The later is used to determine whether two products are complementary, substitutes or independent of each other.

5.3.2   The price elasticity of supply

The price elasticity of supply measures the responsiveness of the quantity supplied by the farm business to a change of the sales price. The price elasticity of supply can be calculated in a way that is similar to the price elasticity of demand. The elasticity of supply is always positive, since there is a positive relationship between the quantity supplied and the price of the product. The elasticity of supply can be perfectly elastic, elastic, unitary, inelastic and perfectly inelastic. If E_S is the price elasticity of supply:

$$E_S = \frac{\%\Delta Q_S}{\%\Delta Q_S} = \frac{\dfrac{Q2 - Q1}{\left(\dfrac{Q1 + Q2}{2}\right)}}{\dfrac{P2 - P1}{\left(\dfrac{P1 + P2}{2}\right)}}$$

$E_s = \infty$ ➔ Supply is perfectly elastic. A change in price causes an extremely large change in quantity supplied.

$E_s > 1$ ➔ Supply is elastic. A change in price causes a relatively large change in quantity supplied.

$E_s = 1$ ➔ Supply is unitary elastic. price and quantity supplied change in the same proportion

$0 < E_s < 1$ ➔ Supply is inelastic. A change in price causes a relatively smaller change in quantity supplied.

$E_s = 0$ ➔ Supply is perfectly inelastic. A change in price does not affect the quantity supplied

5.3.3   Price elasticity of demand and taxes

Suppose the government increases taxes on some inputs (such as fertilizers) used by a seed company. Should the manager increase the seed price by the amount of the tax? This is an interesting question as it illustrates another use of the elasticity concept. If the demand for the seed is inelastic (i.e. the elasticity coefficient falls between 0 and 1), the seed company is safe passing the tax on to the farmer because it will cause little to no impact on its sale and the total revenue received by the seed company. In contrast, if the demand is very elastic (the coefficient is far greater than 1), the company might be better off paying the tax itself or shoulder at least a good portion of it. Passing the totality of the tax amount on to the farmer might turn out to be a big mistake, as the decrease in the quantity demanded will be proportionately greater than the price hike.

5.3.4   Price elasticity of demand and total revenue

Price elasticity of demand can give an indication to what will happen to farm revenues if the prices of the farm product change. If the demand is elastic, a decrease in farm products' price will cause an increase in farm total revenues. The effect will be inversed if the prices were increased. If the demand is inelastic, an increase in farm prices will cause an increase in the farm total revenue. A decrease in farm products' price will decrease the total revenue.

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