

Seed Economics

Commercial Considerations for Enterprise Management in Developing Countries

Sam Kugbei



International Center for Agricultural
Research in the Dry Areas

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Sam Kugbei

Seed Economist, Seed Unit, ICARDA



**International Center for Agricultural Research
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International Center for Agricultural Research in the Dry Areas (ICARDA)

P.O. Box 5466, Aleppo, Syria

Phone: (963-21) 2213433/2213477/2225112/2225012

Fax: (963-21) 2213490/2225105/2219380/5744622

E-mail: ICARDA@cgiar.org

Website: <http://www.icarda.cgiar.org>

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Foreword

The majority of our staple food crops are annual cereals and legumes for which farmers have to obtain seed to produce a new crop each year. For this reason, it is always said that "seeds are the fundamental input to crop production." That statement is true in a biological sense, but it can be misleading in terms of organizing a system to supply seed to farmers. The fact that seeds are 'essential' does not mean that one can easily sell them because, being a living product, they have some other unusual characteristics. Most important, the farmers themselves can usually produce seed, and this is always the case with the traditional staple crops. Consequently, there is no obligation for farmers to purchase seed - it can be obtained from other sources within the farm, village, or nearby areas.

In the past, many seed projects made the mistake of emphasizing production while giving little attention to marketing or to financial management. As a result, they often had unsold stocks of seed, or they resorted to subsidies to create an unreal demand. However, such approaches have become less favored in recent years, as many governments have sought to reduce their expenditure due to policy changes or simply a lack of resources. Consequently, many activities, which were previously regarded as a service to farmers, are now expected to be financially viable and 'sustainable' without external support.

As a result of this change, it is now much more important to understand the economics of seed production and supply as bases for establishing new enterprises which can meet farmers' needs on a regular basis and at a moderate cost. In the case of many staple food crops, this is not an easy task, since as already noted, farmers have alternative options for meeting their seed requirements. This is why government seed organizations and 'parastatals' must also become more conscious about costs, since they usually have the responsibility for producing seed of the strategic crops, which are the most difficult to sell.

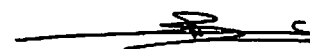
There are other reasons why it is important to have a reliable source of seed available, that is, to provide a channel for introducing and diffusing new varieties coming from research stations. In this case, the economics of variety diffusion and their impact on farmers are very important dimensions of the seed supply system. We recognize the importance of the 'informal seed sector' by which seed is retained or moves within the farms or community, but there is still a need for a secure formal channel, which effectively links research to agriculture. Some farmers will also choose to buy fresh seed from time to time to renew their stocks in cases such as a build-up of disease.

We now understand that it is difficult for large seed corporations to meet the needs of smaller farmers for a variety of reasons. Weak marketing systems, high transport costs, and limited range of varieties are common problems they experience. Of course, subsidies can conceal the true costs of the seed, but as already noted, governments are becoming increasingly reluctant to provide those subsidies.

Against this background, the Seed Unit at ICARDA identified the economics of seed production as a subject which has been neglected in the past and which now needs urgent attention. With the support of a GTZ project, the Unit is bringing together expertise in the area of economics of seed production and seed technology. As a result, economics and financial

management receive priority in the training activities of the Seed Unit. It was also considered important to produce a Manual on the economics of seed production and marketing and relate this to the technical operations involved. The result is this publication, which is intended to assist those who feel that they have a gap in their knowledge, either technologists who need to understand economics or economists who have become involved in the seed enterprises.

We hope that this publication will be a useful contribution to develop seed supply systems, and specifically to assist them in the difficult process of putting their activities on a more secure financial basis and, at the same time, providing the services which farmers need.



Prof. Dr Adel El-Beltagy
Director General
ICARDA

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An important part of the project was a 'train-the-trainer' course in Economics of Seed Production held at ICARDA-Aleppo during 1996, and subsequent follow-up courses in Egypt, Ethiopia, Morocco, Yemen and Sudan. The material presented in this manual has been tested in these various training courses, and revised according to comments and suggestions from former participants, colleagues in the national programs and the ICARDA Seed Unit. I am thankful to everyone for his or her efforts. In particular, I wish to express my sincere gratitude to Dr. A.J.G. van Gastel, who first proposed the idea of an economics manual and encouraged *me* to write it.

To Drs. Michael Turner and John Ryan (ICARDA) and Dr. Rupert Loader (Department of Agricultural and Food Economics, University of Reading, UK), I give many thanks for your helpful comments, valuable criticisms and suggestions on the manuscript.

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PART I
OVERVIEW OF THE
SEED SYSTEM

CHAPTER 1. Introduction

Economics of Seed Production: Brief Overview

Success in seed production is judged not only by the quantity of good seed, but more importantly, by the process through which seed is produced, and the capacity to sell this seed and make it accessible to intended end-users on a regular basis. This is where economics becomes relevant in attempting to seek answers to questions relating to cost-efficiency in seed production, distribution and marketing.

- At what cost is seed produced?
- Who are the intended users?
- What sort of seed do they want, and which attributes are they looking for?
- When, how, and where can seed be delivered to them?
- How can potential customers be motivated to buy more seed?
- Which price can they afford and are willing to pay?
- At what level of activity can seed enterprises break-even?
- What margin of profit is expected from dealing in a particular crop or type of seed?

Answers to such questions are not restricted to one point or stage in operating a seed enterprise but rather stretch right through the production—distribution—use chain. It is therefore important that seed producers, regardless of the scale of their operations, understand the elements of this chain which, in fact, are interrelated and complement one another in function. The principles of economics should be applied to technical aspects of seed production (multiplication, processing, distribution, and quality control), as well as to institutions and services, which influence performance of the seed industry. These include research, extension services, credit arrangements, government policy, and legislation.

The seed industry, with its affiliated institutions and services together, constitute the seed system or seed sector. In the organized seed sector, linkages within the production—distribution—use chain and external institutions are more structured. There are several dimensions to seed system analysis which broadly cover technical, institutional, financial, economic, social, environment, policy, and commercial issues. These are not separated in function, but are rather inter-dependent, as shown in Figure 1.

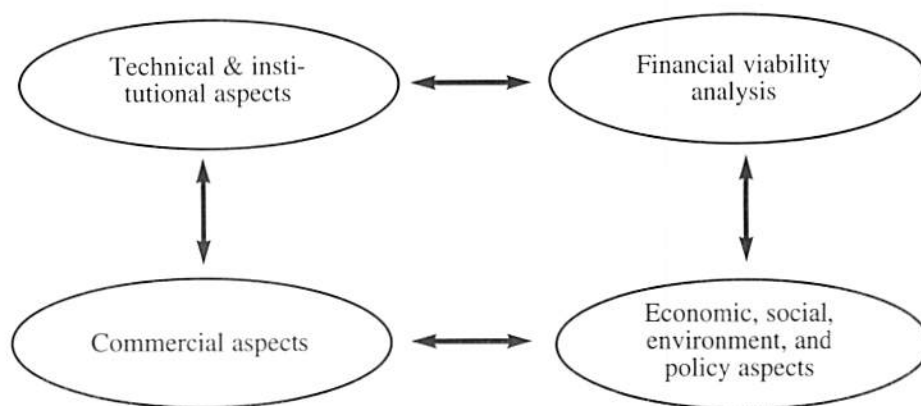


Figure 1.
Complementary
components of the
seed system.

Since little is written on the subject of economics in seed production, this manual has been prepared to meet two specific purposes: first, to provide information on the economic basis of seed operations and second, to suggest guiding principles in running cost-effective seed businesses. The text is intended primarily for use by technical staff and managers in

seed programs. Information provided is of relevance to developing countries at different stages of seed industry growth. Therefore, a choice has to be made between economic principles, examples, and alternatives given to suit specific situations.

The manual is divided into four parts:

PART I. Overview of the seed system

An overview of the seed system is given in the first two chapters—an introduction and a description of the development of the seed industry worldwide.

Chapter 1. Introduction

A brief account of the material contained in the various chapters is described here.

Chapter 2. Development of the seed industry worldwide

Seed production is not a new concept but one that has evolved through centuries of crop production, from ancient agriculture to modern seed companies. A useful starting point is to clearly understand how this process has developed over time in both industrialized and developing countries. The objective is to find out the uniqueness and similarities in the processes of development and lessons that can be learnt. A decision on where in this process one places a given seed program goes a long way in determining which economic analysis to conduct. This chapter is inevitably descriptive but is intended to set a conceptual basis for more practical applications in later chapters.

PART II. Technical and institutional aspects

Technical and institutional dimensions of the seed production are described in two chapters.

Chapter 3. Technical aspects

Good seedsmen must be multi-disciplinary in approach; they should understand both technical and economical dimensions of seed operations. Some basic technical issues or processes which constitute the technical basis of seed production and how these are measured are briefly discussed in this chapter. Reasons for technical analysis are outlined and how results from this analysis are related to economic considerations in seed production. In addition, specific technical issues worth taking into account in undertaking seed production are presented. Much is written on various subjects which constitute the technical basis of seed production. The brief treatment in this chapter is only an attempt to present basic concepts for consideration alongside other related issues.

Chapter 4. Institutional aspects

Institutional aspects of seed production determine how effective technical and economic factors are combined in the day-to-day operation of a seed business. Organization and management, which determine the right balance and timing in decision-making, are discussed in this chapter. These issues help in defining who the staff have to report to and what relationship they bear with other parties, and how decisions or actions taken affect others and the interest of the business. Functions of seed managers as an interplay between organizational and management factors are also discussed.

PART III. Financial, economic, social, and environmental aspects

Besides financial considerations in enterprise management, issues that are not specific to individual enterprises but to society at large are discussed in Part III. Potential contribution to economic development and concerns about social and environmental issues are taken into account.

Chapter 5. Financial viability analysis

Designing seed production systems on the basis of anticipated investments in seed activities and cash flow expected from such investment decisions are discussed in this chapter. It outlines reasons for carrying out financial analysis of seed operations. Numerical examples and a case study are used to demonstrate the application of analytic tools such as discounting, present value, internal rate of return, and benefit-cost ratio. The chapter concludes with an analysis of risks involved in seed production including yield, market, and information risks. Because of the risk and uncertainty associated with investment planning, estimates and predictions of expected cash flows are subject to varying degrees of uncertainty, since there is a possibility that the actual amount may deviate significantly from the expected amount. Risk analysis is therefore a useful tool, which can enable a study of the effects of possible variation in the use of enterprises. Since it is impossible to quantify exactly the risks an enterprise is subjected to, it is usual to make a subjective judgement about the kinds of risks different enterprises face and use this as a basis for choosing the best enterprise management. How the technique of sensitivity analysis is used in making choice between alternative investment opportunities is also explained in this chapter.

Chapter 6. Economic aspects

The material covered in this chapter is complementary to financial analysis in Chapter 5. In fact, results generated by financial analysis form the first step in economic analysis. The difference between the two methods is that financial analysis is viewed from the private or individual point of view, whilst economic analysis considers the national point of view, or the returns to society. In carrying out economic analysis, market prices used in financial analysis are adjusted to reflect the true cost to the nation as a whole.

Although the immediate concern of seed enterprises may be to maintain financial viability, creating an economic impact is crucial to the long-term sustainability of any enterprise since this affects the level and pattern of farm incomes. Creating on-farm impact depends on the degree of adoption of new seed or varieties. Estimating the monetary value of any increased benefit that results directly from adoption will give a good measure of impact. But obtaining values that are attributed to adoption alone is difficult since other factors contribute to impact. The objective of assessing economic impact is to judge the capacity of a seed program to maximize national income, with no adjustments made for the effects that the distribution of such income could cause, or its impact on the environment. To account for these effects, further steps beyond analyzing economic impact to include social and environmental concerns are necessary as explained in Chapter 7. Economic dimensions of seed production are discussed in Chapter 6 using numerical examples and a case study to explain this clearer. For continuity, much of the material used here is an extension of that presented under financial analysis in Chapter 5.

Chapter 7. Social and environmental impact analysis

Social and environmental impact analysis is related to a range of goods and services which by their nature do not pass through domestic or international markets, making it difficult to put price values on them. Because of the difficulty in quantifying or valuing such goods and services in money terms, there is often the danger that they are ignored despite their strategic importance. Poverty alleviation, malnutrition, sustainability, pollution, and natural resource conservation are such examples of social and environmental impact analysis. In fact, one of the major criticisms of benefit-cost analysis is that many factors affecting life may be omitted in this analysis when carried out in terms of money only. So it is increasingly recognized that analysts have to take into account non-market aspects of activities in assessing performance. An attempt to relate social and environmental aspects of seed production to relevant material discussed earlier is made in this chapter.

PART IV. Commercial aspects

Lastly, Part IV deals with commercial aspects which constitute the major part of this manual, since published information on these subjects is scarce. The discussion relates to the day-to-day operation of the business in terms of assessing the levels of costs and returns, and how to plan, monitor, and control these (Chapters 8 and 9). This leads on to the final chapter on privatization as a means of introducing commercialization and cost-effectiveness into seed production systems.

Chapter 8. Components of cost structure

A lot of problems associated with seed production frequently are related to the limited understanding of cost behavior and appropriate procedures to follow in determining the full cost of activities undertaken. This chapter, therefore, is an attempt to provide a detailed description of underlying principles in cost estimation and methods for estimating these costs for the major components of seed production. Where it is possible, data from seed programs in developing countries are used as numerical examples to explain the procedures described.

Determining the true cost of seed is a basic step in defining a realistic selling price. In a commercial situation the selling price of seed is the cost price plus a certain profit margin. In discussing seed marketing and distribution, the concept of marketing, price determination, demand assessment and margin analysis are discussed in this chapter. Knowledge of the true cost price is important even in a system where the selling price for seed is fixed by the government, as this enables a reliable estimation of subsidy levels and other support measures.

Chapter 9. Cost monitoring, control, and planning

The success of commercialization in seed production depends to a large extent on the effectiveness in controlling costs by comparing actual against planned cost levels, and on taking corrective measures when necessary. To make such control effective, the manager should have a reasonable knowledge of basic cost accounting principles and how important financial statements such as the profit and loss account and the balance sheet are compiled and presented. The treatment given to cost accounting in this chapter extends to discussions on budgeting as a means of planning future cost levels. The key role of a manager is to look into the future and plan necessary courses of action needed in attaining objectives set. Budgeting is an essential tool in this respect and, in addition, serves as a basis for performance evaluation and control.

Chapter 10. Privatization of the seed sector

Enterprises within the private sector are primarily concerned with assessing, monitoring, and controlling cost levels because their *principal motive is to maximize profit*. Seed enterprises need to be cost-effective if they are to do good business by selling seed at a price that farmers can afford and are willing to pay. Success in commercial seed production is generally limited in state-owned enterprises and many have therefore been currently privatized. This chapter discusses the status of privatization of seed industries in developing countries, steps that are followed in privatizing state-owned means of seed production, and problems associated with this process. The development of small-scale seed enterprises as alternative supply mechanisms, particularly for small farming communities, is discussed.

To conclude, this manual has been prepared reflecting several years of experience the author had working in developing countries as a *seed technologist, a seed manager and an economist*. It acknowledges the frustration technical staff face in their attempts to understand basic things that economists do when monitoring and evaluating seed activities. The objective of this manual is to create wider understanding of economic principles in seed production, which will guide and ease the work of managers and field staff who are primarily non-economists, but are involved in commercial aspects of seed production. Of course, it is expected that farmers will ultimately benefit once key staff in seed enterprises understand and use these principles and ideas effectively.

CHAPTER 2. Development of the Seed Industry Worldwide

Introduction

A logical starting point in seed-system analysis is a review of how the seed industry has developed over time. This step is necessary in choosing appropriate methods of analysis which are relevant to the stage of development in a given country. The evolution and process of development has not followed the same pattern in both industrialized and developing countries. The seed industry in industrialized countries has evolved over a long period. Within the last twenty years, there has been a mix of activities of multi-national corporations, which, by and large, concentrate on hybrid seed production and sale, and are now making considerable investment in new biotechnologies.

The situation is different in developing countries where, during the past two decades, the seed industry has been characterized by national seed projects serving as a primary means of delivering improved seed to farmers. Not a lot has been achieved in this respect, and many of these projects are currently being privatized into commercially oriented organizations. Although many multi-national corporations extend seed activities to developing countries, companies still remain within the area of hybrids, with a small sale of non-hybrids. The informal sector accounts for much of the seed produced in developing countries, although little is known about the actual production techniques and exchange mechanisms that prevail in farming communities. Linked with the informal sector are non-governmental organizations, which have recently entered the seed sector but serve largely as delivery agents during times of emergency.

The objectives of change, the factors influencing change, and the institutions involved are described in this chapter. This information forms the basis of further analysis in subsequent chapters of the manual.

Seed Industry Development in Industrialized Countries



In ancient times, farmers traditionally performed almost all functions required to meet their individual seed needs. The seed industry in industrialized countries began as traditional small and medium-scale 'family' enterprises and agricultural cooperatives that operated in specific regions and produced seed for local demands. Initial efforts in plant breeding were confined to the public sector. With the support of the government, an increasing number of private enterprises undertook variety selection and seed production. The public sector has continued to provide some breeding support and regulatory functions such as seed quality control.

Seed growers organizing themselves into associations in some countries originated from these early beginnings. The first attempts were motivated by the desire to spread technical knowledge about seed production within grower communities. In many European countries (e.g., France, Denmark, Italy, Sweden, Norway and The Netherlands), farmers have organized themselves into cooperative movements for the production and marketing of seed. In some cases, private seed companies have developed alongside these cooperatives.

The Role of Multinational Corporations

Multinational corporations (MNCs) have played a prominent role in the seed industry of industrialized countries, although traditional small and medium size companies and cooperatives still hold some share in the seed market. Since the 1960s, there has been an increasing internationalization of the seed industry marked by the takeover of smaller enterprises by larger corporations which are already either engaged in the supply of other agricultural inputs such as pesticides and fertilizers, or in commodity trade such as grain. The primary motive of the MNCs entering the seed trade has been the belief that new technologies, especially biotechnology would radically change variety development hence bringing high profits within the global seed industry. The application of new techniques such as genetic engineering in crop biotechnology is of particular importance. Many MNCs have re-appraised their positions and subsequently sold out. Three main reasons why pharmaceutical and petroleum-based companies have been taking over business from the traditional smaller enterprises are illustrated in Figure 2.

The situation is different in developing countries, where there is generally much less commercialization of the seed industry. However, multi-national corporations do some business in developing countries which demonstrate prospects of commercialization, especially where hybrid varieties exist.

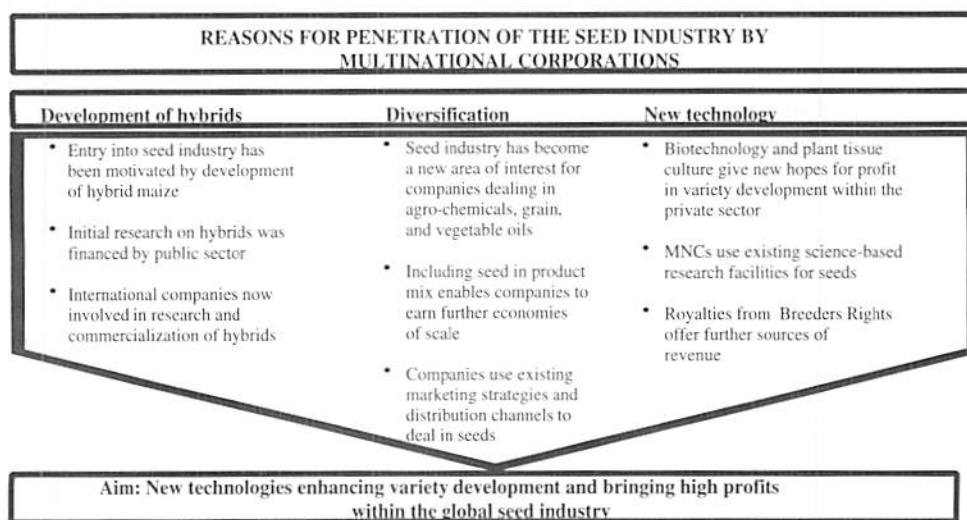
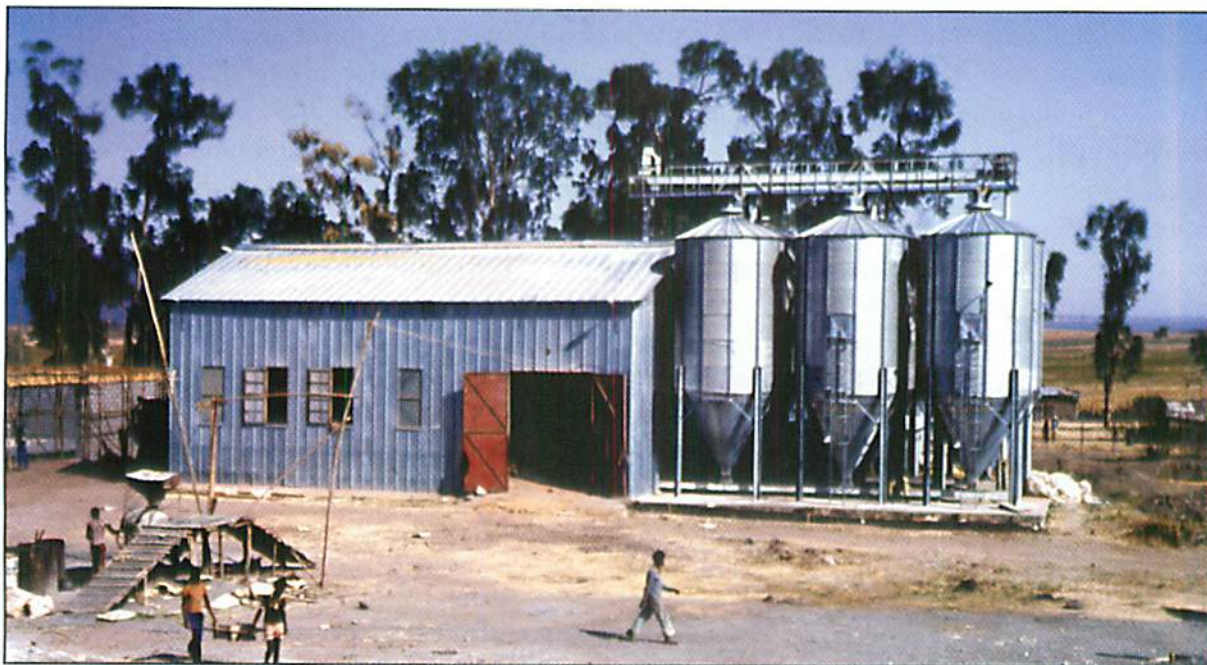


Figure 2. Penetration of the seed industry by multinational corporations.

In spite of the apparent diversity in the nature of companies in the seed industry of industrialized countries, only a few large companies have been recognized as main actors in the takeovers. The seed industry has become highly complex in technical, managerial and orga-

nizational terms. But, on the whole, emphasis in the commercial sector of industrialized countries is on hybrid varieties. It is probable that, at least in the near future, the trend to hybridize varieties in more crops using conventional plant breeding will continue to characterize and possibly dominate growth in the seed sector of these countries, although this will vary between crops.

Seed Industry in Developing Countries



Policies designed to promote seed industry development in developing countries vary considerably between countries. This is reflected in the many institutions that intervene in the seed sector (Figure 3).

On the basis of organization, types of exchange mechanisms, and varieties used, the seed sector can be sub-divided into two groups: the formal (modern) and informal (traditional) sectors.

- *The formal sector comprises those institutions which are engaged in the multiplication, processing, distribution, and quality control of improved seed and use mainly market-oriented means of exchange. This sector comprises mostly public and private seed enterprises. In many developing countries, the formal sector accounts for a small proportion of overall seed used each year.*
- *The informal sector, on the other hand, constitutes farmers who produce and save their own seed of local or improved varieties, and may use traditional forms of exchange such as barter, local trading, seed for work, and other social obligations. These farmers produce the bulk of seed for the major food crops in developing countries.*

In any country, the 'dividing line' between the formal sector and the informal sector (Figure 4) depends on the level of development of the seed industry, or the crop under consideration. The relative proportions of the two sectors also change with time according to dynamics of change in the seed system.

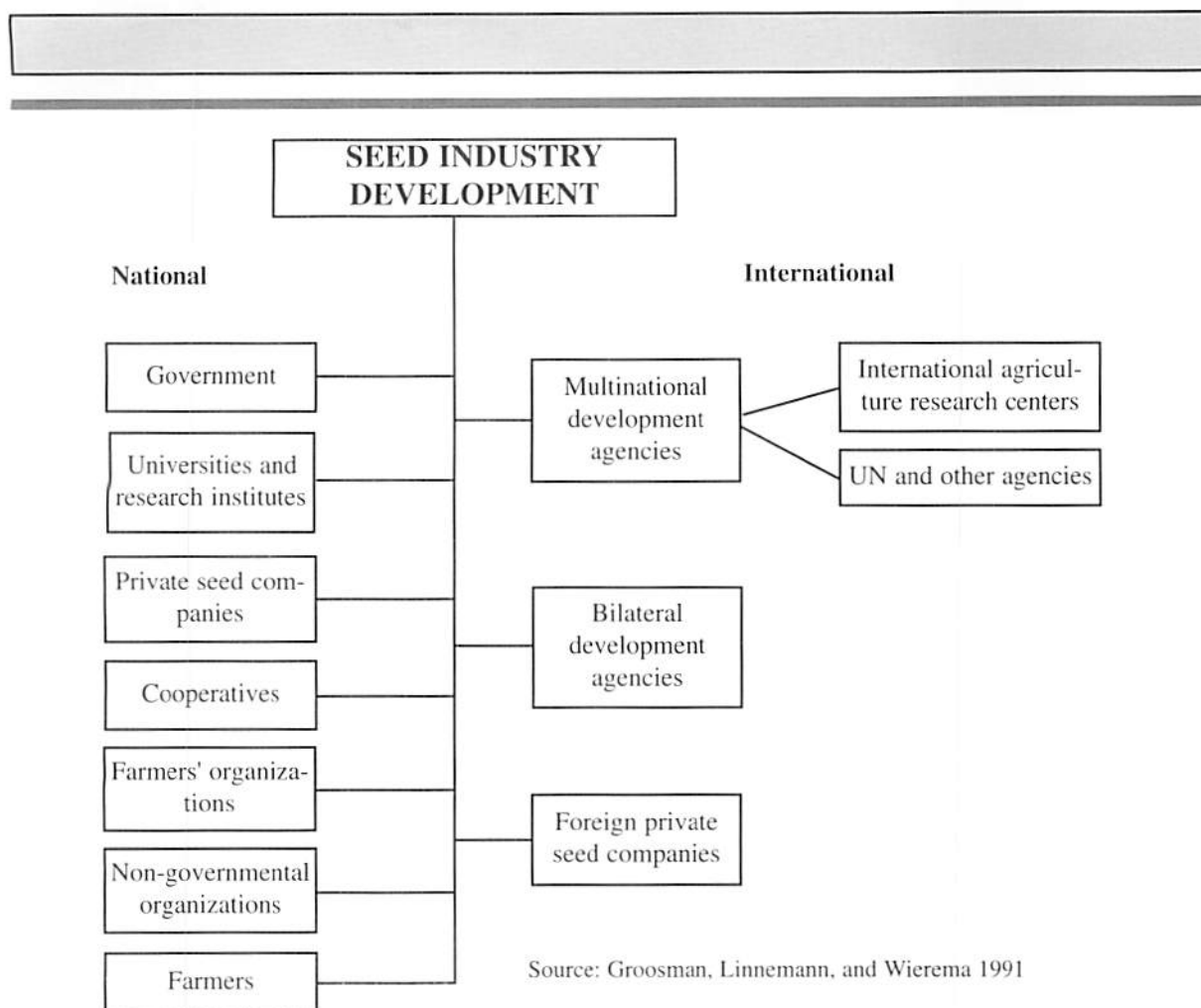


Figure 3. Institutions in seed industry of developing countries.

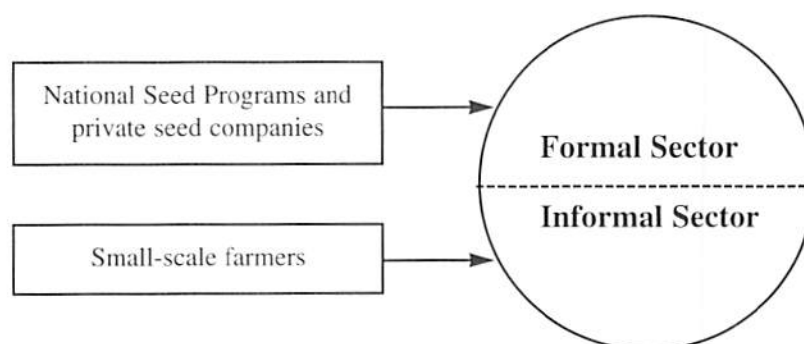


Figure 4. Components of formal and informal seed sectors.

Formal Seed Sector

The formal sector generally refers to government seed programs and private enterprises.

National Seed Projects and Programs

Technological advancements in plant breeding in the early 1960s resulted in the release of dwarf high-yielding varieties of wheat by the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, and of rice by the International Rice Research Institute

(IRRI) in the Philippines. These events were part of the 'Green Revolution', which aroused great interest in national seed projects financed by multilateral and bilateral aid. These projects became the key means of producing, processing, and distributing improved varieties and seed to farmers.

Another factor in formulating seed projects had been the difficulty of farm-saved seed to meet national seed requirements arising from rapid population growth, changes in climatic conditions, and frequent natural disasters. There arose the need for more reliable alternative sources of seed to supplement the traditional seed sector. Seed projects that were established during the 1970s and 1980s were therefore a means of channeling new high-yielding varieties to farmers and for improving the quality of seed sold to them.

There was a proliferation of seed programs in many developing countries, probably motivated by research activities at IRRI and CIMMYT. By mid-1980s, almost every developing country had national seed projects established with the assistance of international development agencies. As a major part of the formal seed sector, these projects created the infrastructure and institutional frameworks necessary for diffusing new varieties. After the project phase, many of the seed activities have become part of broader seed programs comprising related institutions such as plant breeding, extension, seed multiplication, and quality control. These programs continue to be the main source of formal sector high-quality seed and improved varieties in many developing countries. In contrast to Africa, the role of national seed projects has been less prominent and less persistent in Central and South America. In the majority of these countries, the private sector has gradually taken over seed production and marketing.

Generally, national seed projects initially used employed labor and facilities to produce and market seed because of the need to use specialized knowledge and skills in making good quality material available to farmers. However, there has been a shift from production on own farms ('in-house' seed production) to contracting, mainly because the latter has proved to be more cost-effective and efficient. This follows the same pattern as that in developed countries. The low-cost perspective of contracting, however, becomes doubtful in cases where high management costs are incurred in negotiating with a large number of individual growers. The main features of both methods of seed production are illustrated in Figure 5.

Although contract-growing has become a prominent feature of seed production within the formal sector of many developing countries, an important aspect of these programs, which is often overlooked or taken for granted, is the creation within farming communities of knowledge and interest in seed production. In strengthening seed industries in developing countries, the needs of seed growers have not so far received the attention they deserve. Farmers are basically contracted to multiply seed for seed trading organizations. The initial aim of contract growing was not to give growers entrepreneurial skills producing and marketing seed for profit but to just operate as seed multipliers. However, this may actually be a useful way to utilize the acquired knowledge and skills in seed production within the communities. Moreover, successful growers may continue to provide seed after all projects end, and become more lasting seed suppliers. In small farming communities, growers may be in a better position than large seed companies to develop trading links with farmers in the informal sector.

After about two decades of seed program development, the existing cost status of many public seed enterprises is not viable. There is a current view that one of the most promising

ways of creating sustainable seed supply is through the establishment of small-scale seed enterprises that are more responsive to the needs of farmers and which may supply seed more cheaply because of low capital investment, reduced overhead, and transport costs. However, it is not clear who these initial entrepreneurs could be and the way in which they could set up such businesses.

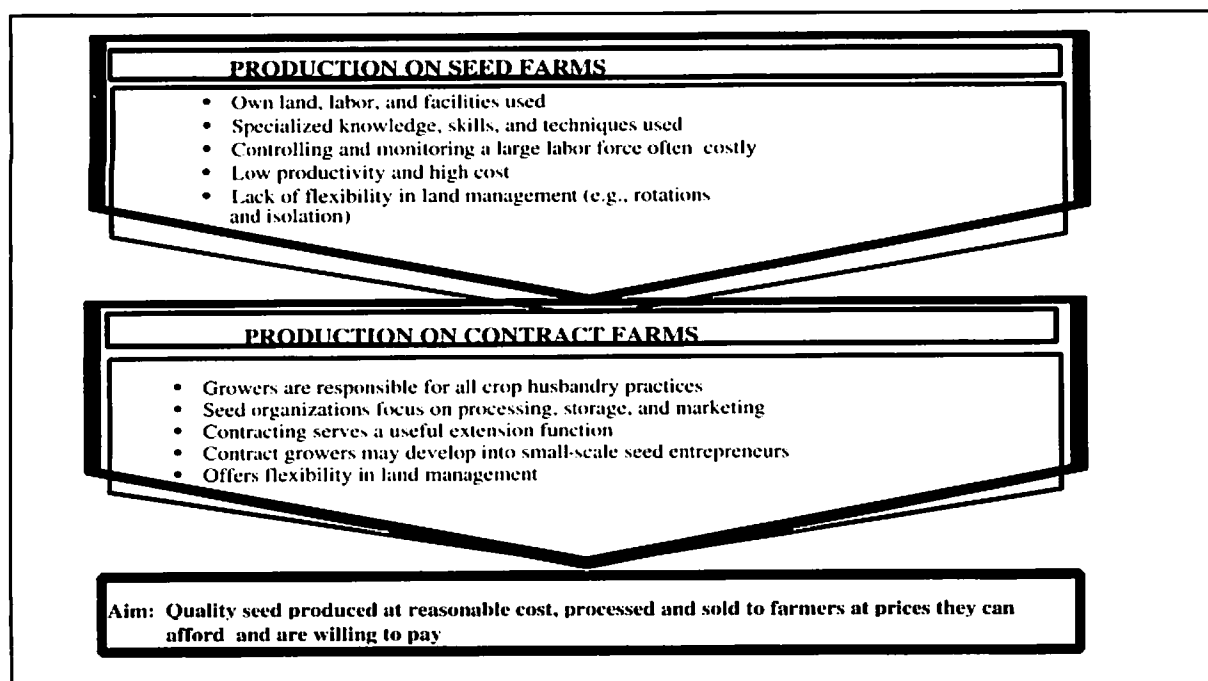


Figure 5. Shift from seed farms to contract production.

Private Enterprises

Private seed companies form the other major part of the formal seed sector. Attempts to commercialize have only been partially successful (e.g., in the case of hybrid maize). Private companies tend to concentrate on profitable crops, especially those in which hybrids exist. The low-value, self-pollinating cereals and legumes do not generally attract private investment and are either ignored or left in the hands of government agencies. Small farmers rely heavily on the cultivation of these low margin crops, but production is often constrained by a combination of factors including low purchasing power, lack of appropriate new varieties, inadequate extension and awareness, and poor infrastructure. The limited success of public enterprises in distributing seed to small farmers explains why many developing countries now seek alternative seed supply systems as a part of their efforts in privatization. The concept of privatization and efforts made in developing seed industries are discussed in Chapter 10.

Informal or Traditional Seed Sector

On-farm saving is usually the most important source of seed for local production and food security, and therefore forms the backbone of many seed supply systems. It is generally estimated that on-farm sources supply over 80% of the area planted to main crops in developing countries. Since a vast majority of farmers use traditional seed supplies, little information is

available on the *varieties and quality* of seed actually used. The informal sector includes those activities, which relate to the production and use of farm-saved seed, whether these are by large or small farmers, cooperatives, and farmers' associations. In many cases the informal sector comprises farmers in marginal areas who save their own seed because they do not have access to certified seed or cannot afford it.

Besides Kenya and Zimbabwe, where hybrid maize is widely used, farmers in Sub-Saharan Africa mostly use farm-saved seed in the case of self-pollinating cereals. Only a small proportion of seed is purchased. With the introduction of improved varieties in recent decades, countries in Latin America have reduced the use of farm-saved seed. Generally, there has been limited impact of new varieties in Africa and countries in Asia and Latin America that use low-input farming methods. In some countries, the dominant role of traditional seed supply that comprises farm-saved seeds of local and modern varieties has, on the whole, remained unchanged.

Considerable attention has been recently paid to seeking better understanding of the production and exchange practices prevailing in the informal sector. Alleviating rural poverty will partly depend on farmers in the large informal sector using seed that will increase agricultural productivity and enhance income of farmers, who, in turn, could produce more food for the people in rural communities.

Non-Governmental Organizations

Part of recent interests in improving the seed production capacity of small farmers within the informal sector are those of Non-Governmental Organization (NGOs), which have become particularly active in many developing countries. The involvement of NGOs in the seed sector generally originates from the supply of seed during emergency situations. The community-oriented nature of NGO operations renders these organizations suitable suppliers of seed during emergencies. This includes seed supply for relief and rehabilitation due to drought, floods, civil wars, etc. Because of this inherent diversity in emergency situations, the choice of strategy is generally dictated by local circumstances. This makes planning for emergency supplies uncertain and challenging. Unfortunately, documented cases of emergency operations involving seed are few. The following are some key challenges which NGOs involved in this aspect of seed delivery usually face.

- ***Duplication of efforts***

The occurrence of natural disasters often attracts considerable NGOs' attention. The keenness of many NGOs to assist can lead to isolated endeavors or wasteful duplication of efforts if action is not taken to coordinate the relief activities.

- ***Identification of appropriate crops/varieties/tools***

Seed and tools are attractive in agricultural rehabilitation, since they are physical commodities that can be easily purchased, transported, and distributed within communities. But for seed, many things can go wrong if necessary knowledge and experience are not sought especially those relating to the choice of varieties and seed quality. The issue of appropriateness extends to tools if this is delivered with the seed as a package.

- ***Quality of seed distributed***

The quality of seed delivered is of paramount importance, particularly the germination

capacity. Only seed that has been assessed to be of acceptable germination is to be used. Any disregard to this may subject the program to high opportunity costs since seed of poor germination may be valuable grain for food but is totally lost once planted.

- ***Identification of the neediest***

Natural disasters usually affect wide areas and large numbers of households differentially. It is therefore important that the neediest groups are clearly identified from the outset.

- ***Timing and distribution of seed***

Timing is crucial for the success of any emergency program involving seed. Seed has to be delivered at a time when it is most likely that it will be planted and not eaten. In the case of drought, rain must be assured and, where possible, the supplies of seed and food should be coordinated. This may need collaboration with agencies that are involved in the distribution of food aid.

- ***Suitable supplementary activities***

The supply of seed may be targeted exclusively at agricultural rehabilitation programs, while refugee settlements receive food aid. However, making vegetable seed available for backgardening for women in refugee situations can be valuable sources of income and food supplement necessary to minimize the effects of malnutrition.

- ***Monitoring and evaluation***

Monitoring and evaluation components are useful in assessing the impact of emergency programs through collecting relevant data after completing a seed distribution exercise. Such information can be a useful addition to needed knowledge on emergency seed delivery, and may form a basis for designing appropriate follow-up actions aimed at strengthening coping mechanisms within vulnerable communities.

As a follow-up measure, some international NGOs seek to link efforts in relief to seed system development. This is a challenging step and entails finding answers to some fundamental questions, including the following:

- What kind of institutions will produce and distribute seed?
- Which exchange mechanisms will be used?
- How will the process be made as low cost as possible?
- Which quality assurance methods will be used?
- How will the seed supply system survive without external support?

Experience in this area is limited, but whatever approach is taken has to be guided by local circumstances.

Conclusions

Growth of the seed industry in industrialized countries will continue to be based on the development of hybrids and advances in biotechnology. However, unlike conventional plant breeding, which is mostly non-proprietary, new biotechnologies being developed by the private sector in the industrialized countries are proprietary. This means that these new tech-

nologies will have *different commercial* implications for acquisition and use, especially in developing countries.

As the population in developing countries continue to rise, with corresponding increase in rural and urban poverty, there is need to develop and link together both formal and traditional seed sectors as a firm basis for increased food production. The increased attention, being given to the informal sector, reflects the general concern of future food production needed to feed the expanding rural and urban population. The formal sector, too, needs to be developed in such a manner as to capture any future gains that could arise from advanced technologies, which may later be diffused by appropriate mechanisms to the informal sector.

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PART II
TECHNICAL AND
INSTITUTIONAL ASPECTS

CHAPTER 3. Technical Aspects of Seed Production



Introduction

One reason for carrying out technical analysis of a seed system is to generate information that could be used in economic analysis. In fact, technical, economic, and policy aspects interact closely in determining the effectiveness of a seed delivery system. Much is known and written on the technical dimensions of seed production, which relate to agronomy, post-harvest technology, and quality control procedures. A brief treatment of some basic technical issues in seed production is given in this chapter.

Concept of Technical Efficiency

In simple agronomic terms, technical aspects of seed multiplication are related to the physiological interaction between crop varieties and inputs such as husbandry, water, land, fertilizer, machinery, and labor to produce a measurable response or output in the form of seed yield per hectare as illustrated in Figure 6.

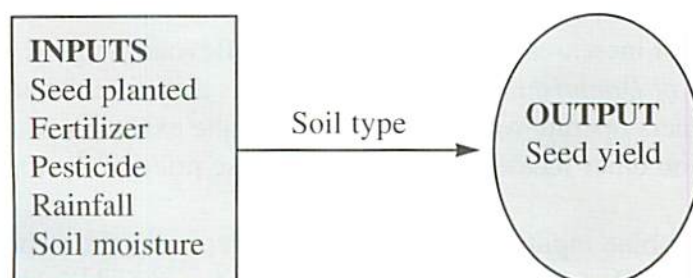


Figure 6. Use of inputs to produce seed output.

This technical process is often represented by a *production function*, which describes the rate at which inputs are transformed into outputs. This is illustrated by a simple case of a single input, labor, as shown in Figure 7. This example shows the influence of labor on seed yield, where at the origin, zero, there is no seed output, since no labor input is used. But as more persons are engaged in production, the amount of seed produced increases until point B, which corresponds to using 50 persons per year to produce 40 tonnes of seed. Any further increase in the number of persons beyond 50 (keeping the level of other inputs constant) may reduce the amount of seed produced per year. B is the point of diminishing returns or the point of technical optimum in the use of labor.

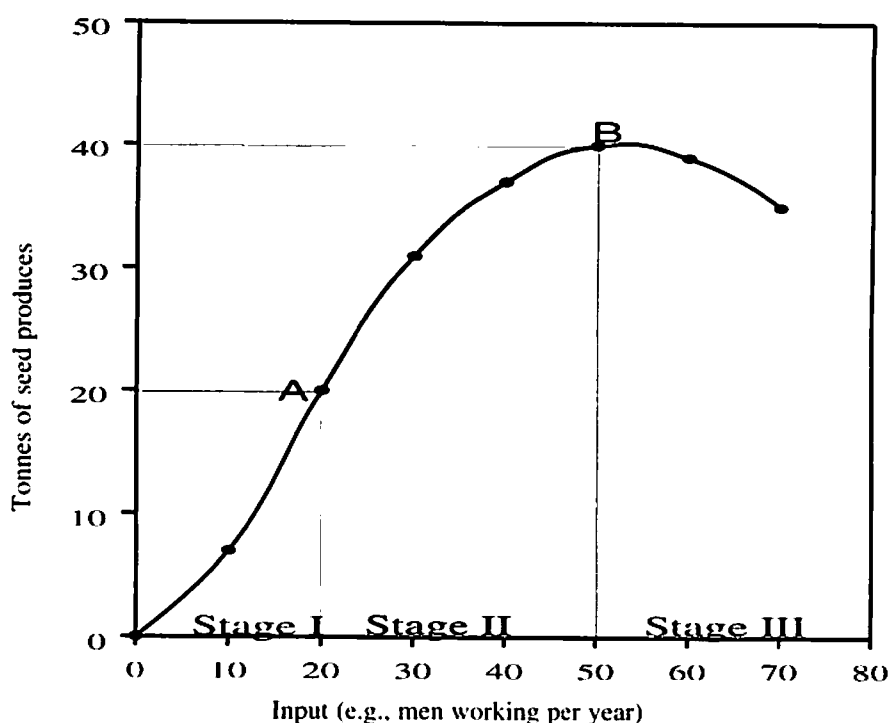


Figure 7. Classical production function.

Between the origin and Point A (Stage I), the slope of the curve is the steepest, which indicates a continuous increase in output as more men are engaged in seed production. Since the amount of seed produced increases throughout this stage, it is not reasonable for the farmer to stop using more labor because the output is increasing steadily. The farmer will add labor until Stage II, when the curve becomes less steep although it continues to rise, meaning that the output increases, but at a slower rate. Beyond Stage II, the output declines according to the *Law of Diminishing Returns*. Stage II is therefore the area of economic relevance and most farmers operate within this stage. But the exact amount of input used in Stage II will depend on other factors such as the purchase price of the input or selling price of the output.

The capacity to combine inputs to produce output determines the technical efficiency in seed production. Technical efficiency can then be defined as *the ability to produce maximum amount of seed of specified quality from a given set of inputs*. This means that one way of

assessing performance in seed production is to carry out a technical analysis. Several studies are based on production function analysis and provide useful information for carrying out economic analysis. For example, defining Stage II of a production process can enable farmers to select the most profitable scale of operation, given adequate knowledge of input and output prices. This section will extend the technical aspect beyond seed production agronomy to include some post-harvest operations as well. These comprise processing, storage, and quality control, considered to be important activities which particularly influence the quality of seed produced.

Reasons for Technical Analysis

Technical analysis can be carried out at the preparation stage of a seed enterprise as well as during the operational stage. The following reasons are suggested as to why it is important to analyze the technical basis of seed production:

Determine the Suitability of a Physical Resource for Seed Production

Technical analysis carried out during an enterprise preparation phase usually helps in determining the capacity of physical resources to generate desired outcome. An enterprise may decide to allocate different crops/varieties to contract growers who are situated in different agro-ecological zones, on the basis of technical information regarding the suitability of these areas for giving high yields because of good soils, low incidence of disease and weeds, favorable climatic conditions, etc.

Provide Basis for Determining Main Physical Components of Seed Enterprises

Technical analysis provides ideas on the type and capacity of physical assets that are required by new seed enterprises. These include land area for seed production, machinery and equipment, processing plants, and seed testing laboratories. A proper assessment of this resource will determine the volume of throughput, the size of equipment, and the length of operating season.

Provide Choice Based on Alternative Uses of Given Resource

Technical analysis provides options which enterprises can consider when making decisions regarding investment in certain means of production. The choice of location, size, and type of seed storage facilities should not be based on cost considerations alone, but also on alternative use of resources. For example, whether short- and medium-term storage could be best handled together, or whether during off-peak periods storage space could be rented to other organizations/farmers. Similar factors could be taken into account when choosing transport, mechanical cultivation equipment, and processing facilities.

Help Establish Production Plans

Technical analysis establishes farm-level assumptions which could be used in annual production planning, and farm budget exercises. Multiplication factors of a variety, increase in yield due to a change in variety or application of a certain level of fertilizer/pesticide, and analysis of results from previous years are important factors to take into consideration when formulating production targets.

Generate Data for Estimating Costs and Benefits of Seed Organizations

Results obtained from technical analysis of seed enterprises can provide useful information for estimating costs and benefits. Technical analysis usually generates information on unit quantities of production, which are used to calculate costs per unit of output, and hence obtain the total value of investment costs. Similarly, yield estimates in tonnes or kilograms are used to obtain value estimates of revenue earned or sales volume.

Provide a Basis for Formulating Organizational Structure

Another useful output from technical analysis is the logical categorization of activities with costs allocated to each category. The assignment of tasks and responsibilities for various activities is a step toward formulating an organizational structure for a seed organization. Therefore, the functions of a seed organization could be divided into technical, commercial, financial, and administrative components. These may be sub-divided into further groups and costs allocated to these. The structure of the technical division of a seed organization on the basis of categorizing activities is illustrated in Figure 8.

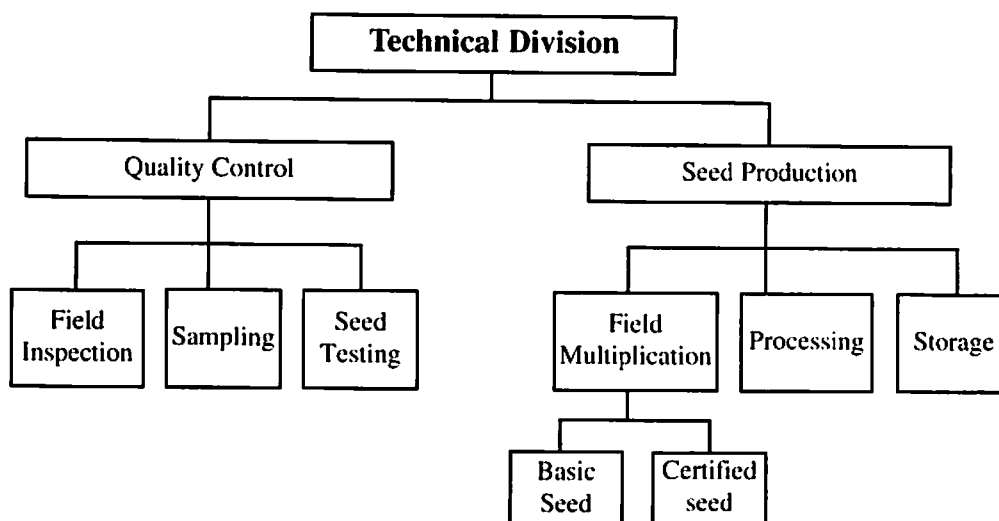


Figure 8. Technical functions of a seed organization.

Technical Considerations in Seed System Analysis

A technical basis must exist upon which to build a seed enterprise and this should be clearly specified from the outset. The following must be taken into account:

Source of Varieties

Effective seed production depends on a reliable source of good seed of desired varieties. There are usually two broad types of varieties: *traditional* (local) and *improved* varieties. In many developing countries, traditional varieties account for a far greater proportion of the total area planted. Although often low yielding, farmers may prefer these varieties because of their adaptability to local ecological conditions and existing farming practices (e.g., harvesting, transport, storage), as well as additional attributes such as cooking quality, aroma, flavor, and texture.

In countries where traditional varieties are important, seed enterprises should seek to first understand how the local seed system works, i.e., perceptions of the farmers and exchange mechanisms that exist. Since farmers may be saving their own seed each year, new entrepreneurs wishing to work with such varieties have to be aware of the technical improvements that are available so as to make their seed more acceptable. Better cleaning to improve physical purity, better packaging and ready availability may be all that is needed in certain situations. An entrepreneur wishing to introduce new varieties from outside has to also understand the existing system to determine new attributes that could be attractive to the farmers.

Activities of some seed organizations may be based on improved varieties coming from research centers and trial systems. However, although improved varieties are generally higher yielding, they require complementary inputs such as fertilizer and agro-chemicals to fully exploit their potential. In many situations, these inputs are too expensive for small farmers in rural communities to afford.

Some breeding programs also attempt to combine high yield with other desired attributes of traditional varieties including disease resistance, flavor, and cooking qualities. The more successful such efforts are, especially for self-pollinating crops, the greater are the chances for farmers to adopt the new varieties.

Field Multiplication

A successful seed multiplication program must increase quantities of seed output, maintain high quality, and keep costs down. There are several approaches to seed multiplication. In general, enterprises that use their own land and employ labor to multiply seed, may produce high yields and good seed, but at relatively high costs which could prevent them from making profits if they are to sell seed at prices farmers can afford and are willing to pay. Instead, most enterprises prefer contracting production to private growers to reduce production costs. However, to ensure that high yields and good quality are maintained, growers should be carefully selected and supervised. These formal approaches to seed multiplication are necessary if seed production is subject to a quality control (certification) system based on field inspection and laboratory testing. Many enterprises use early generation seed (i.e., foundation or basic seed) as starting material for their multiplication programs.

Quality Control

The fact that small farmers have confidence in their own seed or go only to trusted neighbors or traders when short of seed shows that maintaining quality is crucial, even at the subsistence level. There are no formal rules and regulations regarding the quality of seed exchanged in such communities. However, local customs, close personal relationships, and interactions ensure fair dealings in seed exchange. Once seed moves over a wider area and involves commercial transactions, maintaining its quality then becomes difficult, and even more vital. In this case, formal quality control systems with defined procedures, regulations, and standards play an important part. Depending on the stage of development of the seed sector, quality control may be either an internal activity by the producing organization or a function carried out by an independent agency. Besides regulatory functions of field inspection, seed sampling and laboratory testing, quality control schemes can perform other functions such as training and creating awareness. Administering quality control procedures and

enforcing standards/regulations are costly. It is therefore essential that procedures used are simple and effective, and are based on appropriate and achievable quality standards.

Processing and Storage

Processing comprises the post-harvest activities of drying, cleaning, grading, and packaging seed. In large enterprises, these activities are usually capital-intensive. Processing is therefore a 'value-adding' activity which seeks to improve the physical purity and health of seed stocks by removing various contaminants including undersized and shriveled grains, inert matter, and seeds of other crops. As shown in Figure 9, processing provides the link between field multiplication and seed distribution. It is a part of the process where 'raw' seed from growers is brought together for transformation into final clean seed.

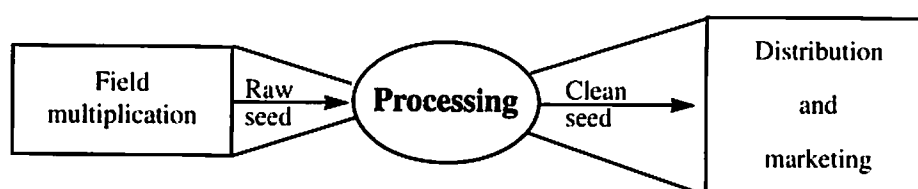


Figure 9. Processing as the link between field multiplication and seed distribution.

The choice of which processing equipment to use may depend on the kind and nature of contaminants to be removed. However, there are also important economic considerations to take into account (these factors are considered in detail in Chapter 8). Once a seed lot is processed, it has to be kept under safe storage conditions until the time of sale to the farmer. Seed is vulnerable to deterioration, so the basic requirement of storage is ensuring that the seed maintains its germination capacity. The best conditions for this are low temperature and relative humidity. Types of storage facilities vary widely and range from containers constructed out of local materials at village level to sophisticated air-conditioned buildings in some large companies. In some situations, simple local systems are enough to keep small quantities of seed for one season's planting. Like processing, storage facilities are diverse and the choice of which to use is based on technical specifications as well as on economic considerations.

Marketing and Pricing Policies

Technical decisions taken at farm level by seed producers may be influenced by existing marketing practices and pricing policies for the crop in question. For instance, small-scale farmers may choose to allocate part of their land to contract seed production if an enterprise buys seed back from them on time, and pays an attractive price based on the prevailing market price for grain of that crop.

Links to Supporting Institutions

Institutions that provide input-related services constitute important technical elements of seed production. Providing extension services, credit, and quality control can be categorized into this group. Other institutional arrangements such as land tenure systems and labor exchange practices are categorized at the local level. These aspects are discussed in greater detail under institutional considerations in Chapter 4. The point to note here is that a seed

producing organization must have linkages with supporting institutions which may have financial and social dimensions (Figure 10). The more effective these linkages are, the greater the degree of success in seed production.

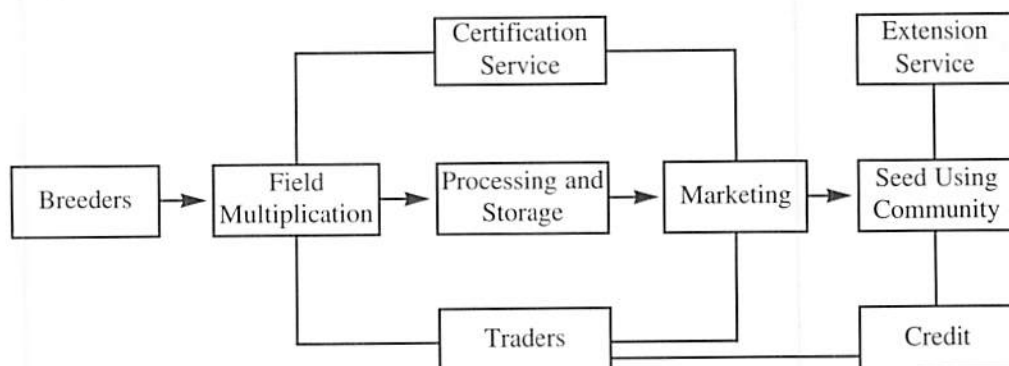


Figure 10. Linkages between the seed supply chain and supporting institutions.

Conclusions

The technical aspects of seed production cover a series of activities ranging from the agronomy of field multiplication to post-harvest functions such as processing, storage, and quality control. There is a lot of information available on seed science and technology, but this has to be linked to economic factors that determine seed enterprise development. There are two main sides to successful seed production and these must be closely related; first, technical efficiency in selecting and making good quality seed of the right varieties available, and next, economic efficiency in making sure that the good seed is taken up and used by the farmer in a beneficial and profitable manner. One cannot go without the other. This means that proper understanding of both technical and economic issues is fundamental for establishing and developing successful enterprises in seed production.

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CHAPTER 4. Institutional Aspects of Seed Production



Introduction

Many of the technical issues raised in Chapter 3 have an institutional dimension since they relate to the production and use of seed within farming communities and the linkages these may have with external support arrangements. Institutional factors have an important effect on seed production; these will be discussed further in this chapter. In fact, the day-to-day affairs of seed enterprises usually involve a close association between activities that are **institutional**, **organizational**, and **managerial** in nature. These three subjects and attempts to clarify misconceptions in terminology that sometimes arise are discussed in this chapter.

Institutional Arrangements

Formal seed supply systems involve an interaction between producers and users. There is a wide range of institutional arrangements within which the multiplication, distribution, and marketing of seed take place. They include the following:

National Institutions

- National seed projects, corporations, and companies
- National seed boards
- Credit institutions (banking, village money lending, etc.)
- Farmers' associations
- Cooperative societies
- Commodity boards
- Government procedures, regulations, and practices

Local Institutions

- Gender relationships
- Land tenure systems
- Village authority
- Labor use traditions
- Customs, traditions, and cultural practices (e.g., religious rights and social norms)

National Seed Projects

Many seed projects in developing countries are part of the Ministry of Agriculture and use existing government structures, resources, and administrative machinery. Providing technical assistance through these projects has often helped to strengthen government ministries by enabling the staff to accomplish more tangible tasks and produce visible output in the form of seed. But, there are difficulties often associated with this kind of arrangement, which partly succeeded in several seed projects:

In some countries, aid agreements stipulate that donor countries offer technical assistance, while recipient governments cover operational costs. However, poor budgetary allocations to government ministries have partly fulfilled such obligations, thus creating more problems than solutions.

Staff recruitment procedures in the civil service and the inherent bureaucracy within government departments do not suit commercial seed production, for which timing of operations and dedication to duty are vital.

The civil service is non-profit activity, and its staff is not accustomed to the commercial way of thinking and practice. This is a major problem facing current privatization efforts of many parastatal seed organizations.

Seed Corporations and Companies

While seed projects are often located within the local Ministry of Agriculture, seed corporations and companies are generally semi-autonomous (usually with board of directors) and are expected to engage in commercial seed production by using national resources and manpower. These organizations often lay the foundation for subsequent privatization of the seed sector through their efforts in training staff and establishing infrastructure such as sales outlets in rural areas. However, government/parastatal seed corporations and companies generally operate at a financial loss, indicating that commercial objectives are only partially achieved. Some factors account for this:

There is an obvious conflict when state-owned seed enterprises are required to both fulfill government obligations and operate as commercial entities. For example, governments may require enterprises to produce large quantities of low-profit, self-pollinating crops for strategic reasons and not on the basis of real demand. This sometimes results in high carry-over of unsold stocks of seed each year, which are later either sold at lower grain prices or disposed of if treated with chemicals.

In a similar manner, state enterprises may also be required to supply seed to government projects and extension programs. In an attempt to survive, some of these enterprises choose to diversify into other high-value activities such as hybrids and vegetable seed production. But even these efforts sometimes require government approval.

National Seed Boards

Whilst seed corporations and companies are established to undertake production and distribution on behalf of the government, seed boards, on the other hand, perform an exclusively regulatory role in ensuring that a government policy regarding seed production is being implemented. The main aim is to protect the interest and welfare of the farming community, especially where smallholders are involved. In this respect, national seed boards undertake activities such as monitoring the procurement price paid to seed growers, the quality of seed produced, the final retail price of seed, and enforcing seed legislation.

The primary aim for establishing seed boards is to link together dispersed organizations within the seed industry. Coordination can occur at two levels: between institutions within the production-distribution chain and/or between the chain and external institutions. Since seed has to pass through different institutions before reaching the final user, coordination and exchange of information are essential. Key functions of seed boards are to ensure the effective operation of the certification service and to coordinate among institutions that are linked to the production-distribution chain. Since the seed industry comprises several inter-dependent elements, membership of the board normally comprises representatives from all participating institutions who meet regularly to discuss the development of the seed industry as well as to draw up policies for implementation. The members are usually made up of about 10 people selected from:

- Ministry of Agriculture (e.g., Monitoring & Evaluation, Planning and Marketing Divisions)
- Variety development institutions (e.g., research stations, universities)
- Seed quality control bodies (e.g., certification service)
- Farmers' organizations (e.g., Cooperatives, Producers' Associations)
- Other interested organizations (e.g., NGOs, input supply firms)
- Private sector

Despite the potentially valuable role seed boards can play, many tend to be ineffective, and in fact seldom meet. Reasons for the ineffectiveness of seed boards include the lack of funds and logistic support or the lack of authority (where there is no national seed law). Another factor is that seed boards, by the nature of their composition, tend to be rather formal and do not represent the interests of small farmers.

Credit Systems

One of the major constraints small farmers face in many countries is the limited availability of credit from formal sources (such as commercial banks and the government) to finance farming operations. In fact, commercial banks often regard small farmers, in particular, as credit risks. In the absence of formal credit, seed programs working with small farmers often provide a credit package which covers the cost of inputs such as foundation seed, fertilizer, and mechanical cultivation, to be repaid using revenue earned from the seed they produce at harvest time. Despite strong control measures, poor loan repayment by small farmers is a serious constraint in using this sector for contract-seed production. This problem is exacerbated during years of adverse weather, when farmers do not realize much income from their farms.

One reason why NGOs embark on communal seed production is to overcome poor loan recovery by using peer group pressure and collective responsibility on the part of loan beneficiaries. In the absence of a credit market, many NGOs producing seed often provide small farmers with input loans. This can be a vital contribution particularly in those areas where government efforts are limited or even absent.

Seed Associations and Cooperatives

Seed associations and cooperatives are normally similar in organization and functions. As mentioned in Chapter 2, seed producers may organize themselves into associations of members who share a common interest and undertake joint activities. Seed associations and cooperatives can perform several useful functions in farming communities by spreading technical knowledge about quality seed production; providing services to members such as credit, extension, processing and storage, and advocating with the government and other institutions on behalf of their members.

Associations can even become part of the seed supply system by supporting their members to produce seed, procuring from them after harvest, and finally distributing clean seed within the farming community. This offers a more lasting seed supply system whose members support and manage themselves and do not rely on external sources that may not be sustainable. Seed associations could be formally organized and guided by by-laws/constitutions. Such a rigid organization may not be necessary in rural communities where informal institutional arrangements already bind farmers together. For example, almost all tef growers in Ethiopia are members of Peasant Associations, which are informal village-level partnerships of farmers set up for acquiring input credit, sale of produce, etc. Although cooperatives have been poorly managed in most developing countries, they are still held in many cases as a means of organizing farmers to solve problems in rural areas.

Commodity Boards

Grain producing organizations with suitable facilities, resources, and trained staff can become part of a seed supply system. For instance, the main function of the Grain and Legume Development Board in Ghana is to promote the production of cereals and grain legumes. This organization now produces foundation seed and manages seed processing and storage facilities of the former Ghana Seed Company.

Gender Relations in Seed Production and Distribution

It is well known that women in developing countries receive a disproportionately small share of development opportunities, partly because of limited access to credit. This severely disadvantages them in many areas, including that of agriculture and, in turn, hampers national development. On the whole, separation of agricultural roles between sexes has to do with the control of resources, although the socially subordinate status of women is maintained. In The Gambia, for instance, men cultivate groundnuts, as this is a cash crop. Men use draught power, and own the animals. Although women are the main marketers of farm produce, the household head (usually male) handles and controls all income. Women instead cultivate rice for home consumption, for which no animal traction is necessary. However, some women are active in groundnut production because their position and wealth allows them to be in control of their own resources. A preferential provision of credit to small-scale seed enter-

prises run by women could be an effective means of promoting women's opportunities locally. It also can boost marketing, as women in many communities tend to be better retailers than men are.

Land Tenure Systems

The kinds of seed production practices undertaken in any community are to a great extent influenced by land ownership patterns. Some seed schemes may require large blocks of land to enable an easier use of capital-intensive methods. This is the case in Ethiopia where public ownership of land has allowed state farms to become major contract growers as well as users of seed produced by the government-owned Ethiopian Seed Enterprise.

In some countries, there is communal ownership of land and this determines the kind of approach used in seed production. NGOs in the Gambia use communal farms for seed production where the seed produced is also communally owned. This group-farming approach has not been so successful because the community allocates poorer land to communal seed production and the farmers themselves are not very dedicated in taking care of crop husbandry practices and post-harvest operations compared to activities they carry out on their private farms.

Other Local Institutions

There are several other institutions based on community norms, structures, and beliefs. They are part of the socioeconomic structure, which varies from one community to another, and influences agricultural practices adopted by farmers. A proper understanding of this structure is particularly important for those who work with farmers in the informal sector. In this case, it is essential to first learn about the farmers' situation and views, since this determines how one motivates them towards change. Examples of local institutional arrangements include the following:

- The traditional hierarchical structure, which is often important in influencing activity at the village level. Therefore, one should be careful to draw on such leadership when introducing new technologies including improved varieties and seed.
- Power groups in the village (traders, moneylenders, etc.) may have economic control over the poorer farming groups.
- There may be different types of labor use traditions in the community such as the traditional system of communal or exchange labor and the more impersonal labor paid in kind or in cash by the job or by the day.
- The extent of community spirit in comparison with individualism may decide whether to undertake communal seed production or contract individual smallholders as seed growers.
- Religious tradition may impose anti-usury laws that forbid interest on loans including input credit or cash advances made to farmers.
- Gender division of labor in farming may be based purely on culture or religious beliefs and not capability. The same kind of work may be done by different sexes depending on the community.

Internal Organizational Arrangements

Seed organizations should adapt to the institutional framework of the communities in which they are located. An organizational structure represents a framework of relationships at different levels which correspond with activities designed to achieve specified objectives. In

diagram form, the organizational structure (Figure 11) represents the pattern of responsibilities and duties of the participants and their interaction. It shows the lines of authority and responsibility and the distribution of functions among the employees. Regardless of the situation, organizational structures of seed enterprises must have certain characteristics if they are to be effective:

- Since each activity in an enterprise has to be supervised, someone should be in charge of these and given authority to carry out the required functions. But the chain of command has to be clear so that people know who to report to and who reports to them.
- Levels of authority have to be matched with a corresponding delegation of responsibility and duties, and kept within the capability of the staff concerned to achieve an effective coordination of functions
- Responsibilities and duties must either be clearly stated in writing or fully understood by all people concerned.
- The organization should be kept simple, with a few levels of authority kept.
- The organization should be flexible and capable of responding quickly and adapting to changing conditions.

Factors Determining the Organizational Structure of Seed Enterprises

Designing an appropriate organizational structure for a seed enterprise depends on several factors including the following:

- ***Types of activities to be carried out and how these could be grouped into main divisions on the basis of similarity in function***

Normally, the functions in a seed production-distribution chain could be categorized into distinct groups such as contract production, seed procurement, processing and storage, distribution and marketing, and quality control. This kind of grouping forms a basis for designing the organizational structure of seed enterprises.

- ***Size and ownership pattern of the organization***

Whilst large organizations often tend to engage in specialization by division of labor, small-scale enterprises are usually family businesses and do the opposite (i.e., the main areas of activity are in control of few people). In general, large organizations have more complicated structures while small-scale ones have simpler structures. Figure 11 is an example of a typical structure of a small-scale seed enterprise which is usually supervised by few key people: an overall manager and two technical assistants. On the contrary, structures of large organizations often tend to be more complicated, with several levels and interactions.

- ***Effectiveness of existing complementary institutions***

The structure of a seed organization should be such as to avoid unnecessary duplication of functions which are already performed by related institutions. Important external institutions include credit, extension, quality control, and seed distribution. It is more cost effective to establish working relations with existing institutions, where this is possible, than seeking to employ staff and devote resources to do the same things.

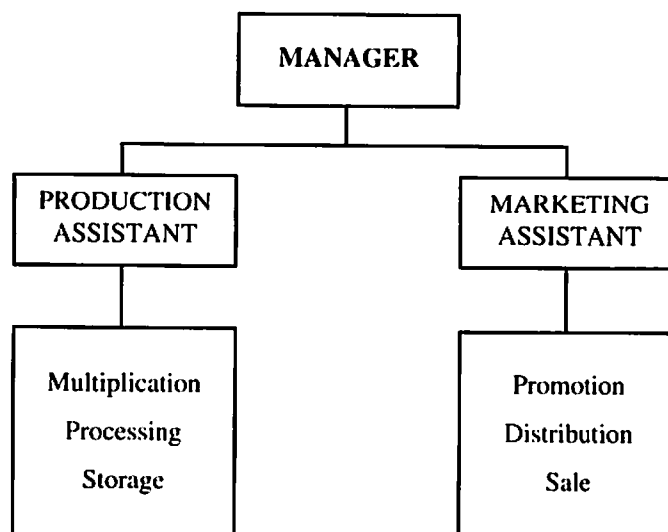


Figure 11. Suggested organizational structure of a small-scale seed enterprise.

- ***Extent to which the organization pursues managerial independence***

A difference between public and private seed organizations is that different practices related to issues such as staff hire and dismissal, salaries and wages, incentive schemes, capital acquisition, cost-accounting, subsidies and taxes, etc. are used. All these factors influence the nature of the organizational structure adopted.

- ***Availability of trained manpower***

Availability of trained and qualified people, and the opportunity to recruit them into positions specified by an organizational structure can sometimes be a limiting factor.

- ***Minimizing bureaucracy***

To be effective, a seed organization should minimize as much excessive bureaucracy as possible. Since activities in large organizations often involve many details which must be handled correctly and on schedule, it is necessary to delegate responsibility. The organizational structure should permit this, although excessive delegation can insulate top management from personal contact with progress and major problems, giving a scope for opportunistic behavior.

Management System

The management of an enterprise comprises persons (managers) who plan, organize, direct, coordinate, and control given resources to achieve specified objectives. The primary function of a management team is therefore to implement those activities which will ensure that the objectives of the enterprise are achieved within the framework of a defined organizational structure, while making meaningful use of resources (personnel, money, machines, materials) available. As part of planning and implementation processes, the management team should have a clear understanding of what the objectives are, the outputs to be produced, and the relevant activities to be undertaken to realize those outputs. The management should be in

position to evaluate the output the organization produces, discover and evaluate markets, and manage the actions of employees by enforcing rules/regulations. The kind of knowledge and skills required for this are unique to specific institutional environments and therefore entail varying degrees of investment in human resources and the kind of information required. These aspects are discussed further under seed marketing in Chapter 8.

The success of an organization depends on trained, qualified, and capable managers at the high levels as well as on support staff with similar attributes. In developing countries, this requires considerable investment in both formal and on-the-job training. It is therefore important that once a core of experienced managers and staff is established, attractive working conditions and appropriate incentives have to be provided to keep these people in the job, since they will help train and pass on expertise to new employees.

Conclusions

The institutional framework determines who participates in seed production, the level of participation, and how income realized from seed activities is distributed. Seed production takes place within the socio-economic framework of the farming community, which the seed worker/researcher must be alert to, explore, and be part of. This is particularly important within the informal sector where community norms, structures, and beliefs are a strong part of the society.

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PART III
FINANCIAL, ECONOMIC,
SOCIAL & ENVIRONMENTAL
ASPECTS

CHAPTER 5. Financial Viability Analysis



Introduction

In a commercial situation, an entrepreneur wishing to invest in a seed enterprise should carry out financial analysis to determine the financial or cash viability of the proposed venture. This exercise is also called investment appraisal, or ex-ante appraisal since it is undertaken before starting the enterprise. Investment appraisal is a planning exercise which involves making estimates and predictions of the costs to be incurred and benefits/cash flows to be generated before launching an enterprise. It is usually carried out using *current market prices*. This analysis is useful because it enables entrepreneurs to determine in advance any expected financial loss and how much will be required to cover such a loss. In addition, it can also forecast how long it will take before the enterprise makes a profit. A number of numerical examples and a hypothetical case study are used in this chapter to explain the principles used in financial appraisal.

Reasons for Financial Analysis

There are two major reasons for carrying out financial analysis of seed enterprises:

Assess Financial Viability in the Production-Distribution-Use Chain

Seed production, distribution and use comprise a sequence of operations, which can be represented by a typical chain as shown in Figure 12.

What financial analysis seeks to investigate is whether sufficient margins, which could enable an investment to provide a return, are created at each successive point in the chain. In other words, financial analysis helps provide answers to questions such as the following:

- Does the price received encourage growers to deliver all their seed to the seed enterprise according to an agreed contract?
- Does the price farmers (users) pay make it viable for the seed enterprise to operate (i.e., procure from growers, process, store, and sell)?
- Do the intermediaries (agents/stockists) receive sufficient commission as incentive to increase their turnover?

The implications of these questions are discussed in detail under Marketing in Chapter 8.

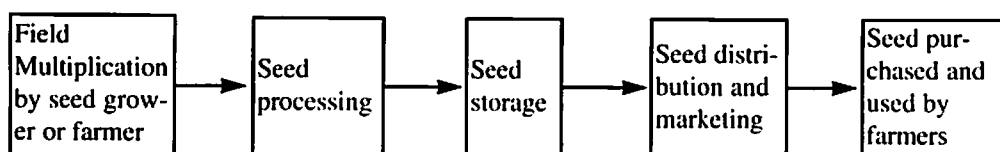


Figure 12. Seed production-distribution-use chain.

Assess Operation and Loan Repayment Capacity of Seed Enterprises

New entrepreneurs may require loans to finance initial acquisitions such as processing plants, transport, and storage capacity. In cases like these, it is important to know whether forecasts of income and expenditure will generate enough net revenue to service these debts on time (including interest payments and depreciation) and have sufficient cash balance to be able to undertake activities envisaged under the enterprise. For example, a seed scheme for women may have the main objective of encouraging female farmers to adopt new varieties and expand their production beyond subsistence level. Although this is a social/development objective and not a typical enterprise objective, it is important to know whether the enterprise will be in a position to generate sufficient additional revenue; hence, it will offer incentives that could motivate these farmers to demand new seed. Where this is possible, production targets could be set. For enterprises, which take loans to finance operations, it is important to prepare plans which indicate the sources of funds, and how and over which periods of time these will be used.

Principles of Discounting

Financial analysis involves making estimates and forecasts of cost and revenue, and applying a discounting technique which follows the following principles:

- Two sources of money having the same nominal value (e.g., \$1000) are not equivalent if they are received or paid in different time periods because of the difference in time of payment or receipt.
- Money that is in use attracts a return or interest, whereas money that is unavailable for use incurs an implicit or opportunity cost.
- This means that to make valid comparisons of amounts of money receivable or payable at different points in time it is necessary that these amounts be converted to some common basis.
- To do so, nominal amounts are adjusted to their effective compounded value at some future time by adding the interest to be earned.
- Alternatively, nominal amounts are discounted back to their present value by taking account of the discount (or interest foregone) during the intervening period.

Discounting methods measure the present value of future cash flows associated with an enterprise. It is the process by which each of the cash flows of all the years of an enterprise are discounted to a base year giving present values. For example, the cash flows for Year 1 and subsequent years are reduced by the discount factors or present worth factors (PWFs), which represent the earning power of the cash flows in the intervening years.

The standard way of finding costs and projecting revenues is to extrapolate current accounting statements to forecast future cash flows. There are different types of cash flows:

- ***Net cash receipts (including depreciation)***

There can be no net return on capital invested unless the cost of capital is covered. So the investor has to find out whether the present value of all net cash flows is greater than the capital outlay, i.e., there is a positive net present value.

- ***Net residual values (end value of asset)***

This gives some allowance for the market value of the capital. Net residual value is the net cash flow resulting from the disposal of assets remaining in an enterprise at the end of its life. This value may not always be a positive benefit since, for example, in the end there may be a need to repair damage done to the asset.

- ***Taxes (when paid)***

There may be no need to cover taxes when one is evaluating situations on behalf of the government. However, for private investors there is a need to pay tax. The proportion of tax paid varies from country to country. Entrepreneurs allow for the fact that taxes have to be paid from taxable incomes, and these are recorded as negative items in the year of payment.

- ***Interest***

Knowledge of interest enables an entrepreneur to seek the cheapest way to finance an enterprise and avoid situations that impose heavy charges. To avoid double counting, it is better not to deduct interest and then do the discounting exercise.

Net Present Value

In present value terms, a dollar *now* is worth more than a dollar to be received some time in the *future*. This is because the present dollar at hand, given time could be invested to accumulate more than its original value. This can be represented as follows:

$$P_v = \frac{F_v}{(1+r)^n}$$

Where: P_v = Present value, F_v = Future value, r = Rate of interest and n = Number of years

Re-writing the above equation, future value after number of (n) years can be represented by $F_v = P_v (1 + r)^n$.

This means that the present value of \$1 due at the end of one year must be less than \$1 now no matter which rate of interest is used. This is the present worth factor (PWF) represented as $P_v = 1/(1+r)^n$ in Appendix 1.

Since $P_v = F_v / (1+r)^n$, this means that future values (e.g., values of forecast cash flows) are adjusted by the PWF of $1/(1+r)^n$ to give present values. The greater the number of years, the less the PWF; the higher the rate of interest, the less the PWF. Consider an enterprise with the following investment outlay (negative) in dollars, operating cash flows (positive) in dollars and rate of interest $(n) = 10\%$. Using the PWFs in Appendix 1, the following values can be derived:

	Y_0	Y_1	Y_2	 Y_{12}	 Y_{20}
Investment/cash flow	-100	+110	+121	+314	+672

$$Pv: 110 \times 0.909 = 100 \quad 121 \times 0.826 = 100 \quad 314 \times 0.318 = 100 \quad 672 \times 0.149 = 100$$

All the cash flows are equivalent on a basis of 10% interest rate. This means that \$100 in Year 1 is compounded to \$672 in Year 20 at 10% interest rate (or \$672 in year 20 is worth \$100 now). In other words, the present value of \$672 in Year 20 is just \$100 in today's money. Since these are equivalent, an entrepreneur should be equally happy receiving \$100 now as having \$672 in Year 20.

Choice of Enterprises

The principle of selecting enterprises can be illustrated using three hypothetical cases, with investment outlays and operating cash flows as shown in Examples 1 to 3.

Example 1

	Y_0	Y_1	Y_2	Y_3	Y_4
Enterprise A	-100	+50	+40	+30	+20
Enterprise B	-100	+20	+30	+40	+50

Three criteria could be used to decide between Enterprise A and Enterprise B. These are rate of return, payback period and interest.

(i) Using rate of return:

Investment outlay for both A and B is the same = \$100

Total net operating cash flow (NCF) is the same = \$140

Number of years $(n) = 4$

$$\text{Rate of return} = \frac{\sum \text{NCF} - \text{Outlay}}{n} = \frac{140 - 100}{4} = 10$$

$$(10/100) \times 100 = 10\%$$

Since both A and B have the same average rate of return, there is no difference between the two enterprises on this basis.

(ii) Using payback period and interest rate:

A recovers \$100 in three years whilst B recovers \$100 in four years. On this basis, A is a better investment than B. Calculating the relative benefits of A and B (i.e., allowing for

interest), A is superior to B because in Year 1, A yields \$30 more cash flow which could be invested to earn interest.

Example 2

	Y_0	Y_1	Y_2	Y_3	Y_4
Enterprise A	-100	+50	+40	+30	+20
Enterprise B	-100	+20	+30	+40	+50

PWF for A: $50 \times 0.909 = 45.45$
 $40 \times 0.826 = 33.04$
 $30 \times 0.751 = 22.53$
 $20 \times 0.683 = 13.66$

Total 140 114.68

PWF for B: $20 \times 0.909 = 18.18$
 $40 \times 0.826 = 24.78$
 $40 \times 0.751 = 30.04$
 $50 \times 0.683 = 34.15$

Total 140 107.15

The PWFs can be calculated for Enterprises A and B as follows:

Net present value of A (NPVA) = $114.66 - 100 = \$14.68$

Net present value of B (NPVB) = $107.15 - 100 = \$ 7.15$

In both cases, the forecast NCFs cover or repay the initial investment outlay of \$100 and the rate of interest. But on the NPV basis, A is better because an entrepreneur can borrow \$114.68 and use \$100 as an investment outlay to start the business because this is going to yield (with the given cash flows) the initial capital plus the interest, that is, \$100 and \$14.68. So the entrepreneur can regard the extra \$14.68 as an additional sum which can be kept or reinvested.

The NPV method usually uses the opportunity cost of capital as the discount rate. It is therefore assumed that operating cash flows are reinvested at a rate equal to the pre-specified cost of capital. It is usual to use NPVs to assess enterprises by accepting all independent enterprises with NPV equal to or greater than zero but this must be discounted at a satisfactory estimate of the opportunity cost of capital. It is therefore not possible to rank independent enterprises on the basis of their NPVs because for a given enterprise the NPV is an absolute, and not a relative measure. Obviously, an estimate of NPV depends on the size of the enterprise. For a small-scale enterprise, NPV in money terms is relatively less than that for a large enterprise because the level of investment and volume of earnings are small. Therefore, as long as there are sufficient funds available to finance all enterprises (and these enterprises are not mutually exclusive), the difference in the size of NPV is not important as any enterprise with NPV equal to or greater than zero could be worthwhile. However, when funding is scarce, it is better to raise the discount rate until sufficient fund is available to finance only those enterprises that have NPV equal to or greater than zero.

Mutually exclusive enterprises are usually ranked according to NPV at a particular rate of interest. The higher the NPV, the greater the chances are for an enterprise to be chosen since the higher NPV creates greater wealth. The size of NPV for an enterprise is important. It represents savings over and above the investment needed to sustain a rate of return that is equal to the pre-specified cost of capital. The enterprise in Example 3 below can be financed with an investment outlay of \$200, whereas a much higher outlay would be required if 16% rate of return is to be earned throughout the life of the enterprise.

Example 3

Consider an investment with the following outlay and cash flows:

Y_0	Y_1	Y_2
-200	+123	+123

$$\begin{aligned}\text{Rate of return} &= \frac{(123 + 123) - 200}{2 \text{ years}} = 23 \\ &= (23/200) \times 100 = 11.5\%\end{aligned}$$

However, it is possible to seek a maximum overdraft of 15% for this investment so that the owner can borrow \$200 at 15% rate of interest.

So at Y_0 borrow	\$200
Add 15% interest	<u>30</u>
	230
Less Y_1 cash flow	<u>123</u>
	107
Add 15% interest	<u>16</u>
	123
Less Y_2 cash flow	<u>123</u>
Net loan	<u>0</u>

Thus, the entrepreneur can pay off the debt by borrowing \$200 at 15% rate of interest with forecast cash flows of \$123 in Year 1 and \$123 in Year 2.

The same results can be obtained using PWFs for cash flows at 15%.

$$Y_1 \quad 123 \times 0.879 = 107$$

$$Y_2 \quad 123 \times 0.756 = \frac{93}{200}$$

$$\text{NPV} = 200 - 200 = 0$$

Therefore the maximum borrowing rate is the rate at which NPV = 0. This rate could be obtained by trying different values of discount rates until the right one is found. Consider a case where the entrepreneur borrows \$200 at 14% rate of interest:

$$\text{Year}_1 \quad 123 \times 0.877 = 107.87$$

$$\text{Year}_2 \quad 123 \times 0.769 = \frac{94.59}{\text{PV} = 202.46}$$

$$\text{NPV} = 202.46 - 200 = +2.46$$

In this case, the borrower has extra cash of \$2.46 since he could borrow \$202.46 at 14% interest, invest \$200, and, with the cash flow in the two years, repay all the debt. But the situation will be different if capital is borrowed at a rate of 16% with the same expected cash flow:

$$\begin{array}{l} \text{Year}_1 \quad 123 \times 0.862 = 106.03 \\ \text{Year}_2 \quad 123 \times 0.743 = \underline{29.89} \\ \text{PV} = 135.95 \end{array}$$

$$\text{NPV} = 135.95 - 200 = -64.08$$

So at 16% interest rate, the entrepreneur would not be able to pay since the present value of the cost stream is greater than the present value of the benefit stream (cash flow).

Internal Rate of Return

The internal (or financial) rate of return (IRR) is the maximum borrowing rate or the maximum interest that an enterprise can pay to cover all investment and operating costs. It is therefore the break-even rate of return or rate of discount which makes the present value of the revenue or benefit stream exactly equal to the present value of the cost stream (capital outlay). In other words, the internal rate of return is the rate which makes the present value of the entire stream of benefits and costs exactly equal to zero (i.e., $\text{NPV} = 0$). For example, if the IRR of an enterprise is 20%, then this is the rate of interest the enterprise can afford to pay. This means that if the capital cost of the enterprise were financed by borrowing at 20% rate of interest, then the enterprise would earn sufficient income to repay the loan and interest charges. The following example of cash flows illustrates the principle of IRR:

Y_0	Y_1	Y_2	Y_3	Y_4	Y_5
-1000	500	300	200	200	300

PWF at 15%	$500 \times 0.870 = 435.0$	PWF at 20%	$500 \times 0.833 = 416.5$
	$300 \times 0.756 = 226.8$		$300 \times 0.694 = 208.2$
	$200 \times 0.658 = 131.6$		$200 \times 0.579 = 115.8$
	$200 \times 0.572 = 114.4$		$200 \times 0.482 = 96.4$
	$300 \times 0.497 = 149.1$		$300 \times 0.402 = 120.6$
	PV 1056.9		PV 957.5
	NPV \$ 56.9		NPV -\$42.5

The values of NPV indicate that the rate at which $\text{NPV} = 0$ lies between 15% and 20%, (i.e., $15\% < \text{IRR} < 20\%$). It can be seen that the higher the discount rates the lower the PV and vice versa. A positive NPV (+\$56.9) indicates that the PV of the benefit stream (cash flow) is greater than the PV of the cost stream at 15% discount rate. This means that 15% discount rate is too low and the enterprise can afford a higher rate of interest and still recover the cost of resources invested. However, a higher discount rate of 20% gives a negative NPV of -\$42.5 indicating that the PV of the cost stream is greater than the PV of the benefit stream at this discount rate. In this case, the enterprise cannot pay the high rate of 20% and still recover the cost of resources invested.

The method of interpolation is used to estimate the true value of IRR. This method involves finding the intermediate value between the two discount rates of 15% and 20%. In practice, it is better not to interpolate between intervals greater than five percentage points, as this tends to introduce a greater margin of error when estimating the true value of the IRR. There are two alternative ways of interpolating between a high and a low discount rate:

First solution

Internal Rate of Return	=	Lower Discount Rate	+	Difference between the Discount rates	×	$\frac{\text{NPV at the lowerdiscount rate}}{\text{Sum of NPVs at both discountrates, signs ignored}}$
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Second solution

Internal Rate of Return	=	Lower Discount Rate	+	Difference between the Discount rates	×	$\frac{\text{NPV at the higherdiscount rate}}{\text{Sum of NPVs at both discountrates, signs ignored}}$
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Substituting into the first solution gives:

$$\text{IRR} = 15\% + (20 - 15) (56.9/99.4) = 17.9\%$$

Similarly, substituting into the second solution gives:

$$\text{IRR} = 20\% - (20 - 15) (42.5/99.4) = 17.9\%$$

At the discount rate of about 18%, the enterprise just breaks even so all capital and operating costs are covered. Using the method of interpolation, a linear relationship between changes in discount rate and IRR is assumed. This can be shown graphically by plotting NPV against discount rate as in Figure 13.

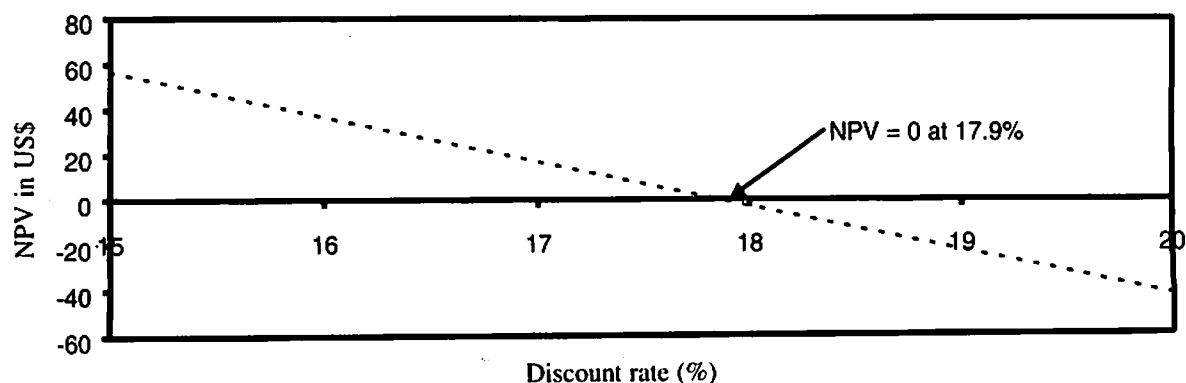


Figure 13. Estimation of internal rate of return by graphical method.

Between 15 and 20% the rate of decline in NPV is linear. The point of intersection with the baseline gives the discount rate at which NPV = 0 or the internal rate of return. The precision of this mathematical procedure has several advantages, that is the capacity to make better forecasts and to improve capital formation (higher rates of return on capital) and help earn better returns.

Benefit-cost Ratio

A private seed enterprise is guided by normal commercial criteria (i.e., financial incentive or profit motive) that require revenues to exceed costs. Very often, investors are faced with a number of alternative investment options. Carrying out a benefit-cost analysis is another way of evaluating and deciding whether to undertake a proposed investment. It offers a means of comparing each investment with available options.

Therefore, a formal application of benefit-cost analysis involves estimating the stream of costs, (capital outlay) set against a stream of future net benefits (gross benefits, less operating costs) which are spread over a number of years and discounting these at a realistic rate of interest. Methods of estimating costs and benefits vary according to the enterprise. Investment in a seed enterprise may require an initial capital spread over the first one or two years depending on the scale of the enterprise. These expenditures can be divided into capital costs and operating costs.

- Capital costs are incurred on items needed to build the enterprise. For a small producer, these may include a range of little items such as a farm hut or barn, tools, simple farm equipment, containers, etc. A larger enterprise may require a tractor, a cleaning machine, land, etc.
- Operating costs, on the other hand, are met from a fund set aside to meet payments during the operating period, such as wages/salaries, repairs and maintenance, consumable materials, etc.
- Benefits in the commercial sense are understood to include expected receipts from seed and by-products sold.
- It is a usual practice in each period to subtract all operating costs including expenditure on wages, salaries, materials, etc., from gross receipt, leaving only a stream of net benefits or net revenues.

The benefit-cost ratio at a given discount rate can be represented as follows:

$$\frac{B}{C} \text{ ratio} = \frac{\text{Present value of benefit stream}}{\text{Present value of cost stream}}$$

The value of the benefit-cost ratio depends on the discount rate. The higher the discount rate, the lower the benefit-cost ratio, since the value of the cost stream increases relatively to the benefit stream.

An enterprise cannot afford to pay a rate of interest which drives the benefit-cost ratio to less than one, since the returns generated cannot cover the initial cost because the PV of costs will exceed the PV of benefits.

Comparing Discounting Measures

With no scarcity of capital, IRR is a reasonably valid decision criterion. The usual procedure is to accept any independent enterprise with IRR that is higher than the opportunity cost of capital or market rate of interest. Any enterprise with IRR lower than this target cost of capital is rejected. The size of IRR or B/C ratio indicates the earning power, but does not directly give information about the scale of enterprises. An attractive small-scale enterprise can have high IRR and high B/C but low NPV, whilst a large enterprise could have a relatively low IRR and low B/C ratio but high NPV, and therefore adds more to wealth.

However, if funds to finance enterprises are limited, then it may become necessary to screen competing enterprises for acceptability by ranking them in order of their IRR, selecting those with higher values provided such rates are in excess of the opportunity cost of capital. This works well for enterprises having equal lives and equal investment outlays. It is not advisable to use IRR to decide between enterprises with different lives and/or different capital outlays. When lives of enterprises differ, conflicts may arise over which enterprise to accept. The IRR and NPV have different implicit assumptions for reinvesting cash flow from operations.

Even for enterprises with equal lives and investment outlays, the exclusive use of IRR can lead to incorrect investment decisions when making a choice between mutually exclusive enterprises, that is, the NPV and IRR may give results which are contradictory to each other. The inconsistencies involved for two enterprises, A and B, where plots are made of NPV for different discount rates are illustrated in Figure 14. A decision based on IRR alone (where curves cut horizontal axis) favors enterprise A with 25% IRR over enterprise B with 18% IRR. A decision using NPV provides better insight into the likely performance of an enterprise since it uses the opportunity cost of capital as the discount rate. Therefore, if the opportunity cost of capital is greater than 12%, Enterprise A will be preferred regardless of whether IRR or NPV is used, since in addition to the higher IRR, Enterprise A also generates higher NPV (or wealth) at discount rates above 12%. However, if the opportunity cost of capital is less than 12%, Enterprise B with higher NPV is preferred irrespective of its lower IRR. For example, if an entrepreneur borrows at 10% rate of interest, then Enterprise B is more profitable because its NPV is in excess of that of Enterprise A.

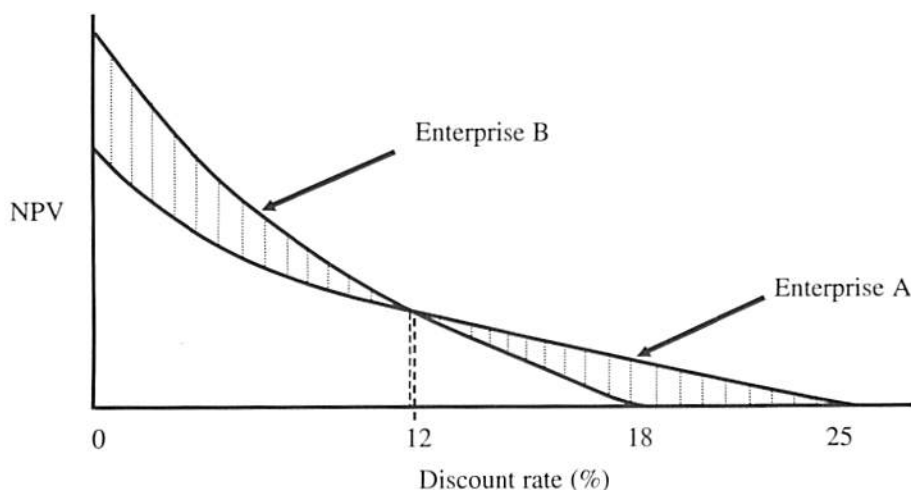


Figure 14. Comparison between net present value and internal rate of return.

Assuming Enterprises A and B were mutually exclusive, with A being small-scale enterprise and B a large-scale one, and supposing that in addition to the higher IRR, A also has higher B/C ratio relative to B. In this case, direct comparison of the IRR and B/C ratios (at say, 10% opportunity cost of capital) can lead to an incorrect investment decision. This is caused because selecting the small high-paying enterprise (A) will preclude generating more wealth or higher NPV through a moderately remunerative but larger alternative enterprise (B). This shows that NPV is the preferred measure for choosing among mutually exclusive enterprises.

Other Shortcomings of Internal Rate of Return

Non-existing Value

By definition, IRR exists when $NPV = 0$ for a series of PV of costs and benefits. This requires that at least one of the values have to be negative. If a series does not include a negative value, no discount rate can make the NPV of that series equal to zero, irrespective of how high the discount rate used is. Note that the higher the discount rate the lower the NPV as explained earlier. It is not possible to obtain IRR in a case where cash flows generate only positive NPV at all possible discount rates. In practical terms, this means that an enterprise can operate above breakeven point at all possible discount rates, making a cost input irrelevant. This is not possible in practice, since enterprises incur costs and cannot afford to pay all levels of interest rates.

Multiple Values

In normal investment situations, Y_0 negative outflows are followed by positive cash inflows at Y_1, Y_2 , etc. In these cases, there will be only one discount rate that will equate costs and benefits in present value terms. This means that only one discount rate gives $NPV = 0$, giving a useful value of IRR. Although very rare in agricultural enterprises, there may be situations where investments are not normal (e.g., an enterprise generating alternating series of positive and negative operating cash flows) with large negative cash balances occurring later in the life of an enterprise such that different solutions for IRR are mathematically possible. So for enterprises with unusual patterns of cash inflows and outflows, IRR is less reliable since multiple solutions are possible.

Shortcomings of Net Present Value

Lump Sum Effect

IRR may be preferred to NPV because NPV is a lump sum and may be difficult to interpret. To interpret this easier, the NPV lump sum can be converted to an annuity, which is a series of payments (or receipts) of a fixed sum of money for a specified number of periods (for example, \$1 per year). Each payment is assumed to occur at the end of the period. Annuity therefore represents constant or regular net cash flows.

In present value (PV) terms, an annuity is obtained by adding up the present worth factors of a series of cash flows. Therefore, the value in Y_0 of \$1 received at the end of the year for three years is the Annuity Factor (AF). This could be illustrated in the following example:

PV of \$1 received at the end of $Y_1 = \text{PWF (5\%)}$	= 0.952
PV of \$1 received at the end of $Y_2 = \text{PWF (5\%)}$	= 0.907
PV of \$1 received at the end of $Y_3 = \text{PWF (5\%)}$	= 0.864
PV (i.e., value at Y_0) of \$1/year for three years @ 5% or AF	= 2.723

Hence, \$1/year, received year-end, for three years at 5% has a present (Y_0) value of \$2.723. In other words, if \$1 is received at the end of the year for n years, the value of the annuity is the sum of the n year PWFs. Since \$1 year for three years has a present value of \$2.723, the annuity factor (AF) is therefore 2.723 as shown in Appendix 2. So for a three-year loan of \$1000, one needs an estimate of annual cash flow that 'justifies' the outlay of \$1000. The annual cash flow is derived from $(\$1000)/\text{AF} = \$1000/2.723 = \$367$.

The annuity factor can therefore be used to work out a debt repayment sum on a yearly basis or amortization represented by:

$$\text{Break-even net cash flow} = \frac{\text{Capital outlay}}{\text{Annuity factor}}$$

The break-even NCF can then be determined if the capital outlay, the length of life of the asset, and the rate of interest (hence the AF) are known. Similarly, it is possible to work out the capital outlay if the net cash flow, the rate of interest and the length of life of the asset (hence, the AF) are known. The annuity factor could be also used to convert an irregular net cash flow series into a regular one following two steps:

- Working out the PV of the irregular series year by year and adding up.
- Dividing this sum by the corresponding AF (i.e., same year and discount rate).

For example:

$$\begin{aligned} Y_1 &= 10000 \times 0.952 = 9520 \\ Y_2 &= 15000 \times 0.864 = 12960 \\ Y_3 &= 21000 \times 0.784 = 16464 \\ Y_4 &= 12000 \times 0.746 = 8952 \end{aligned}$$

$$\text{PV} \qquad \qquad \qquad = 47896$$

AF (5% at Year 6) = 5.075 (see Appendix 2). Therefore, annual equivalent = $47896/5.075 = \$9438$ per year.

Difficulty in Deciding on Discount Rate

The NPV method is reliable if it uses a relatively satisfactory estimate of the opportunity cost of capital as the discount rate. Assuming a perfect money market, the correct discount rate to use in deriving present values is the market-borrowing rate. NPV under these circumstances is preferable since it selects enterprises which add to wealth (the higher the NPV, the greater the wealth creating potential of the enterprise). Conflicting results between the two methods (IRR and NPV) arise mainly from different assumptions with respect to the

reinvestment rate of cash flows from the enterprises.

Net Present Value is best calculated using the opportunity cost of capital as the discount rate, thus implicitly assuming that these cash flows can be reinvested at the cost of capital. On the other hand, the IRR method implies that earnings from an enterprise are reinvested at the internal rate of return, with re-investment rates differing from enterprise to enterprise, and not necessarily corresponding to the prevailing interest rate for those types of enterprises. In effect, although both methods are based on discounting (i.e., working in PVs), both equally depend on reinvestment rates, although different rates are assumed. On the whole, NPV is safer to use because it is easier to verify (since it is related to the cost of capital) and is more market-based.

Practical Example of Financial Analysis

The principles of benefit-cost analysis as applied in seed enterprises are illustrated with the following hypothetical example in which costs and benefits are expressed in \$ (domestic currency):

Mr Mohamed Ali registers as a grower to multiply certified wheat seed on contract for the National Seed Company. This requires investment in land, a tractor, a pre-cleaner, and a warehouse. In the first year, Mr Ali undertakes the following:

- He acquires 100 hectares of land and pays compensation or rent to the landowners for a 10-year period at the rate of \$250 per hectare. The land at present is used for growing local wheat varieties, earning on average a net income per annum of \$500 per hectare.
- He buys a tractor and implements that cost \$380,000 with an expected working life of five years. To promote productivity in farming, the government levies no duty on the import of agricultural machinery and implements.
- He purchases a pre-cleaner at \$95,000, with an expected working life of 20 years. Similarly, no duty is paid on the import of this machine.
- He constructs a new farm building (store, office, machinery shed) using local contracts and materials at the cost of \$500,000. However, about 15% of this cost comprise a retail tax on cement. The economic life of this building is expected to be 20 years.

In the second year, Mr Mohamed Ali carries out the following activities:

- He commences seed multiplication on all 100 hectares. The tractor is operated by a driver and a helper, and is expected to cultivate on average five hectares a day.
- One operator and one helper pre-clean five tonnes of the harvested seed per hour for two hectares.
- To plant each hectare, 125 kg foundation seed that cost \$1.2/kg is used.
- Fertilizer is imported into the country at US\$787 a tonne. The Government pays a 50% subsidy on fertilizer. Mr Ali applies 100 kg fertilizer per hectare for which he pays only \$250 (domestic currency).
- For harvesting, Mr Ali rents a combine at \$60 per hour to harvest 10 hectares.
- Mr Ali requires an additional labor input of 10 days per hectare. He pays all his labor at a daily rate of \$10, although the prevailing wage rate is only \$5 per day.
- Mr Ali estimates his overhead and contingency costs as 20% of his total direct costs.
- The current official exchange rate is US\$ 1 = \$6.35 (domestic currency), whilst the shadow exchange rate is US\$ 1 = \$7.65 (domestic currency).

The cost estimates per hectare of Mr Ali's operations are shown in Table 1. Calculations of benefit-cost ratio using a comparison between present values of benefits with present values of costs are illustrated in Table 3. The PV of the cost stream at 10% discount rate is found to be \$1,819,248.80, whilst the PV of the benefit stream is found to be \$1,942,942.50. The benefit-cost ratio of 1.07 is found by dividing the PV of the benefit stream by the PV of the cost stream ($1,942,942.5 \div 1,819,248.8 = 1.07$). Note that whilst the PV of the costs at Year 0 remain constant, the PV of the cost stream decreases as the rate of discount increases. As in the cases of the NPV and IRR criteria, all independent enterprises with a benefit-cost ratio of one or greater, can be considered acceptable for investment provided the costs and benefits are discounted at the opportunity cost of capital. Similarly, results for mutually exclusive enterprises are subject to error, and it is generally better to use the NPV criterion for choosing between such enterprises.

Examining the results from Mr Mohamed Ali's seed farm (where B/C ratio = 1.07 at 10% discount rate), we can derive the following additional information:

Rise in costs required keeping benefit-cost ratio equal to one.

$$\frac{(1942942.5 - 1819248.8)}{1819248.8} = \frac{123693.7}{1819248.8} = 6.8\%$$

$$\frac{(1942942.5 - 1819248.8)}{1942942.5} = \frac{123693.7}{1942942.5} = 6.4\%$$

Fall in benefits required keeping benefit-cost ratio equal to one.

This means that for Mr Mohamed Ali to break-even (i.e., B/C = 1), the total cost has to drop by 6.8%, or the total benefit rises by 6.4%. It is convenient to use the benefit-cost ratio in this way since it directly estimates how much cost could fall or benefits rise to maintain a break-even condition.

As shown in Table 2, Mr Mohamed Ali estimates his annual harvest at 3.5 tonnes/hectare, which is equivalent to 3.4 tonnes of seed/ hectare after pre-cleaning. The procurement price offered by the National Seed Company is \$900/tonne. Mr Ali therefore expects a total return of \$306,000/annum. However, he earns \$1200/tonne if he sells his seed direct to small farmers in the community.

Table 1. Cost estimates of Mr Mohamed Ali's operations.

	Cost/hectare in \$ (domestic currency)			
	Domestic	Foreign	Taxes	Total cost
Land preparation by tractor				
Repairs and maintenance	8.00	32.00	-	40.00
Fuel: 15 l/ha @ \$2/l	10.00	5.00	15.00	30.00
Labor	4.00	-	-	4.00
Sub total	22.00	37.00	15.00	74.00
Foundation seed				
125 kg seed @ \$1.20/kg	100.00	50.00	-	150.00
Fertilizer				
100 kg @ \$1.50/kg	-	250.00	-	250.00
Combine harvesting				
Rent @ \$60/hour/10 ha	6.00	-	-	6.00
Pre-cleaning				
Repairs and maintenance	2.00	8.00	-	10.00
Fuel: 5 l/hr/5t/2 ha @ \$2/l	0.85	1.65	2.50	5.00
Labor	1.00	-	-	1.00
Sub total pre-cleaning	3.85	9.65	2.50	16.00
Other labor				
10 days @ \$10/day	100.00	-	-	100.00
Sub total multiplication cost	231.85	346.65	17.50	596.00
Add 20% other costs (overheads)				119.20
Total				715.20

Table 2. Seed sales revenue from Mr Mohamed Ali's seed farm.

	Value in \$/ha
Sale of 3.4 tonnes of raw seed to National Seed Company @ \$900/tonne	3060.00
Revenue from 3.4 tonnes of seed if sold to farmers @ \$1200/tonne	4080.00

Table 3. Financial analysis of Mr Mohamed Ali's seed farm.

	UNIT	UNIT COST \$	Yr ₀	Yr ₁	Yr ₂	Yr ₃	Yr ₄	Yr ₅	Yr ₆	Yr ₇	Yr ₈	Yr ₉	Yr ₁₀	Yr ₁₁
CAPITAL REQUIREMENT														
Purchase tractor	5 yr life		1	0	0	0	0	1	0	0	0	0	1	0
Build store	20 yr life		1	0	0	0	0	0	0	0	0	0	0	0
Buy pre-cleaner	20 yr life		1	0	0	0	0	0	0	0	0	0	0	0
Acquire land	ha		100	0	0	0	0	0	0	0	0	0	0	0
Cultivate land	ha		0	100	100	100	100	100	100	100	100	100	100	0
COSTS														
Tractor	each	380000	380000					380000					380000	
Store	each	500000	500000					0					0	
Pre-cleaner	each	95000	95000					0					0	
Land compensation	per ha	250	25000					0					0	
Sub total fixed costs	per ha		1000000					380000					380000	
Seed Multiplication Yr1-Yr10														
Land preparation	per ha	74	0	7400	7400	7400	7400	7400	7400	7400	7400	7400	7400	0
foundation seed	per ha	150	0	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	0
Fertilizer	per ha	250	0	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	0
Labor 10 days @ 10\$/d	per ha	100	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	0
Seed pre-cleaning	per ha	16	0	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	0
Sub total	per ha	590	0	59000	59000	59000	59000	59000	59000	59000	59000	59000	59000	0
Other costs (20%)	per ha	119.2	0	11920	11920	11920	11920	11920	11920	11920	11920	11920	11920	0
Total multiplication cost			0	70920	70920	70920	70920	70920	70920	70920	70920	70920	70920	0
Total cost			1000000	70920	70920	70920	70920	450920	70920	70920	70920	70920	450920	0
Discount factor (10%)			1	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35
Present value of costs			1000000	64537.2	58863.6	53190	48225.6	279570.4	39715.2	36169.2	33332.4	29786.4	175858.8	0
Total PV costs		1819248.8												
BENEFITS														
Seed sales: 3.4t @ 900 \$/t	per ha	3060	0	0	306000	306000	306000	306000	306000	306000	306000	306000	306000	306000
Salvage values at Y11														
Tractor (new)	each	380000												380000
Store (11 years old)	each	225000												225000
Land	per ha	250												25000
Pre-cleaner (11 years old)	each	42750												42750
Total benefits			0	0	306000	306000	306000	306000	306000	306000	306000	306000	306000	978750
Discount factor (10%)			1	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35
Present value of benefits			0	0	253980	229500	208080	189720	171360	156060	143820	128520	119340	342562.5
Total PV benefits		1942942.5												
NPV at 10%		123693.7												
B/C ratio at 10%		1.0679916												

Risk Analysis (Adapted from Kugbei, forthcoming)

In economics, risk and uncertainty are not exactly the same. While uncertainty refers to the state of not knowing what the exact outcome would be, risk is that part of uncertainty that can be measured and therefore could be included in the planning process. For instance, the likelihood of drought is an uncertain event, but an estimated fall in earnings due to 20% yield loss from drought is regarded as a risk.

For enterprises, a single figure of performance such as rate of return, net present value, annual cash flow, or profit margin can be misleading. Actual and expected results often differ because estimates and predictions of outcomes are subject to varying degrees of uncertainty. It is therefore necessary to indicate a degree of possible variation in the result or output of an enterprise when conducting exercises such as investment appraisal and benefit-cost analysis.

Seed production is a risky business whether it is done at the subsistence or at the commercial level and therefore requires careful analysis. Risk in a seed enterprise is diverse and relates to a wide range of different activities including field multiplication, quality assurance, seed purchasing, processing, storage, distribution, and marketing. Each activity is usually associated with different types of risk and therefore requires specific management strategies to mitigate these risks.

Types of Risks in Seed Production

There are two broad types of risks that an enterprise faces in seed production: financial and physical risks.

Financial Risks

These arise from financial claims made on the seed business and are usually of the following types:

- ***Debt and equity***

The ratio of debt to equity (financial leverage) is an important indicator of financial viability. It is risky for an enterprise with low equity to take more loans because the higher the financial leverages the greater are the risks for the enterprise to meet financial obligations to lenders are.

- ***Interest and exchange rates***

Changes in interest or exchange rate could have serious implications on cash flow projections. In such cases, the enterprise has to carry out proper financial planning as a risk management strategy to minimize damaging effects on cash flow or revenue.

- ***Asset protection***

Financial planning should also ensure protection of assets by taking into account possible hazards that could result in a major loss or damage to capital items such as buildings and machinery.

- ***Terms of credit/loan repayment***

Variations in loan terms can also affect cash flow projections and should form part of the financial planning strategy.

- ***Inflation***

Enterprises operating in conditions of rapid inflation find it hard to conduct business transactions in nominal currency since monetary values are always changing and some-

times by wide margins. Estimating future price levels or repayment terms for input loans become difficult. One option, if permitted by government policies, is to maintain cash deposits in a more stable currency such as the US dollar. Alternatively, arrangements could be made for input loans and services to be repaid in kind. For example, fertilizer and transport charges could be converted into equivalent physical quantities of seed and these recovered as such from the grower at harvest time.

Physical Risks

Physical risks are wider in scope than financial risks. They are inherent in operating enterprises and are generally out of control of the management of the business. They include the following:

(i) Environment risks

There is a range of possible impacts of the physical environment on seed enterprises. Examples of environment risk include climate, weather, and outbreak of pests and diseases. All these factors affect crop yield and therefore influence performance although situations such as drought and floods may be within partial control of the enterprise. For instance, effective planning could help minimize disease risk by selecting resistant varieties and identifying suitable location of farms. In some countries, harvesting during dry weather is crucial for seed quality since sun drying is the only means of bringing seed to safe moisture content for storage. This may mean adjusting planting time so harvesting does not take place during the rainy period. This can be a risky decision to make since changing planting time could limit yield potential, while not providing a firm guarantee of dry weather at harvest time. Seed enterprises may face risks if crops registered for certification are rejected. This has a number of cost implications, which are reduced earnings for the growers who may find it difficult to repay input loans, increased cost of production per unit output, and reduced capacity of the enterprise to match actual with target production. A severe shortage may have other effects such as sub-optimal utilization of processing capacity, storage, and transport facilities. There is also the risk of storage loss, especially in climates with high temperature and relative humidity, which create ideal conditions for pest infestation. The risk of carryover stock not maintaining an acceptable level of seed viability the following season because of pest damage and physiological deterioration becomes an important factor in production planning.

(ii) Market risks

This results from variation in prices for inputs as well as outputs. A sudden increase in input prices could influence production costs significantly, resulting in higher seed prices, which some farmers could not afford. On the product side, high yield during a good year may depress prices in the grain market and farmers will save their own seed. If the agreed procurement price for contract seed becomes much higher than the grain price, there is a possibility that some growers will be tempted to sell grain as seed with the intention of fetching higher prices. Similarly, during a bad year, shortage could increase grain prices so they will be higher than the procurement price of raw seed from contract growers. In this case 'seed leakage' could occur as growers may decide not to sell their production back to the seed enterprise and instead choose to sell directly to the grain market for a higher price.

(iii) Human risks

Besides variation in prices, there is a risk associated with unpredictable behavior of other people such as traders, competitors, buying and commission agents, international agencies, and government officials who make decisions on pricing. The relationship between growers and dealers is a risky one; especially where seed moves through different hands and involves credit. The possible dishonesty of growers who may not abide by the terms of the contract agreement because of profit motive is another source of risk.

Human risk also relates to the dedication of staff to delicate tasks such as sampling, quality assessment, lot labeling, cleaning processing machines, and adjusting processing equipment to clean seed or applying chemical treatment. Mis-labeling a winter for a spring variety could lead to total loss.

Management decisions and actions are also subject to risk. A decision to treat a certain proportion of seed with chemical can be risky if this seed remains unsold and can no longer be used as grain. Similarly, deciding to keep seed in storage longer than necessary could lead to losses due to a decline in quality or lack of demand.

(iv) Lack of information

Decision-making that is based on a lack of complete information or on inaccurate information is risky to the business. For a seed enterprise to function well, information on key elements including varieties farmers want, the quantity of seed needed, the cost of producing and distributing the seed, and the price farmers are willing to pay must be available. Some of this information may already be available elsewhere and could be used readily, while others need to be collected. However, since acquiring information involves cost, enterprises should compare the cost of seeking new information with its usefulness and value. Enterprises must decide on the type of additional information, why it is needed, and how to acquire and use it.

(v) Failure of new technology

Seed enterprises may wish to diversify activities or respond to demands of the farmers by attempting to grow new crops and varieties, or introduce new practices that may in the end not be successful. Besides any financial loss, such a failure could harm the reputation of the enterprise and have adverse effects on future relationships with farmers.

Ways in which elements of financial and physical risks may affect each stage of the seed production-distribution-use chain are illustrated in Figure 15.

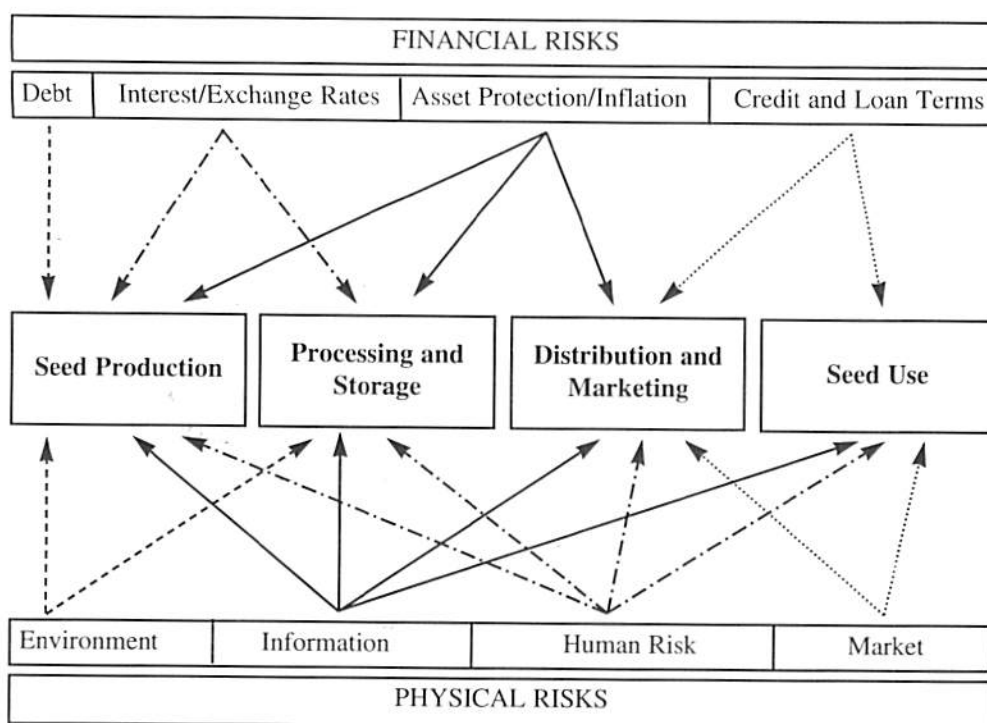


Figure 15. Financial and physical risks in seed production.

Estimating Risks

Since future circumstances are bound to change, it is necessary to assess the risk and uncertainty surrounding an enterprise undertaking. It is widely accepted that the most useful way of measuring risks is through the use of probability (i.e., probability of success or failure). Risky variables have a probability distribution, which defines the chance of gain or loss. Important variables in seed production such as future yields, prices, profit, and production costs are associated with a degree of uncertainty, and hence show a probability distribution.

At the start of a growing season, farmers do not know exactly what yields or selling prices they will receive, although they may have a reasonable idea of forthcoming possibilities. In this respect, they face risky prospects in both yield and prices. In addition, the cost of production (expenditure on inputs and overhead costs) is subject to risk too because of possible variation in the prices of inputs and other related cost items. It thus follows that profit is also risky since it represents the difference between revenue (selling price received) and production cost, both of which are risky variables.

Considering seed yield, there is a distribution of individual yield values about a mean ($\bar{y}$) expressed in kg/ha. This means that although there is an expected yield value (mean value), the actual yield obtained by the farmer fluctuates from year to year around this expected value. The deviation from the mean is expressed as the standard deviation (s), which is interpreted as a risk. It is important to always compare the standard deviation with the mean to know how representative the mean is for individual values in the data set (e.g., yield values obtained). The smaller the standard deviation is compared to the mean, the closer the individual values are around the mean. This means that the more representative the mean is for the values in the data. For a given probability distribution, an individual value (y_j) has to be compared to the mean ($\bar{y}$) and standard deviation (s) of the distribution so:

$$\frac{y_j - \bar{y}}{s}$$

gives the number of standard deviations away from the mean for the value y_j .

In statistical analysis, if the distribution of yield is normal, then 68.3% of yield values will fall within ± 1 standard deviation on either side of the mean yield, and 95.4% within ± 2 standard deviations (Figure 16). The range of possible yield values is measured on the horizontal axis and the probability of each yield value arising is measured on the vertical axis. The area under the curve equals one, which indicates that the total probability of all possible yield values occurring is 100%.

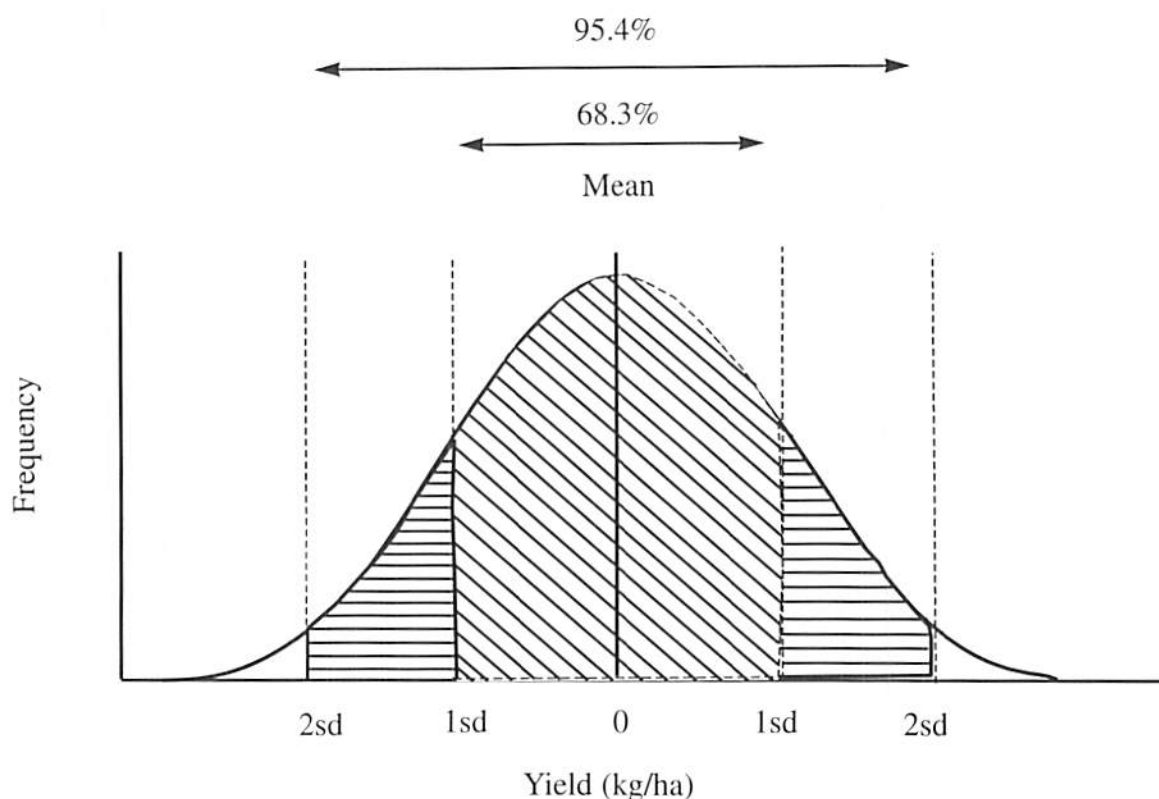


Figure 16. Normal distribution of yields values.

In many practical situations, probability distributions tend to be skewed and are seldom normal. For these, different statistical methods are used to measure the dispersion of values. In general, the greater the dispersion of values around the mean, the riskier the activity or outcome for the enterprise. Examples of different types of distribution and their characteristics are illustrated in Figures 17, 18, and 19.

A situation in which two enterprises are growing the same variety could be represented, with Enterprise A under rainfed conditions and Enterprise B under irrigation (Figure 17). Enterprise A is riskier since the degree of dispersion of yield around the mean is higher and there is a probability that low yields could arise although high yield are also possible. On the other hand, Enterprise B is more efficient and is associated with less risk, since there is a smaller dispersion of yield around the mean and there is less likelihood of low yields.

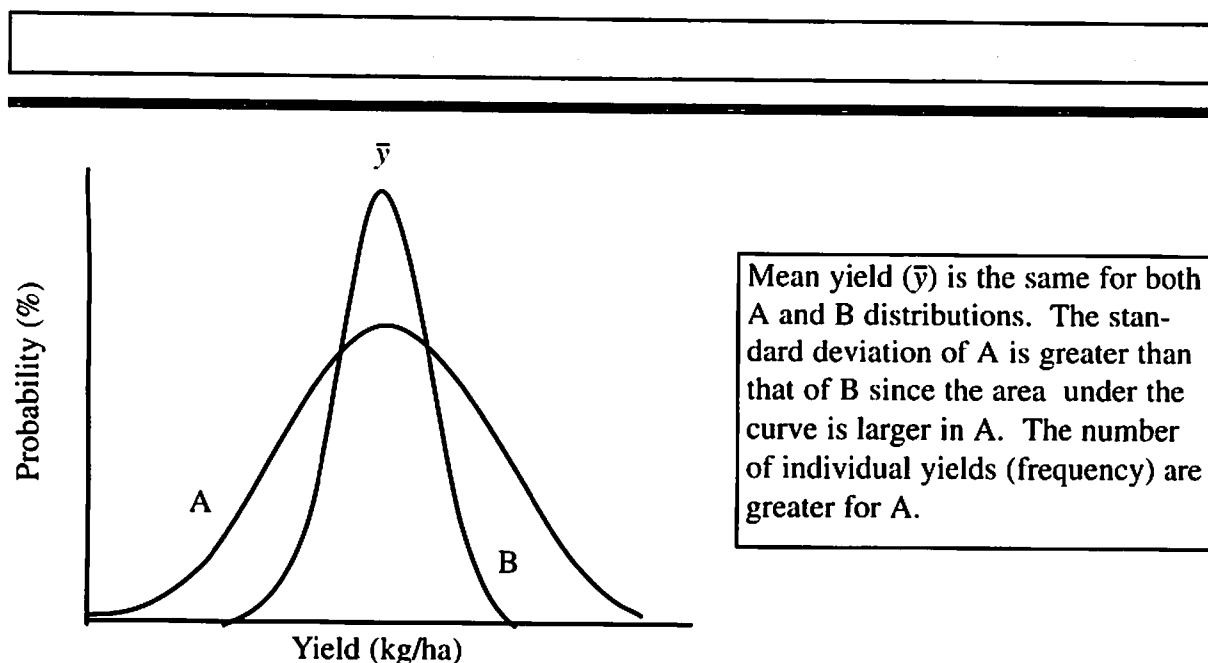


Figure 17. Probability distribution of yield with the same mean.

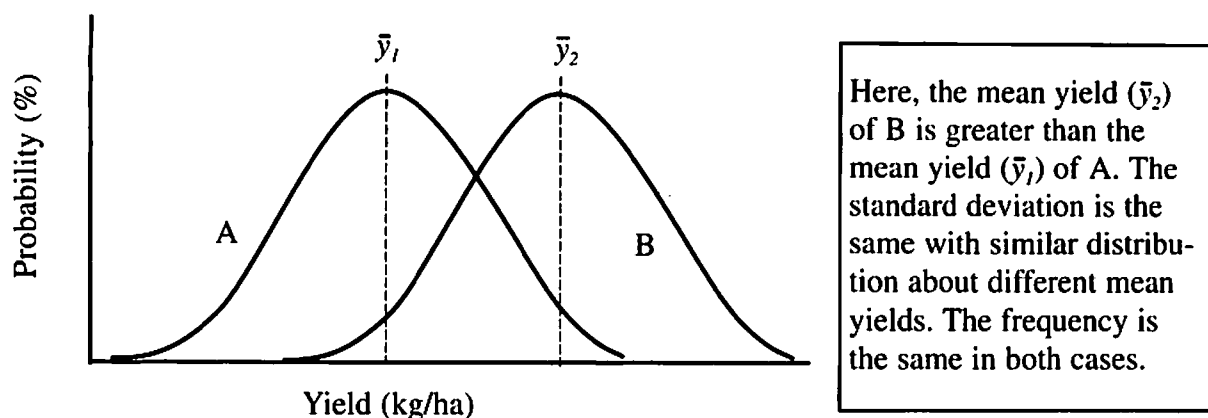


Figure 18. Probability distribution of yield with different means.

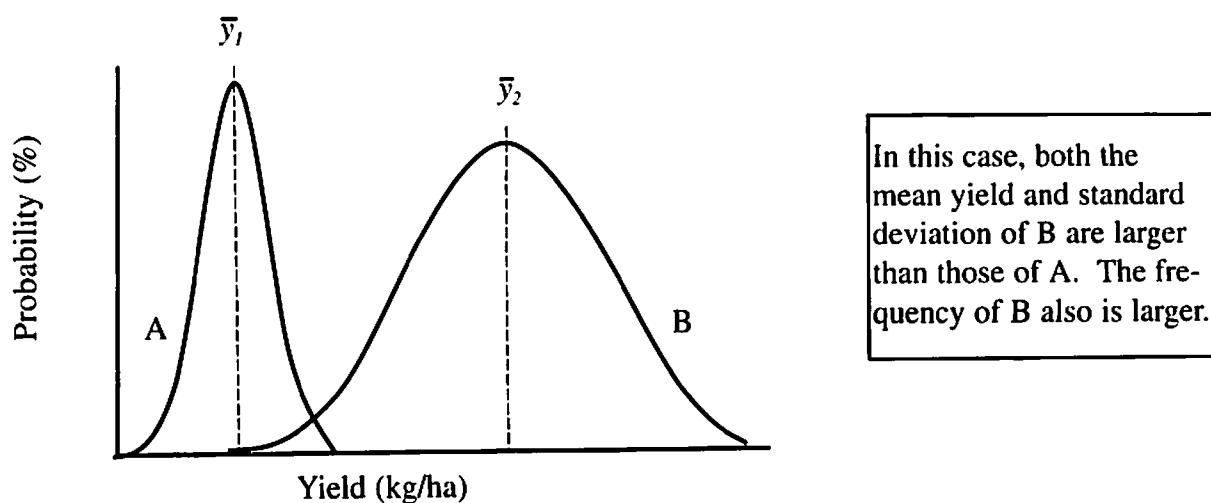


Figure 19. Probability distribution of yield with different means and standard deviation.

Since the complexity involved in dealing with a large number of variables, which are subject to chance variation is great, computing is usually used in risk analysis. Although it is useful to understand the principles used, it may not be relevant for small enterprises to engage in details of risk analysis. An important point to note is that, despite mathematical robustness, it is impossible to calculate exactly all the risks an enterprise is subjected to. In practice, it is sufficient, in many cases, just to record the kinds of risks different enterprises face and use this as a guide in enterprise management. Of course, this choice and the perception of risk are often subjective, but depend much on the level of investment or stake in the business. The entrepreneur is regarded as a person who actually accepts risk as part of the business of making money. Traders and processors often take less risk than those involved in actual commercial seed production.

Attitude towards Risk

Small-farm enterprises are generally assumed to be risk averse. This means that where there are alternatives, with seemingly the same expected return, they would usually prefer the one associated with less risk. For example, assuming a case where a local variety has 80% probability of achieving a yield potential of 500 kg/ha, the expected yield will be given as $500 \times 0.8 = 400$ kg/ha. Similarly, if an improved variety has 20% probability of giving a yield potential of 2000 kg/ha, the expected yield in this case will be given as $2000 \times 0.2 = 400$ kg/ha. Although the local variety has less yield potential, the probability of complete failure and getting zero yield is less (20%) compared to that of the improved variety (80%). A farmer who is indifferent (an often unlikely scenario) and equally desires any of the two varieties because they have the same expected yield of 400 kg/ha is considered risk neutral. The farmer who is risk averse, however, will choose the local variety with less risk of failure, judging at the same time the two varieties as equivalent only if the improved variety had a higher yield potential beyond 2000 kg/ha. A farmer who is a risk taker will prefer the improved variety because of its higher yield potential. This attitude to risk influences the adoption of new technologies especially by small farmers or businesses operating in difficult environments. They usually form different perceptions about the risk involved in new options and carefully weigh possible effects on their operations before making a decision.

Risk Management Strategies

Risk management involves formulating actions for countering business and financial risks in an enterprise. The management strategy adopted depends on the circumstances of the business. The types of managerial responses to risk in a large commercial enterprise may not be appropriate in a small business. Small enterprises often rely exclusively on building up close and trustworthy relationships with their clients, which as with other means of control, may be extremely difficult. However, in farming, risk management involves ways of coping with key effects such as unexpected changes in weather (= yield), changes in prices for inputs and outputs, or changes in the behavior of market intermediaries. For yield and price risks, the following management options could be considered:

- *Responding to price risk*

Option 1: Diversifying income sources

Enterprise diversification is the act of holding a combinations of investments. It is a risk-reducing strategy and can be part of planning. The idea behind diversification is that different combinations of investments may reduce an investor's risk more than having a single investment. It ensures a possible reduction in the total variability of returns by combining different income generating activities without unduly sacrificing expected returns. Success in minimizing risks through diversification is determined by the correlation (or covariance) among investments. Generally, higher risk investments carry higher expected returns, and vice versa. So, there should be a trade-off between the extent of risks and the magnitude of expected returns. This trade-off forms the basis of risk management strategies.

It is therefore desirable for enterprises to incorporate into their investment portfolio those activities whose returns are not perfectly correlated, that is to include activities having negative covariance, in which a high profit potential of one activity is associated with a low profit potential of the other. For seed enterprises, examples of diversification include combining production on seed farms with contract growing, seed production with grain trading, growing improved varieties with traditional ones, or seed production with other activities such as milling and sales of agro-chemicals and tools. There is a possibility for seed production to stand alone as a business especially for small enterprises.

The overall aim of diversification is to smooth the flow of income to the enterprise by allowing different activities to generate returns during different periods within the farming year; and in this way reduce the possibility of loss. The important aspects are ensuring reasonable cash combined with some element of risk avoidance.

Option 2: Contract growing

Although growers may face price risks in acquiring inputs, there is usually a greater risk associated with the final selling price of the seed they produce. Here, market choices become important if growers seek to take advantage of competitive price offers from different contracting enterprises. Growers usually enter into forward contracts with seed enterprises to guarantee them a market or a certainty of higher or stable prices. For enterprises, this is a means of maintaining a reliable source of supply and reducing the risk of buying poor quality products.

- *Responding to yield or production risk*

Option 1: Technical efficiency

Technical efficiency involves efforts to minimize losses resulting from machinery break-down. Another factor which influences yield is following technical advice and recommendations on correct seed rate, weeding practices, pest/disease control, etc.

Option 2: Diversification

Diversification in investment options can also play an important role in minimizing yield risks. Farmers may judge yield prospects by comparing current rainfall distribution with the historical pattern. On this basis they may decide to use some specific combination of crops/varieties in a particular season or adjust the use of particular inputs.

Option 3: Flexibility

There should be enough flexibility in seed production to enable the enterprise to manage risk. That is:

- to respond quickly and correctly as new information becomes available,
- to adopt technology, crops or varieties with higher prices, and withdraw from those with relatively lower prices,
- to reduce fixed costs by substituting wage labor for mechanization, and
- to use general-purpose equipment in preference to specific alternatives of higher costs.

Sensitivity Analysis

In making investment decisions, using methods such as benefit/cost analysis, a practical way of describing risk is by means of sensitivity analysis, in which the values of certain risky variables are changed and the effects of these are noted. This analysis should be done at any appraisal stage and may be included as part of the business plan, since it influences the direction of the investment.

Sensitivity analysis is a technique for testing the sensitivity of results to changes in some key variables. It is useful to assess how profit generated by an enterprise is affected by specified changes in some key variables in the sensitivity analysis.

The likelihood of occurrence of these proposed changes in key variables is then examined to determine whether the resulting changes in profit will influence decisions to proceed with the investment. In this context, sensitivity analysis is a 'what-if' technique which attempts to answer a question such as: **"What will be the net income of an enterprise if, for some reason, the volume of seed produced changes from the amount that was originally predicted?"**

Sensitivity analysis can be carried out in simple informal ways or in more formal ways. A major advantage of this analysis is that it provides an immediate financial measure of the consequences of possible prediction errors. There are two elements of sensitivity analysis.

• *Identifying key variables*

There are two characteristics that a variable must possess to be regarded as a key variable:

- It should be an important or major element of cost or return/benefit.
- There should be uncertainty about its true value (i.e., it should be variable).

Defining key variables helps focus on those factors that have the most pronounced effect on benefits and costs, easing the entrepreneur's mind about predictions that have little impact on decisions. By dealing with key variables, sensitivity analysis offers a simple means of analyzing the effects of risk on enterprise management and analysis.

The following examples are effects of some key variables often used in analyzing the performance of seed enterprises:

Example 1: Sales price(s) of main output (certified seed)

It is important to examine the activities of the enterprise to assess what will happen if assumptions about the final sale price of seed are wrong. This may happen in the case of a crop where the market price for grain is a strong basis for deciding on the seed price. For instance, in a bad year, the price of grain may rise to such a level that an enterprise may find it difficult to pay its seed growers the agreed premium, which is a specified percentage above the market price for grain.

Example 2: Purchase price(s) of capital items and main inputs (foundation seed, fertilizer)

Seed enterprises need to acquire certain capital items or facilities in the early years before any benefit can be realized. Cost overrun, that is costs rising significantly more than predicted values at this stage, should therefore be avoided as much as possible, otherwise the enterprise may become unprofitable. There could also be overruns in production costs if prices for inputs (fertilizer) and supplies (fuel) rise significantly in later years. In a case where an enterprise is shown to be very sensitive to cost overrun during sensitivity analysis, it may be desirable for the entrepreneur to obtain firm estimates of costs before proceeding with the investment.

Example 3: Demand for certified seed

It is generally difficult to make firm predictions about seed use in situations where a large majority of seed-using farmers can produce and save their own seed. Similarly, in markets dominated by few large users (such as development projects), any cancellations or reduction in seed orders could result in far less volume of seed demanded. In situations where profitability can be adversely affected by fluctuation in demand, enterprises should analyze such effects carefully as part of the production planning.

Example 4: Yield

Cultivating a newly released improved variety could be risky if the actual yield at farm level may fall significantly short of the reported estimate of yield potential. Testing the sensitivity of the enterprise to reduced yields could serve as useful guide to make decisions where an outcome like this might happen.

Example 5: Discount rate

In cases where an enterprise borrows money, the choice of borrowing or the discount rate used should best be based on the opportunity cost of capital. Where wide fluctuations in market rates of interest are possible due to rapid inflation, it is important to test the sensitivity of the enterprise to such possible changes.

Example 6: Delay in operations

Timeliness in operations is vital to the success of seed enterprises. Use of seed by farmers may be severely curtailed if seed is not available in time for planting. Delays in ordering and receiving equipment and inputs such as fertilizer may adversely affect the performance of the seed crop and render other estimates of limited use. Therefore, carrying out a sensitivity analysis to assess the effects of delay on a proposed seed enterprise is an important element in planning and decision-making.

- *Repeating the analysis for high (pessimistic) and low (optimistic) values of key variables*

Having identified key variables, the next step is to repeat the analysis with lower and upper limits of these variables (e.g., varying the key variable by $\pm 10\%$) and recording the effects. The example of Mr Mohamed Ali's farm is used to test the following:

- What would be the NPV of the financial analysis at 12, 14, and 16%?
- What would be the NPV at 10% discount if the National Seed Company purchase price of foundation seed falls from \$900 to \$850 per tonne?
- What would be the NPV of the financial analysis at 10% discount rate if Mr Ali recruits a Farm Manager whose annual salary is \$10000?

This stage in the analysis helps the entrepreneur to select suitable points at which to operate, and to formulate appropriate plans of action to minimize the negative effects of changes in key variables. Results of the sensitivity analysis are shown in Table 4.

Table 4. Sensitivity analysis of Mr Mohamed Ali's seed farm.

1. NPV of Financial Analysis at 12, 14, and 16%.

	Yr ₀	Yr ₁	Yr ₂	Yr ₃	Yr ₄	Yr ₅	Yr ₆	Yr ₇	Yr ₈	Yr ₉	Yr ₁₀	Yr ₁₁
Total benefit	0	0	306000	306000	306000	306000	306000	306000	306000	306000	306000	978750
Total cost	1000000	70920	70920	70920	70920	450920	70920	70920	70920	70920	450920	0
Modified benefit - cost	-1000000	-70920	235080	235080	235080	-144920	235080	235080	235080	235080	-144920	978750
Discount factor (12%)	1	0.89	0.8	0.71	0.64	0.57	0.51	0.45	0.4	0.36	0.32	0.29
Discount factor (14%)	1	0.88	0.77	0.68	0.59	0.52	0.46	0.4	0.35	0.31	0.27	0.24
Discount factor (16%)	1	0.86	0.74	0.64	0.55	0.48	0.41	0.35	0.31	0.26	0.23	0.2
PV at 12%	-1000000	-63118.8	188064	166906.8	150451.2	-82604.4	119890.8	105786	94032	84628.8	-46374.4	283837.5
PV at 14%	-1000000	-62409.6	181011.6	159854.4	138697.2	-75358.4	108136.8	94032	82278	72874.8	-39128.4	234900
PV at 16%	-1000000	-60991.2	173959.2	150451.2	129294	-69561.6	96382.8	82278	72874.8	61120.8	-33331.6	195750
NPV at 12%	1499.5											
NPV at 14%	-105111.6											
NPV at 16%	-201773.6											

2. NPV of Financial Analysis at 10% if NSC purchase price falls to \$ 850/tonne.

	Yr ₀	Yr ₁	Yr ₂	Yr ₃	Yr ₄	Yr ₅	Yr ₆	Yr ₇	Yr ₈	Yr ₉	Yr ₁₀	Yr ₁₁
Modified total benefit	0	0	289000	289000	289000	289000	289000	289000	289000	289000	289000	961750
Total cost	1000000	70920	70920	70920	70920	450920	70920	70920	70920	70920	450920	0
Modified benefit - cost	-1000000	-70920	218080	218080	218080	-161920	218080	218080	218080	218080	-161920	961750
Discount factor (10%)	1	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35
PV at 10%	-1000000	-64537.2	181006.4	163560	148294.4	-100390.4	122124.8	111220.8	102497.6	91593.6	-63148.8	336612.5
NPV at 10%	28833.7											

3. NPV of Financial Analysis at 10% if Farm Manager hired at 10000 \$/annum.

	Yr ₀	Yr ₁	Yr ₂	Yr ₃	Yr ₄	Yr ₅	Yr ₆	Yr ₇	Yr ₈	Yr ₉	Yr ₁₀	Yr ₁₁
Total benefit	0	0	306000	306000	306000	306000	306000	306000	306000	306000	306000	978750
Modified total cost	1010000	80920	80920	80920	80920	440920	80920	80920	80920	80920	440920	0
Modified benefit - cost	-1010000	-80920	225080	225080	225080	-134920	225080	225080	225080	225080	-134920	978750
Discount factor (10%)	1	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35
PV at 10%	-1010000	-73637.2	186816.4	168810	153054.4	-83650.4	126044.8	114790.8	105787.6	94533.6	-52618.8	342562.5
NPV at 10%	72493.7											

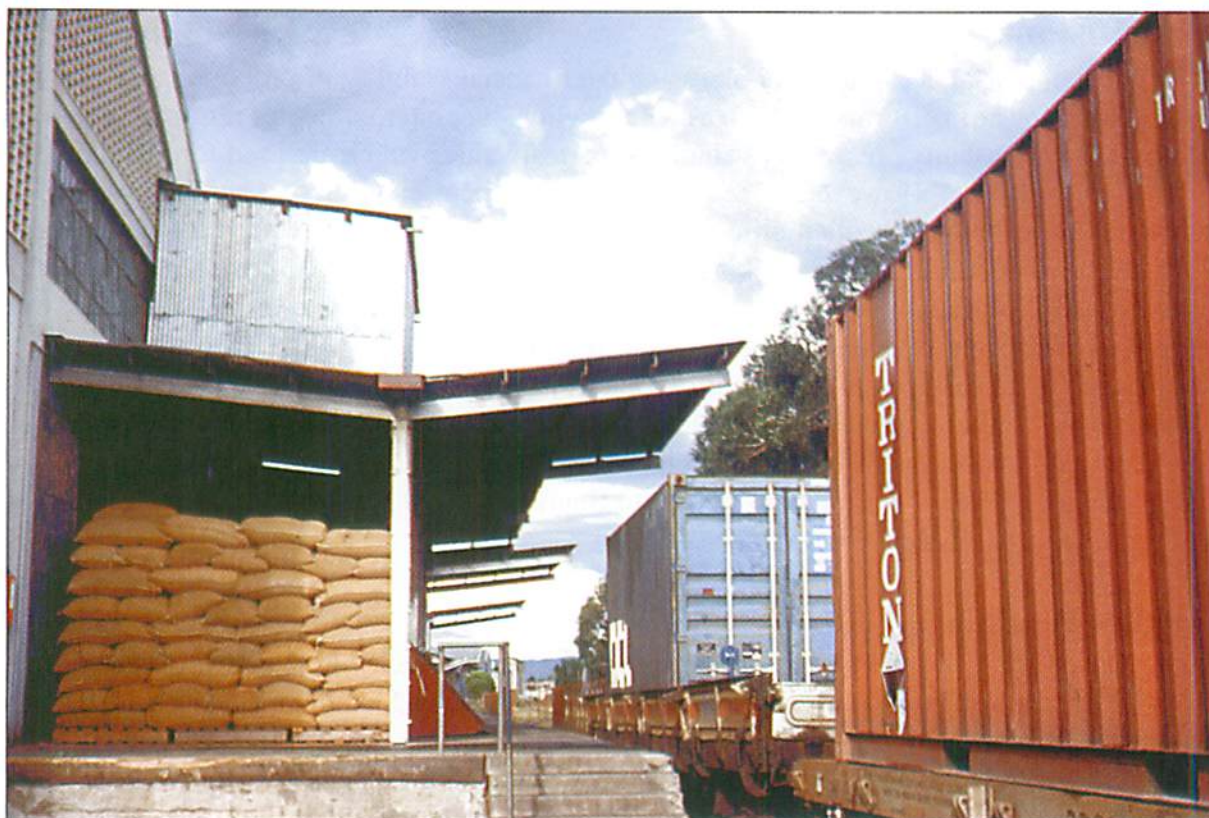
Conclusions

Investment appraisal is essential for assessing the financial viability of proposed seed businesses. Measures of performance such as net present value, internal rate of return and benefit-cost ratio are usually presented as single numerical values which are used for planning and decision-making. However, these single values by themselves are not sufficient since actual and expected results often differ because of the risks associated with seed operations. Risk analysis is a useful tool for making management decisions, since it provides information on possible variation in the measures of performance. Among the various types of risks seed businesses face are those that result from the influences of natural events, which are more difficult to handle. The effects of other forms of risk such as price distortion and dishonesty of market intermediaries could be minimized by appropriate government policy. Therefore, in many cases the government has a key role to play in formulating appropriate policy and legislation if seed enterprises are to flourish. This is particularly relevant in difficult financial and physical environments.

Further Reading

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CHAPTER 6. Economic Analysis



Introduction

Economic analysis of seed systems is complementary to financial analysis, which is discussed in Chapter 5. In fact, results generated by financial analysis are used in economic analysis. The same discounting methods are used in both cases. However, while financial analysis is regarded from the point of view of an individual or company, economic analysis considers benefits to the nation as a whole. In carrying out economic analysis, the market price used in financial analysis is adjusted to reflect the true or opportunity cost to the nation. In this way, economic analysis estimates the effect on national income, that is whether gross national product (GNP) improves or not. Prices used in economic analysis are referred to as 'shadow' or **economic accounting prices**. This chapter discusses the theoretical basis of economic analysis and illustrates this with an extension of the example in Chapter 5.

Goods Used in Economic Analysis

There are generally four types of items for which economists evaluate costs and benefits:

Traded Goods

These are goods that are traded internationally (imports and exports) and their values reported in the national accounts.

Non-traded Goods

These are domestic resources and other goods and services produced locally but because of

their nature; they are not easy to trade. Although not traded, these goods have to be valued somehow. The market price of these items often represents a measure of willingness to pay. Therefore, this is generally taken as the best estimate of opportunity cost or economic value. Non-traded items can be sub-divided into: *composite goods and services* such as electricity, water and road transport; and *domestic resources*, that is, land and labor.

Tradable Goods

These are goods that are not traded but could be, for instance goods that could be imported or exported but may not be the case because of government regulation or other restrictions. These 'tradable but not traded' items are best valued as non-traded. To do so, the domestic or market price is taken as the valid measure of economic value of the good in question since this reflects a 'willingness' to pay.

Goods and Services with Intangible Costs and Benefits

These are goods that are never likely to pass through the market system (e.g., environmental amenities, natural beauty, biodiversity, and good health). Although these are benefits to society, they do not bear a direct price since they do not pass through the market. The usual practice is to use money values for these items on the basis of willingness to pay. This aspect is discussed under economic valuation for environmental goods in Chapter 7.

Reasons for Economic Analysis

Four reasons are outlined here as to why it is necessary to estimate economic value of goods and services.

Market Failure

The varying nature of goods and services pose different problems when one shifts from financial analysis to economic analysis. Because of their nature, some goods and services either do not pass through the market and therefore have no market price, or are difficult to trade but could have a price. This category includes the non-traded goods such as subsistence goods or family labor.

Market Distortions

Market distortions could arise from three main sources:

- ***Private market imperfections***

Private markets may develop into monopolies and charge prices that give a misleading view as to the real value of the commodity to society. In economic terms, what is considered is the opportunity cost of the good, that is, what the good earns in its best alternative use. In the case of monopoly, the opportunity cost could be the free or competitive market price, which should be taken as a basis of estimation.

- ***Income distribution effects***

In economic cost-benefit analysis, income distribution effects within society are ignored and only the total income effect is considered. This means that economic analysis only assesses the capacity of an enterprise to generate or maximize national income. Income distribution (equity), poverty alleviation, and employment creation as part of social analysis are discussed in Chapter 7. The rationale behind economic analysis is that income distribution

effects normally influence actual prices. If there is a strong shift in income from the rich to the poor, then the price of basic goods will rise and there will be a fall in demand for luxuries. Therefore, the relative price of the commodities could be shifted.

- **Government policies**

These could be applied in different forms, for example:

- Minimum wage laws could offer wages that are higher than the opportunity cost of labor.
- Taxes as transfer payments (money transfer within the society) in the opposite direction; for instance, producers and consumers pay tax to the government.
- Subsidies paid by government are another form of transfer payment since these subsidies are paid out of taxes, which in turn are collected from producers and consumers. From the national point of view, subsidies are irrelevant in determining whether an enterprise will improve the national welfare since these are transfers of funds within the same society.
- Interest rates may be controlled by the government at levels above or below the opportunity cost of capital, which depends on the monetary policy. In this case, the economic accounting rate of interest may differ from the market rate of interest.
- Foreign exchange rates may be distorted, for which an allowance needs to be made. Overvalued national currency, in terms of foreign exchange, may mean that imports are cheap whilst exports become expensive. However, if the currency is much overvalued, it may become non-convertible at that rate.
- Restrictions on trade may lead to distortions. The export of seed may be prevented for strategic reasons so domestic prices become lower than export prices if the seed were traded (i.e., the domestic market is over-supplied and consequently the price falls). In this case, the economic value cannot be based on the border price as if the seed were traded. Rather, it is better to take the lower domestic price as the best estimate of economic value because farmers' willingness to pay for excess seed on the market is reflected in the lower price. This means that as long as the low price remains attractive, farmers can buy any quantity of seed available on the market. Similarly, an import ban on seed from outside may drive up the domestic price of any limited seed that finds its way onto the market. If this seed is bought at a high price because of better quality, then the economic value has to be based on willingness to pay, and the high market price becomes a good indicator of opportunity cost of the imported seed. The concept of willingness to pay is particularly useful in dealing with final goods and services because their consumption value sets the economic value, so willingness to pay becomes more relevant than opportunity cost (value in some alternative use).

Consumer Surplus

The gain in welfare of seed-using farmers is not just the *price of seed* $\times$ the *extra seed purchased*, because the price paid may fall. Since economic accounting prices are expressed in terms of *consumer willingness to pay*, a surplus arises when a farmer currently pays a lower price for seed although that farmer would have been willing to pay a higher price for the same seed (the price foregone or opportunity cost). Farmers who can afford the higher price enjoy a surplus since they are paying a lower price than what they would have been willing to pay. The difference between the two prices is the consumer surplus.

Estimating Economic Value of Goods and Services

To estimate economic values for goods and services, the results from financial analysis are adjusted to reflect opportunity cost. The exact nature of the approach used depends on the type of good or service under consideration, as shown by the following examples:

Foreign Exchange

An attempt to convert foreign exchange prices of traded goods to domestic values at the official exchange rate often results in a mismatch between relative prices of traded and non-traded items. Distortions in official exchange rates normally give rise to *shadow exchange rates*. An appropriate premium has to be attached to foreign exchange if financial prices have to be adjusted to adequately reflect economic values or opportunity costs.

The supply of foreign exchange results from exports and dealings in foreign exchange, which are credits on the balance of payments. On the other hand, demand for foreign exchange arises from the need for imports and is a debit on the balance of payments. Many countries operate over-valued exchange rates. This means that foreign exchange is cheaper in terms of local currency, than the equilibrium rate. Governments may maintain such economic situations through import controls or by regulating the volume of foreign exchange that is traded. Under these circumstances, the over-valued rate is taken as the official exchange rate. An over-valued exchange rate distorts the real value of traded commodities in which exports become expensive and earn less than in the case of a free-floating currency. This results in a decline in the supply of foreign exchange. The shadow exchange rate is an attempt to get a better measure of the value of foreign exchange. The foreign exchange premium can be expressed simply as:

$$\text{Foreign Exchange Premium} = \frac{\text{Shadow Exchange Rate}}{\text{Official Exchange Rate}}$$

The foreign exchange price of a traded good is converted to the appropriate economic value by multiplying this price by the foreign exchange premium.

Import and Export

One way of estimating the economic accounting prices of traded commodities such as seed or grain is to use international prices as a basis. There are often two types of border prices used in international trade:

The free-on-board (f.o.b.) price

For seed that is processed for export, the f.o.b. price is the total value of the seed when it is moved from the point of storage to the point of export (e.g., the harbor). This includes the ex-store price of the seed + transport costs from the store to harbor + harbor charges + handling charges + export tax/subsidy.

The cost, insurance, and freight (c.i.f.) price

For seed that is imported, the basic price is the f.o.b. price at the point of export in the exporting foreign country. To this f.o.b. price, the freight charges to the port of discharge at the importing country + insurance charges are added.

The border price used in determining the economic value of seed depends on whether the seed is for import or export. If a country produces seed locally, which replaces imported seed, then this local output serves as an *import substitute*. The opportunity cost of using domestic seed in place of imported seed is the foreign exchange saved, which is measured in terms of the c.i.f. price. On the other hand, if seed is used domestically instead of exporting it (*diverted export*), the opportunity cost in this case is the loss in foreign exchange for exports foregone, which are valued in terms of the f.o.b. price.

In the case of exports, the f.o.b. price is entered into the financial analysis by converting the foreign exchange price to domestic currency at the official exchange rate. Any export subsidy is added to this. In economic analysis, the shadow exchange rate is used to convert the f.o.b. price to domestic currency. Again, no account is taken of export subsidy since this is a transfer payment. In the same way, the economic value of diverted exports are based on the f.o.b. price, while the economic values of imports and import substitutes are based on the c.i.f. price.

In some instances, it is necessary to calculate the economic value of a traded commodity at the farm gate or enterprise site, that is, *the export and import parity prices*. The parity price of a commodity is the price that applies at the farm gate, and comprises two elements: the traded and the non-traded domestic elements, all of which have to be valued in economic terms. Normally, the imported value (c.i.f.) is the traded element, whilst the local transport and domestic handling costs are non-traded, except where transport involves considerable use of an imported item such as petroleum fuel.

The export or import parity price of a traded item (seed that is exported or imported) is its *economic value* at the farm gate or enterprise site. These values are obtained by adjusting the f.o.b. and c.i.f. prices to reflect economic values by taking into account internal transport and marketing costs. To do this, the c.i.f. and f.o.b. prices and all relevant charges, namely, charges between the farm gate and the point where the f.o.b. or c.i.f. price is quoted are converted to economic values.

Import Parity Price

The financial value of an imported tractor at the farm gate (*the financial import parity price*) comprises the c.i.f. price converted to domestic currency at the official exchange rate + domestic handling charges + local transport from the harbor to the farm gate or the enterprise site.

For instance,

(c.i.f. values) + (transport and other costs from point of import to point of sale).

To obtain the *economic import parity price* we use the shadow exchange rate to convert c.i.f. price to domestic currency omitting the duty since this is a transfer payment but adding the costs of the non-traded domestic items. Note that shadow prices are used for domestic items in cases where the market prices do not reflect true opportunity costs.

Export Parity Price

Similarly, the export parity price at the farm gate consists of: (the f.o.b. price at the point of export converted to local currency at the shadow exchange rate) minus (harbor charges) minus (local transport and domestic handling charges from the farm gate to the point of export, where these do not form part of the enterprise cost).

For instance,

(f.o.b. values) – (transport and other costs from point of sale to point of export).

In the case of seed produced for export, the f.o.b. price in \$ per tonne is entered in the financial accounts by converting the price in dollars to the equivalent domestic currency using the official exchange rate. Any export subsidy is added to this. However, in the economic accounts, the f.o.b. price in dollars is converted to the domestic currency at the shadow exchange rate, ignoring any subsidy since this is a transfer payment. The effect of this is to increase the value of the exported commodity. The same procedure is followed for diverted exports. If seed, which is destined for export, is diverted to the domestic market, the price that is foregone (the opportunity cost) is the f.o.b. price. There is an economic loss if the domestic price falls below the export or f.o.b. price.

Land

Since land is a domestic resource, it is logical to put a domestic price on it. The opportunity cost of a domestic resource represents what that resource would earn when it is engaged in its best alternative use. Estimating the cost of land is generally not easy because the cost depends on both the means of acquiring the land and the use, to which the land is put, some of which are discussed below:

Buying and Selling Agricultural Land

Enterprises may have to acquire land for production purposes. Therefore, It is expected that the cost of purchasing land or the rights to use land should be entered into the financial accounts of an enterprise. But in many countries, there is no proper market price for agricultural land since land is not sold at all. In cases where sales are made, the prices charged may not reflect the true opportunity cost of the land, that is, what the land is expected to produce when used for agricultural purposes. Such prices therefore cannot form a good basis for estimating the economic value for land. An alternative is to consider renting land.

Renting Land for Agricultural Production

Although agricultural land is not often sold in many countries, renting land is fairly common. Where a rental value exists, this value should be entered into the financial accounts of the enterprise as a cost. In theory, the present value or market value of land is expressed as follows:

$$\text{Value} = \sum_{n=0}^{\infty} \frac{\text{Annual rent}}{(1+r)^n}$$

for instance, the discounted value of annual rent for any period up to infinity. This can be simplified as:

$$\text{Value} = \frac{\text{Annual rent}}{r}$$

Where r = rate of interest or discount rate.

The appropriate rate of interest to use is the opportunity cost of capital. This means that dividing the annual rent by the opportunity cost of capital gives the economic value of land. For example, if the annual rent for land is \$500 and the rate of interest is 16%, then annual economic value of land is given by:

$$\frac{500}{0.16} = \$ 3125$$

Therefore, a reasonable estimate of annual opportunity cost of land, which is equal to the annual rent (what land is worth in its best alternative use), is the best alternative price of land.

Changing the Use of Land

Changing the use of land offers a straightforward approach to estimating the value of land. The opportunity cost of land in its present use is the *net* value of production foregone by changing the pattern of land use. This method enables a direct estimate of the productive capacity of land. For example, if an enterprise introduces an improved variety on a piece of land in place of a traditional one, the *Net return with new variety – Net return with old variety* has to be determined. The incremental effect of using the new variety is summarized in Table 5.

Table 5. Estimating the changing use of land.

	With old variety	Year 1 (With new variety)	Year 2 (With new variety)
Gross output	A	D	G
Purchased inputs	B	E	H
Cash flow	C = (A – B)	F = (D – E)	J = (G – H)
Incremental cash flow		F – C	J – C

Note that it is the net benefit or incremental cash flow that is discounted. The resources associated with the traditional variety are accounted for by always subtracting the value of C (that is, the return which would have been earned annually with the traditional variety), to get the incremental cash flow. If an enterprise acquires unused land for which rent is required for using the land, the costs of these payments are entered into the financial account of the enterprise. However, converting these financial costs to economic values involves no cost in the economic account since there has been no net value of production foregone in acquiring land that is unused.

Labor

As in the case of land, labor is a domestic resource. Although labor is movable, it is generally difficult to trade this resource since there are often restrictions imposed on the price of labor. Similarly, for economic analysis it is the opportunity cost that determines the value of labor.

Labor is valued in domestic currency. Valuing skilled and specialized managerial labor is easier because the scarcity in supply of such skills make the wage rate (w) or salary paid to be equivalent to the value marginal product (VMP) or opportunity cost. The VMP represents the value of the increase in total output of an enterprise resulting from hiring an additional worker. It pays to hire an extra laborer as long as $w = \text{VMP}$. This situation holds in the case where full employment exists for skilled labor (which is usually the case) and in cases where foreign labor is hired. Here, the market value of the wage paid is expected to equal to the actual cost or opportunity cost, and is therefore entered directly into the economic accounts. This reasoning also holds for wages paid to unskilled agricultural labor during peak seasons such as planting and harvesting. Here, competitive wages are assumed to be paid since labor is in short supply during these periods, and the wages are a reasonable estimate of value marginal product.

The analysis is different for unskilled labor in situations of significant unemployment. The employment may be *disguised*. This means, that people may be employed on farms but are not supposed to do real productive work. If these people are not employed on the farm, they otherwise produce nothing. Hence the opportunity cost of labor is very low and sometimes may be close to zero (i.e., in an alternative use, labor produces nothing since it is unemployed), meaning that the labor earns nothing if it is not used on the farm. While under such circumstances, the market value of the wage paid is entered into the financial accounts; the cost of labor entered into the economic accounts will be relatively very small. Therefore, in countries with abundant labor (and where the opportunity cost of labor is low), it is economically better, to encourage labor-intensive activities over capital-intensive ones. This may also lessen the social problems associated with unemployment.

Estimating Economic Impact of Seed Enterprises

Evaluating the success of a seed program is a continuum, starting from applying inputs and ending in assessing impact on agricultural production. The final exercise of estimating impact is actually part of economic analysis since it determines the effects at a wider level such as benefits or costs to farming communities. An example of the general steps in assessing impact is illustrated in Figure 20.

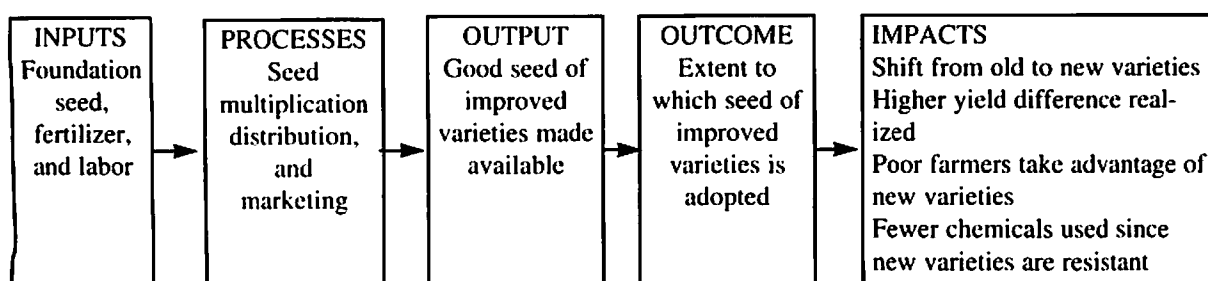


Figure 20. Suggested stages in impact assessment.

In the short-term, a seed enterprise is usually concerned about making profit but creating long-term impact is obviously important and influences the sustainability of any enterprise. What is illustrated in Figure 7 is that in assessing impact, the following question is asked: *Does the outcome or immediate result of an investment lead to an impact?* The answer to this question will depend on the kind of impact that is expected. The outcomes of a seed

enterprise may be expressed in terms of the degree of adoption of certified seed or a new variety. Adoption in this sense refers to the decision made by the farmer to take up and use new seed or a new variety. There are many factors which may influence farmers to adopt a new variety. These include the price of seed relative to what they currently use, the availability of information on the characteristics of the new variety, the perceived yield advantage, timeliness in supply, access to points of supply and sale, and sources of funds to finance costs of seed and accompanying inputs.

Therefore, measures of the degree of adoption include the proportion of farmers growing the new variety, the proportion of area cropped, or the proportion of harvest that is accounted for by the new variety. The monetary value of any increased benefit resulting directly from adoption gives a good measure of impact. This could arise from an increase in yield. But measuring yield differences that are attributed to adoption alone is difficult, since many other factors such as variations in climatic conditions, soils, and crop management practices contribute. Farmers' surveys and on-farm experiments are the main sources of such yield data. These should be collected with care, taking into account other important factors that may influence yield besides the decision to adopt a new variety. Once a reliable yield difference is estimated, it is possible to assign a value to this increase in yield to obtain a measure of benefit resulting from adoption of the new variety.

Another way of assessing the outcome of a seed enterprise at farm or community level is to determine the extent of diffusion of a new variety introduced by the enterprise. Diffusion is the process by which a new variety is spread within the community over time and space. The flow of benefit over time can be determined by calculating a diffusion curve for a new variety for a group of farmers in the community. The conventional way of representing diffusion is by a sigmoid curve as shown in Figure 21.

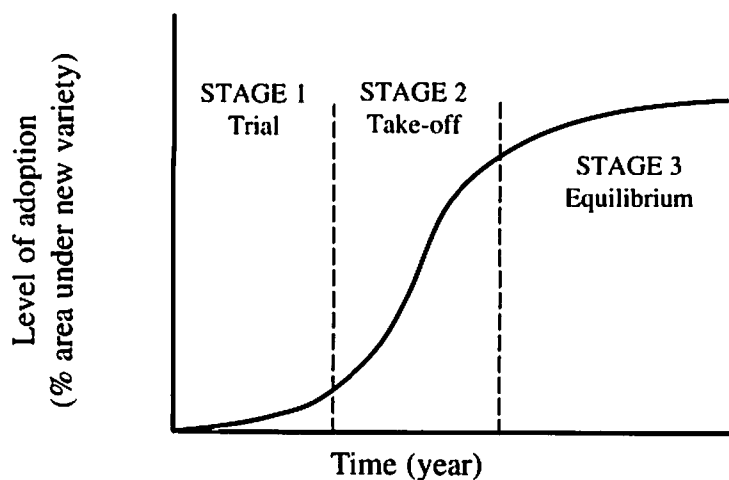


Figure 21. Diffusion curve for a new variety.

The actual increase in income realized by farmers who use new varieties depends on the variable costs (including the cost of new seed) associated with using the new variety. This can be expressed in the form of gross margins as discussed in Chapter 8. Gross margins reflect farm output response to prices, technology, and management. Results of a study con-

ducted in Egypt to determine the differences in gross margins for farmers who purchase certified seed of faba bean compared to those who use retained seed of the same crop are summarized in Table 6.

Table 6. Gross margins earned by farmers using certified or retained seed of wheat.

Item	Certified seed (CS)			Retained seed (RS)			Difference (CS - RS)	
	t/ha	LE†/ha	%	t/ha	LE/ha	%	LE/ha	%
Yield	5.4	3604.76		4.9	3359.52		245.24	7
By-product		702.38			616.67		85.71	14
Total revenue		4307.14			3976.19		330.95	8
Variable cost								
Seed		197.62	12.1		140.48	8.5	57.14	41
Manure		52.38	3.2		159.52	9.7	-107.14	-67
Chemical fertilizers		230.95	14.2		216.67	13.2	14.28	7
Pesticides		7.14	0.4		50.00	3.0	-42.86	-86
Hired machines		359.52	22.0		280.95	17.1	78.57	28
Hired labor		309.52	19.0		197.62	12.0	111.90	57
Family labor		371.43	22.8		411.90	25.0	-40.47	-10
Others		71.43	4.4		157.14	9.6	-85.71	-55
Interest		30.95	1.9		30.95	1.9	0	0
Total cost		1630.94	100.0		1645.23	100.0	-369	1
Gross margin		2676.20			2330.96		1314	15

† 1LE = Egyptian pound (US\$1 = 3.4 LE; 1998 official rate).

Source: Central Administration for Seed Production, Cairo.

For this study, results show that the yield of certified seed is marginally higher than that of retained seed. Since both products are sold mainly as grain, they fetch the same market price, and hence the similarity in the values of total revenue. It can also be seen that certified seed users tend to use less family labor, but hire more labor and machines. The amount of fertilizer used in both cases is the same. But retained seed users apply far more manure in addition to fertilizer, which may account partly for enhanced yield values close to those realized by certified seed users. Pesticide use seems significantly less in the case of certified seed, probably due to the use of treated seed or pest/disease tolerant materials. On the whole, these results do not indicate a clear advantage in the use of certified seed over retained seed since values of the total cost and the total revenue are nearly the same. In fact, a significant increase in the cost of certified seed could even further slow down the rate of adoption.

Other important factors, which can influence adoption of new varieties at farm level, are property rights and collective action. Security of tenure and ownership of land may limit the extent to which farmers would put land under cultivation although they may wish to plant larger areas with a new variety. For example, small farmers may find difficult to grow seed

of hybrid maize partly because they may not have enough land to meet necessary isolation requirements. This is linked with the externality or spillover effect of maize pollen. Growing seed of hybrid maize in such small farming communities may require collective action by farmers in the area, since the success of a farmer in growing hybrid maize seed will depend on whether neighboring farmers decide to do the same.

Practical Example of Economic Analysis

As stated earlier, results of financial analysis are the 'building blocks' of economic analysis, in which the financial prices are adjusted as required to show the impact on national income of both inputs and outputs of an enterprise. Economic analysis is therefore normally applied to development projects or enterprises which tend to have diverse social benefits. On the other hand, economic analysis is of less relevance in a situation where the objective is to maximize the household's incremental income. Therefore, for a family business (e.g., Mr Mohamed Ali's seed farm in Chapter 5) financial analysis is more relevant. Economic analysis may become necessary if for reasons of social policy the government, for instance, heavily subsidizes the use of farm inputs or waives taxes and import duties.

Having discussed some examples of how to derive economic value of important variables, the example of Mr Mohamed Ali's seed farm will be used to demonstrate economic analysis based on financial information provided in Chapter 5. The results obtained when financial prices are adjusted to give economic values are shown in Table 7, the final results of corresponding calculations for NPV and B/C ratio are outlined in Table 8. There is little difference between the results of NPV and B/C ratio at 10% discount rate for both the financial and the economic analyses (Tables 4 and 8). This shows that adjustments made to financial prices (mainly for foreign exchange effects) make a little difference to the economic outcome of the enterprise. Note that the foreign exchange premium is only 1.2 (Table 7).

Table 7. Adjusting financial prices to generate economic values.

Item	Market price (\$)	Shadow price (\$)
Costs		
Net value of wheat production (local variety) foregone per hectare, i.e., opportunity cost of land	500	500
Tractor	380,000	$380,000 \times 1.2 = 456,000$
Pre-cleaner	95,000	$95,000 \times 1.2 = 114,000$
Store	500,000	$(500 - 10\% \text{ sales tax on cement}) = 450,000$
Land preparation by tractor	74	$\text{Foreign cost} = 37 \times 1.2 = 44.4$ $\text{Domestic repairs and maintenance} = 8 \times 1 = 8$ $\text{Domestic fuel use} = 10 \times 1 = 10$ $\text{Labor cost from } \$4/\text{ha to } \$2/\text{ha} = 2 \times 1 = 2$ $\text{Total land preparation by tractor} = 64.4$ $(\text{For labor: } \$20/\text{d} = 5 \text{ ha} = \$10/\text{d shadow price.})$ $\text{Hence Mr Ali's wage} = \$4/\text{ha}$ $\$4/\text{ha Mr Ali's wage} = \$2/\text{ha shadow wage})$
Foundation seed	150	$\text{Foreign cost} = 50 \times 1.2 = 60$ $\text{Domestic cost} = 100 \times 1 = 100$ $\text{Total foundation seed cost} = 160$
Fertilizer	250	$0.787 \text{ US\$/kg} \times 7.65 = \$6.02/\text{kg shadow price}$ $6.02 \times 100 = \$602/\text{ha}$
Daily wage rate	10	\$5
Other labor	100	$10 \times 5 = \$50$
Seed pre-cleaning	16	$\text{Foreign cost} = 9.65 \times 1.2 = 11.58$ $\text{Domestic repairs and maintenance} = 2 \times 1 = 2$ $\text{Domestic fuel use} = 0.85 \times 1 = 0.85$ $\text{Tax} \times 0 = 0$ $\text{Labor from } \$1/\text{ha to } \$0.5/\text{ha} = 0.5$
Combine harvesting	6	$6 \times 1 = 6$
Revenue		
Value of pre-cleaned 3.4t @ \$900/t wheat seed/ha	$= \$3060$	$3.4 \times 1200 = 4080$
Salvage values:		
New tractor	380,000	$380,000 \times 1.2 = 456,000$
Store (11 years old)	225,000	$225,000 \times 1.2 = 270,000$
Pre-cleaner (11 years old)	42,750	$42,750 \times 1.2 = 51,300$

$$\text{Foreign exchange premium} = \frac{\text{shadow exchnage rate}}{\text{official exchange rate}} = \frac{7.45}{6.32} = 1.2$$

Table 8. Economic analysis of Mr Mohamed Ali's seed farm.

	UNIT	UNIT COST	Yr ₀	Yr ₁	Yr ₂	Yr ₃	Yr ₄	Yr ₅	Yr ₆	Yr ₇	Yr ₈	Yr ₉	Yr ₁₀	Yr ₁₁
CAPITAL REQUIREMENT														
Purchase tractor	5 yr life		1	0	0	0	0	1	0	0	0	0	1	0
Build store	20 yr life		1	0	0	0	0	0	0	0	0	0	0	0
Buy pre-cleaner	20 yr life		1	0	0	0	0	0	0	0	0	0	0	0
Acquire land	ha		100	0	0	0	0	0	0	0	0	0	0	0
Cultivate land	ha		0	100	100	100	100	100	100	100	100	100	100	0
COSTS														
Net value of wheat production foregone	per ha	500	0	0	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
Tractor	each	456000	456000					456000					456000	0
Store	each	450000	450000					0					0	0
Pre-cleaner	each	114000	114000					0					0	0
Land compensation	per ha	0	0					0					0	0
Sub total fixed costs	per ha		1020000	0	50000	50000	50000	506000	50000	50000	50000	50000	506000	50000
<i>Seed Multiplication Yr1-Yr10</i>														
Land preparation	per ha	64.4	0	6440	6440	6440	6440	6440	6440	6440	6440	6440	6440	0
Foundation seed	per ha	160	0	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	0
Fertilizer	per ha	602	0	60200	60200	60200	60200	60200	60200	60200	60200	60200	60200	0
Labor 10 days @ 10\$/d	per ha	50	0	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	0
Seed pre-cleaning	per ha	14.93	0	1493	1493	1493	1493	1493	1493	1493	1493	1493	1493	0
Combine harvesting	per ha	6	0	600	600	600	600	600	600	600	600	600	600	0
Sub total	per ha	891.33	0	89733	89733	89733	89733	89733	89733	89733	89733	89733	89733	0
Other costs (20%)	per ha	178	0	17800	17800	17800	17800	17800	17800	17800	17800	17800	17800	0
Total multiplication cost			0	107533	107533	107533	107533	107533	107533	107533	107533	107533	107533	0
Total cost			1020000	107533	157533	157533	157533	613533	157533	157533	157533	157533	613533	50000
Discount factor (10%)			1	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35
Present value of costs			1020000	97855.03	130752.39	118149.75	107122.44	380390.46	88218.48	80341.83	74040.51	66163.86	239277.87	17500
Total PV costs		2419812.62												
BENEFITS														
Seed sales: 3.4t @ 1200 \$/t	per ha	4080	0	0	408000	408000	408000	408000	408000	408000	408000	408000	408000	408000
<i>Salvage values at Y11</i>														
Tractor (new)	each	456000												456000
Store (11 years old)	each	270000												270000
Land	per ha	0												0
Pre-cleaner (11 years old)	each	51300												51300
Total benefits			0	0	408000	408000	408000	408000	408000	408000	408000	408000	408000	1185300
Discount factor (10%)			1	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35
Present value of benefits			0	0	338640	306000	277440	252960	228480	208080	191760	171360	159120	414855
Total PV benefits		2548695												
NPV at 10%		128882.38												
B/C ratio at 10%		1.053261306												

Conclusions

Individual seed enterprises and farmers are more concerned about the profit or the immediate financial return than the benefit to society or the nation. Economic analysis is usually undertaken by development or government agencies. The greater the distortions in the market for inputs and outputs are, the more differences there are between financial and economic valuations and the greater a need to carry out both forms of analyses.

Further Reading

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CHAPTER 7. Social and Environmental Impact Analysis



Introduction

Individual businesses do not usually consider rigorous impact assessment as an immediate objective. Since many of the impacts may relate to social and environmental issues, it is governments or development organizations which usually have interest in assessing impact. These issues are important, particularly at the national level and help in determining impact on local communities or farming systems in terms of effects on social patterns or on the environment. Economic analysis in Chapter 6 examined the capacity of seed programs to maximize national income, with no adjustments for the distribution effects of such income or other effects. To take these other factors into account, additional approaches are necessary beyond economic analysis which can enable a choice between enterprises on the basis of their contribution to social or environmental objectives. These additional forms of analysis are often subjective since it is difficult to use conventional quantitative methodologies for this purpose.

Social Impact Analysis

It is not sufficient to just express the impact of a seed program in terms of yield or income gain without specifying which categories of farmers are able to take advantage of the new seed, or how the benefit derived from using it is distributed among various sectors of the population. The following are two alternative views regarding social analysis:

- *Treating social analysis as social-impact analysis*

Indicators, which reflect the effect on social patterns in the community, are selected.

Examples include the effect on standard of living, income distribution, malnutrition, employment creation, or human capacity building.

- ***Carrying out social benefit-cost analysis by using social accounting prices***

This entails a complete re-calculation of NPV and IRR using these prices. This approach is similar to that one on the use of economic accounting prices (shadow prices) in economic analysis. The objective is to use social accounting prices as income distribution weightings. Social cost-benefit analysis is less widely used because the underlying ideas are complicated and abstract; hence, it is difficult to apply in practice. This approach is not considered further in this manual.

In practice, it is better to carry out social impact analysis of a seed system by providing basic information on issues such as the welfare of groups in the community who are affected by the activities of a seed program, or the effect on standard of living and malnutrition. Although subjective, this simple approach is cheaper, less time-consuming, and, of course, less abstract than detailed social benefit-cost analysis.

Examples of Social Impact

The ultimate social outcome of efforts to improve the seed sector should be the alleviation of poverty and a better income distribution for farmers.

Poverty Alleviation

Farmers, who are generally smallholders located in rural areas, save most of the seed used in developing countries. They produce food for subsistence and cannot afford or have limited access to modern inputs, such as improved seed, fertilizer, herbicides and technology. Commercial seed programs often have little impact on these poor farming communities.

Benefits from seed programs in developing countries need to extend beyond financial and economical considerations to include social benefits such as the effect on incomes of the poorest group of farmers. The extent to which the income of the poorest sector of the rural farming community is improved as a result of seed activities is an important indicator of social benefits.

There are several ways in which seed programs located in rural areas can improve the income of poor farmers and thus enhance their well being. Examples include the following:

- ***Creating employment opportunities***

This could be achieved through direct involvement in the activities of the seed enterprise. Contracting smallholders to produce seed of subsistence crops and providing employment to casual labor from the villages are examples of how to create employment opportunities.

- ***Improving on-farm yield***

Introducing varieties which have higher yield potential, or which are disease tolerant and require less use of commercial inputs.

- ***Training***

It could be achieved by providing knowledge and expertise within farming communities on good seed production practices aimed at improving the quality of farm-saved seed.

- ***Promoting local seed activities***

These activities could be targeted at the needs of vulnerable members of the farming population. Providing female refugees in resettlement schemes with seed for vegetable gardening is a way of promoting these types of activities.

- ***Helping to establish distribution/marketing systems***

These systems should be able to handle excess production (output above subsistence level), which result from the use of good seed and better farming practices.

Seed programs can contribute to a general increase in agricultural productivity and help in creating more affluent rural communities. This could minimize other social problems such as migration from rural to urban areas. Government policies on commodity pricing, which encourages rural production by promoting attractive prices for staple food crops, could enhance the process. However, reaching the poor and helping them benefit from seed activities is a practical challenge.

An obvious advantage of small rural enterprises is their ability to reach small communities in isolated areas which large organizations find difficult to serve. Meeting the location-specific seed needs of such communities is often an objective of NGOs, which seek to promote seed enterprises in rural areas.

But in many rural communities, it is easier to assist those farmers who already have some assets such as productive land or draught animals and can take a certain amount of risk rather than those with nothing. In practice, it may be difficult to become directly involved with the poorest farmers while starting seed production schemes and backing enterprise development. Nevertheless, these farmers may be beneficiaries in other ways once local suppliers are able to deliver good seed at affordable prices.

Malnutrition

Malnutrition can be an important component of poverty. Malnutrition is prevalent in many poor communities because a balanced nutrient intake is secondary to the ability of the people to afford minimum food in terms of calories. Good nutrition is desirable because of its effect on health, which is translated ultimately into increased productivity. Seed programs can help improve nutrition level in poor communities by introducing appropriate food legume varieties to supplement cereal diets, or by designing seed components specifically focused on the cultivation of vegetable crops by poor women. Besides improving the level of nutrition, the latter may also provide cash.

Income Distribution

Developing small-scale seed enterprises provides self-employment opportunities for pioneering entrepreneurs and remunerative/wage employment for others within the community. Small-scale enterprises usually use more labor-intensive practices and are important sources of employment in rural areas. Employment is a means of empowering the poor since it enables them to take part in production activities which give them the power to purchase goods and services. Opening credit, particularly to women and encouraging them to establish small enterprises based on labor-intensive cultivation methods can facilitate employment creation for the poor in rural communities. Choosing a technology is important here because much of the direct benefit from some technologies that give high returns (e.g., hybrid production) go to better-off farmers who can afford the accompanying inputs. Poor farmers, who cannot afford the full package every year, but wish to benefit from hybrids, may resort to using recycled seed with lower yield potential.

Enhancing Participation of Women

Women in developing countries receive only a small share of development opportunities. Outstanding among these is the poor access to credit, which places women in agricultural development in an unequal position compared to men. Seed enterprises should consider the

implications of their activities on the relationship between men and women. Where it is possible, an effort should be made to exploit comparative advantages in favor of women in seed production. The following questions are examples of women's role in agricultural development.

- Does a distinct division of labor by sex exist in seed activities?
- Do women play a greater role in the marketing of seed?
- Do farmers' wives play active roles both as cultivators and as key decision-makers within the domestic economy?
- Are women farmers more effective in the management of input credits, especially in terms of repayment of loans?

Seeking answers to these questions can help in designing appropriate seed schemes that will focus on the needs and capabilities of women.

Human Resource Development through Training

Efforts in training are aimed at human capacity building to help solve specific agricultural problems in developing countries. Training is generally expensive, not only in financial terms but also, and perhaps more importantly, in terms of the productive time trainees devote to courses. This is one reason why private enterprises often find it difficult to send staff away, particularly for long-term training since the opportunity cost may be high. The most successful training efforts are those that reflect changing requirements in national seed programs. They should also build on indigenous knowledge and transmit appropriate information and skills, which help transfer new technology. But determining the absolute effectiveness of training is always a difficult task. The number of courses offered or personnel trained tells only a part of the story. In fact, these represent only outputs of investment or inputs into training. What is more important, is ensuring that those people trained have distinct and positive impacts on agricultural productivity as a result of the training received. That qualitative training evaluation remains a problem.

The objective of a seed program should be to encourage the development of small-scale seed enterprises by training local entrepreneurs in seed production and marketing. The output of the scheme will be the number of people trained over a period of time. As a consequence, new entrepreneurs could organize themselves into commercial cooperatives, or local businessmen who have received training could replace public sector seed suppliers. These outcomes could lead to impacts such as (i) a shift from farmers saving their own seed to a regular purchase of seed; (ii) an increase in the area covered by certified seed compared to 10 years ago; (iii) farmers in an area using far better quality of seed than in previous years; (iv) the selling price falling in real terms as a result of competition between seed suppliers; or (v) farmers receiving higher incomes because the varieties sold by private sector entrepreneurs are higher yielding and are supported by more vigorous extension.

Monitoring and assessing how effective training efforts are should be an ongoing process. Realizing returns from investment in training is a long-term process and accomplishments are generally difficult to assess and quantify. However, important factors such as careful selection of trainees and subject matter as well as appropriate methods of instruction which target felt needs and allow active participation by the trainees themselves should be considered when assessing impact. Evaluations should not be considered as single studies conducted at the end of a training effort. Rather, monitoring changes and assessing impact should be continuous elements of the entire training process.

Environmental Impact Analysis

Environmental impact analysis generally considers a range of items, which do not pass through domestic or international markets, making it difficult to put monetary values on them. These include issues such as *in situ* conservation on farm, environmental influences on crop genetic resources, pollution, and natural resource conservation. Since they are difficult to quantify or evaluate in money terms, there is a possibility that they will be ignored as part of the analysis. In fact, one of the criticisms of benefit-cost analysis is that many of the factors affecting life may be omitted when analysis is carried out in terms of money.

Consequently, it is increasingly recognized that analysts should take into account non-marketed aspects of enterprises and refer to them when carrying out environmental impact analysis. The idea is that, rather than just giving a single value of NPV, IRR, or BC ratio, analysts should, in addition, provide information on environmental and social impacts. For simplicity, these may be recorded separately from the BC analysis itself.

Approaches to Environmental Impact Analysis

Environmental impact can be analyzed in several ways. Some approaches are suggested below:

Risk of Pollution and the Impacts on Natural Features (Land, Water, Flora, and Fauna)

A method of assessment is to list all the natural features and then record the extent to which they may be affected (or polluted) by the activities of an enterprise. This approach is referred to as environmental accounting and can be done using a simple matrix to measure all the possible impacts created by different elements of the enterprise under consideration as illustrated by a hypothetical example in Table 9.

Table 9. Environmental accounting matrix.

Natural features	Elements of an agri-business and associated impacts		
	Fertilizer use	Agrochemical use	Upland cultivation
Land	-	-	Exposes hillsides to erosion
Water	Pollutes water downstream	Pollutes water down stream	Exposes water shed
Flora	-	Introduces chemicals into fresh food products	Destroys bush fallow
Fauna	-	Destroys part of food chain	Burning destroys food chain

Having recorded the effects, the next step is to prioritize and introduce countervailing measures to minimize the consequences of these damages. These should be included in project proposals and action plans for implementation.

Use of Natural Resources and Ecological Consequences

Here, one considers conservation measures and management of natural resources, which may be renewable (fuel wood, water, fisheries, wild life) or non-renewable (land/soil, minerals,

oil). It is also important to consider ecological sustainability since there may be sensitive points in the local ecological system that might be affected by the business in question.

Creation of New Micro-ecosystems

The effects of certain activities may lead to creating new micro-ecosystems. For example, an irrigation scheme may change an ecosystem so that a piece of land becomes suitable for growing new crops which were not originally cultivated in the area. This may create a social problem if the original users of the land are forced to abandon their traditional activities, while at the same time they are not able to participate in the new ones.

Environmentally Friendly Approaches

The seed industry, in general, escapes criticism by environmentalists because it does not generate the kind of negative externalities associated with the chemical industry, although seed treatments may be a sensitive issue. Examples of positive environmental effects of the seed industry include conventional plant breeding and improved seed research aimed at developing better pest/disease resistant varieties and adapted local landraces that use less fertilizer and agro-chemicals.

Property Rights and Collective Action

Another important aspect of environmental impact is the case where natural resources are often treated as *public goods*, that is, forests as source of fuel wood; wild game and medicinal resources; grazing land for animals; water resources in a river, lake or underground; and fish resources. In all these cases, anyone in particular exerts control since individuals can help themselves to the resources. Associated with common property resources is a problem referred to as the '*tragedy of the commons*', which means that no one has an interest in conserving common property for the future when it benefits each person to exploit as much as possible. In effect, there is a tendency to over exploit forest resources for fuel wood or shifting cultivation, water and fish resources, and to over-graze rangelands. There are no straightforward solutions to the problem of securing common property resources, although several alternative measures are often suggested. A few are considered here:

- ***Private ownership***

It is often argued that if private individuals become owners of common property resources, they will have an incentive to keep for the future. For instance, a private landlord will take into account the element of exploitation in his rent calculation. However, an argument against private ownership is the negative impact this may have on income distribution or equity.

- ***Charging fee***

Fees may be charged for exploitation. That is water charges, charges for fuel wood and subsidies for conserving resources.

- ***Government controls***

Controls could be on the allocation and distribution of common property resources.

- ***Collective action***

Cooperative efforts using local customs are usually effective in some village communities to solve conflicts and enforce codes of conduct or collective behavior. This is prevalent in traditional societies where communal systems for allocating the use of rights over com-

mon resources prevail. Many national resource innovations require collective investment and action. The management of a watershed may require all farmers in a community to join together in collective action. This is because the risks involved in watershed management may be a risk for the whole community and not entirely for individual farmers.

From the outset, large development projects, in particular, should consider the above issues as an integral part of planning. This means that the appraisal of such projects should highlight environmental concerns, and suggest ways in which specific action plans could help improve environmental impact.

Evaluating Environmental Costs and Benefits

Many of the environmental costs and benefits do have money value and appear in financial or economic evaluations. Increases in agricultural productivity resulting from a soil conservation program can be estimated as illustrated in Figure 22.

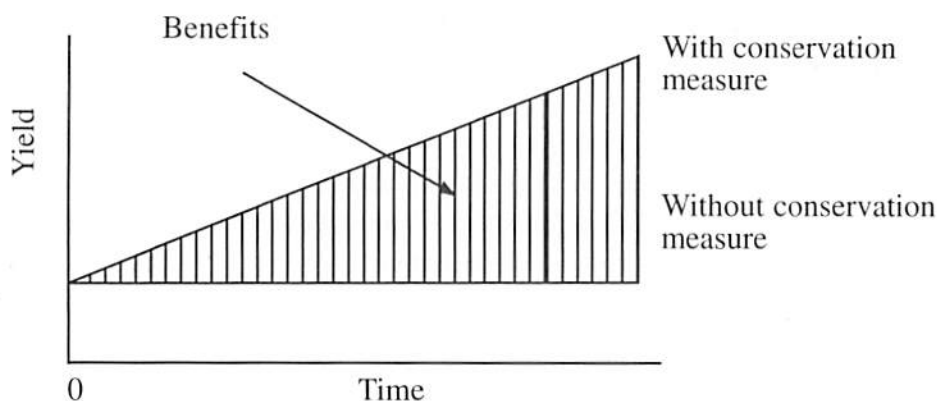


Figure 22. Increasing agricultural productivity through soil conservation.

Alternatively, a conservation measure may reduce crop losses. In other words, reduction in the progressive loss of production may be the result from a conservation measure as shown in Figure 23, or there may be combinations of the two situations.

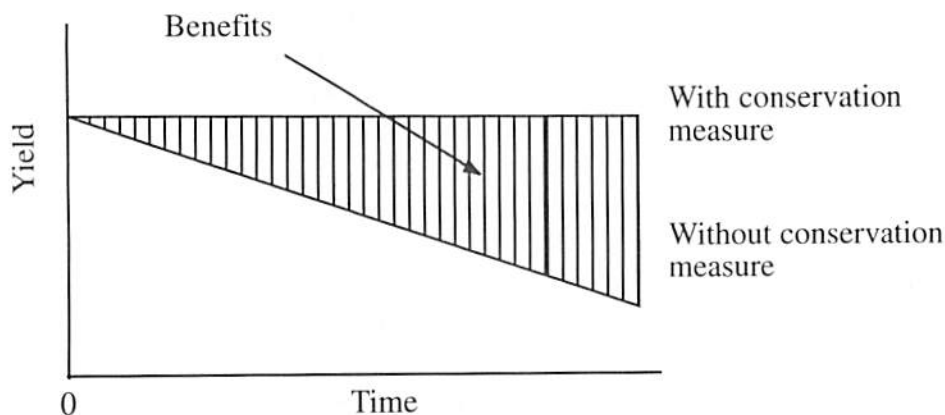


Figure 23. Minimizing loss in agricultural productivity through soil conservation.

In developing countries, the success of macroeconomic measures such as structural adjustment could result in enhanced agricultural productivity through intensive crop production and improved soil conservation. However, this productivity increase may be accompanied by other harmful environmental effects such as those of agro-chemicals, shorter fallow periods, and reduction in plant biodiversity.

Many environmental benefits take the form of payoffs in economic terms in the long run. Examples include the following:

- Improved genetic resistance may lead to increased crop productivity through reduced disease infestation.
- Improvement in the conservation and management of rangelands could bring about increased productivity in the long run.
- Agro-forestry may be practiced as a conservation measure but fuel wood and fodder produced have definite economic value.
- Income may be derived from the conservation of wildlife, parks, and game reserves.

Since all the above examples are associated with real economic value, there is a need for additional analysis that takes these into account. However, many environmental effects are *externalities*. They are environmental spillover effects of economic activities that are external to the enterprise in question. The effects of externalities are usually negative. For instance, constructing a dam for irrigation and diverting the water may limit the traditional use of water downstream to create negative effects for farmers located there although this project may provide fishing facilities. Deforestation of upper slopes of a watershed could create a shortage of water downstream. Here again, there may be a need for local institutions to deal with such matters through collective action.

Pollution, in particular, encompasses a whole range of externalities since it generally affects different categories of people outside the enterprise. Examples of pollution are the use of agrochemical, application of fertilizers, dust emission from seed processing, and dumping residues. These external effects are seldom reflected in the market price of inputs. The economic answer to negative externalities is to 'internalize' them by making polluters or causers pay for the costs associated with environmental degradation. This could be done through a regulatory system, which imposes appropriate taxation on those who cause environmental damage.

Estimating Money Value of Environmental Impact

The value of environmental impact cannot often be expressed absolutely in terms of money. For instance, maintaining plant genetic diversity within traditional cropping systems may be beyond monetary valuation. However, because of the economic trade-off between protecting the environment and other production objectives, it is important to have an idea of the cost implication of some environmental effects.

Using money values represents willingness to pay for environmental goods and also serves as a basis for comparing different environmental objectives. In cases where there are external impacts on the environment, it may be possible to measure the direct costs and benefits of such impacts. If producers lose or benefit downstream, the loss or increase in output could be measured by this effect. An alternative strategy may be to look at the costs of preventing an external effect such as pollution with agrochemical by introducing some counter-

vailing measures. The most practical approach to valuing environmental impact is based on the willingness to pay, which forms a basis for its direct measurement. Two methods, hedonic and contingent valuation, can be used for this.

- ***Hedonic pricing***

This is an indirect method of valuation, which infers the prices that individuals are willing to pay for environmental benefits. Two examples are land values and wage differentials. The value of a piece of agricultural land could be related to the environmental quality of the neighborhood in which the land is located, such as the incidence of pests and diseases or the quality of water for irrigation. Given that different locations have different environmental attributes, such variation will result in differences in land values. So the differences in values can be taken as a measure of willingness to pay for environmental advantages. This may require a detailed survey in an area affected by environmental changes compared to an area that has not been affected by such conditions. Similarly, environmental factors can cause wage differences between working in a pleasant as opposed to a less pleasant environment such as a processing plant where there is exposure to seed treatment chemicals or dust emission.

- ***Contingent pricing***

This is a direct method which involves asking individuals what they are willing to pay for an environmental benefit or what they are willing to receive as minimum compensation to tolerate environmental costs so the payment is contingent upon some desired environmental outcome. This is usually done through a formal questionnaire survey where respondents are asked what compensation they are willing to accept to protect or preserve varieties within a certain natural environment. Although it may be obvious that a protected area will yield economic benefits by preserving species or varieties that could have commercial value, it is difficult to predict in advance the exact value of a site for this purpose. Contingent pricing is very dependent on the respondents' familiarity with the environmental good in question and the means of payment, such as the compensation or the benefit to be made. This sort of information is rarely available or precise. Contingent pricing has a wider application than hedonic pricing because the former is a method that generates more reliable results.

Conclusions

Social and environmental impacts are less straightforward than other forms of analysis. Since these relate to effects on society at large, they are often not the primary concern of individual seed enterprises, which tend to be more interested in profit. Social and environmental issues have direct effects on sustainability of seed enterprises and are therefore of equal importance as financial, economic, and commercial concerns. However, since valuation using conventional methods is difficult, it is better for enterprises to identify and be aware of the social and environmental dimensions of their activities and where it is possible, draw up action plans for mitigating adverse effects. These could then be taken as complementary to other more direct measures such as net present value, internal rate of return and benefit-cost ratio.

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PART IV

COMMERCIAL ASPECTS

CHAPTER 8. Components of Cost Structure



Introduction

As a business undertaking, a seed enterprise must make a profit. This profit is the difference between the total revenue obtained from selling seed and the total cost of producing it. Commercial aspects of seed production relate to the operational stage of the seed enterprise. They cover all activities related to procuring and supplying inputs and services. These activities range from farm-level seed multiplication, processing, and storage, to distribution and marketing. When analyzing seed production commercially, it is important to define and estimate those elements which constitute the total cost of inputs and services and the value of the final seed sold. This analysis is important because to stay in business, the enterprise's profit must be sufficient enough to pay for all factors of production that are used. This means that for the enterprise to function well, the cost and revenue expectations must be planned. Details of these are included in relevant financial statements which are used as a guide in monitoring and evaluating actual performance.

Classifying Costs

Classifying costs involves grouping costs that have similar characteristics. Categorizing costs in this way facilitates analyzing cost behavior and preparing commercial reports. Costs can be classified in several ways, depending on the information required for a specific method of analysis.

Costs can be grouped according to their intended function, that is, costs intended for seed procuring, for processing, for storage, or for marketing. These costs could be categorized further according to their natural characteristics. Processing costs could be sub-divided into labor, fuel and lubricants, bags, twines, etc.

There are two other ways of grouping costs: (i) by association with a product (direct and indirect costs) and (ii) by the tendency to vary with changes in activity level (fixed and variable costs).

Direct and Indirect Costs

Direct costs are those that are measurable and could be identified with specific units (kg/bags/tonnes) of the final processed seed. Direct costs of seed production are divided into materials costs and labor costs.

Direct materials include physical resources for which quantities and costs can be conveniently measured and traced to units of the final seed offered for sale. Seed obtained from contract growers is a direct material (in this case, 'raw' material), and is acquired and recorded at its actual procurement price, which represents a certain proportion of the final selling price of processed seed. Other examples of direct materials are those which are required for the production process such as fuel/lubricants for processing, seed dressing, fumigants, and packaging material.

Direct labor consists of the services of employees who are engaged in physical operations that are linked directly with units of seed produced such as services of casual laborers who are hired specifically to load and unload trucks of seed. Here, the specific quantity or units of seed involved can be clearly identified with the labor inputs, that is, labor hours used.

However, certain types of material-related costs (machinery repairs and maintenance, depreciation, power, lighting and heat, insurance, rent) and some categories of labor cost (supervision and store keeping) are clearly costs of producing the final seed. It can be difficult to associate them with a unit of seed output and it may not even be worth the effort. For practical reasons, these are usually classified as indirect materials costs and indirect labor costs, which together are included in the production overhead.

Overhead costs are seldom as identifiable and measurable as direct costs. Although it might be theoretically possible to measure, for example, the amount of power, rent, or insurance needed to produce a unit of seed, it may be better to use approximation methods to allocate overhead costs to seed output. Any index chosen to attach overhead costs to seed output should directly reflect the way in which the overhead costs are incurred, namely, changes in levels of production activity. For this purpose, direct labor hours are often used as an index since many overhead costs tend to vary proportionally with the number of direct hours worked, which in turn often vary according to the number of units of seed produced.

Fixed and Variable Costs

It is useful to consider the planning periods of seed enterprises as short run and long run periods. In the short run period, seed production levels often tend to be stable. Small changes in output do not affect costs such as supervision salaries and depreciation. Therefore, these costs remain more or less constant. However, in the long run period, most of these costs become variable as output increases beyond its current level.

The short-run is a period of time which is long enough to permit certain changes in seed

output without changing the production capacity of the enterprise. The long run is generally considered to be that period which is sufficiently long for seed output to be altered by varying the size of the enterprise. For example, during the short run, it may be possible to increase the quantity of seed processed by varying the amount of labor (e.g., by using two or more shifts). On the other hand, in the long run, the amount of seed processed can be varied either by increasing the size of the processing plant and warehouses, or by increasing the number of staff including supervisors. This additional investment increases depreciation and supervision costs (previously regarded as fixed costs), thus making them variable this time.

There are two major categories of costs associated with short run and long run planning periods: fixed costs and variable costs.

- *Fixed costs (sunk costs)*

These are costs which are incurred regardless of whether seed is produced or not. This group includes items such as supervision salaries, rent, insurance, and depreciation. It should be emphasized that costs do not become fixed until they have been incurred. But after costs have been incurred, they do not vary with changes in seed produced and can have no effect upon decisions regarding an increase or decrease in production.

- *Variable costs*

These are costs which tend to increase or decrease with changes in the quantity of seed produced. Examples include direct materials and direct labor costs.

In the short run, some costs are fixed and others vary. In the long run, however, all costs become variable. Those, which were originally fixed, may now influence decisions regarding a change in the level of production. Figure 24 is a graphical representation of the behavior of fixed and variable costs of production.

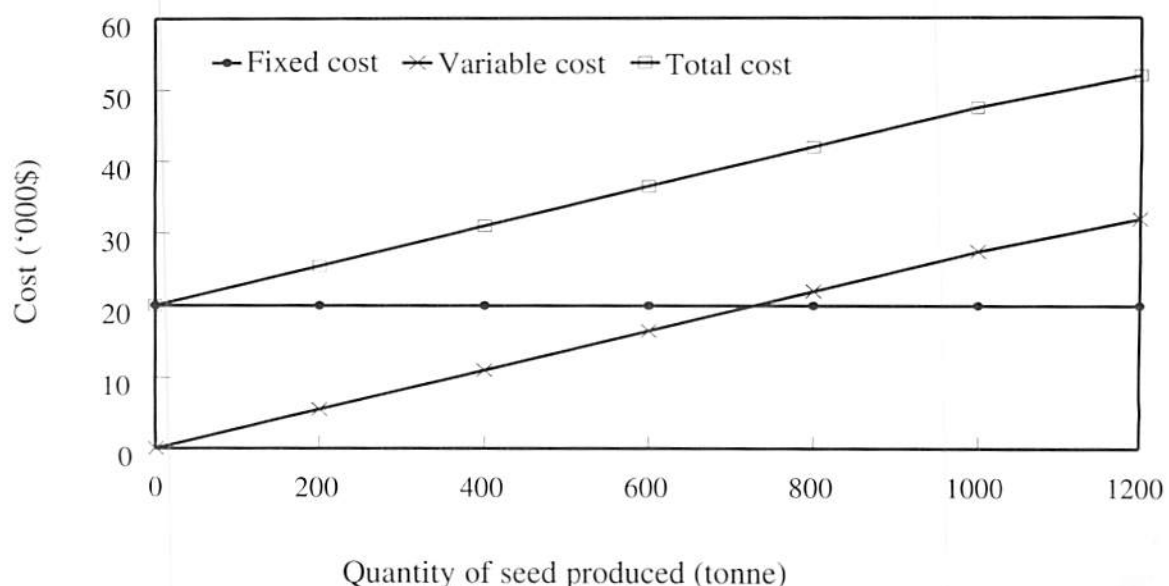


Figure 24. Fixed and variable costs of production.

Production Overheads

Besides direct materials and direct labor, all other costs, which can be identified with the seed produced, are classified as production overheads. Production overhead costs are usually divided into fixed and variable components.

- **Fixed production overheads**
These tend to remain the same regardless of changes in production such as depreciation, rent, and supervision salaries. In processing seed, depreciation or rent remains the same whether the plant operates one shift or more.
- **Variable production overheads**
These tend to vary in response to changes in production levels, so that a direct relationship between a cost item and the seed processed in the plant may exist. Examples of variable production overheads include heating, lighting, repairs, and maintenance.

Total Cost of Seed Production

The total cost of seed production comprises various components, which can be classified as fixed, variable, direct, or indirect. The various categories of costs in the production-distribution-use chain are shown in Figure 25.

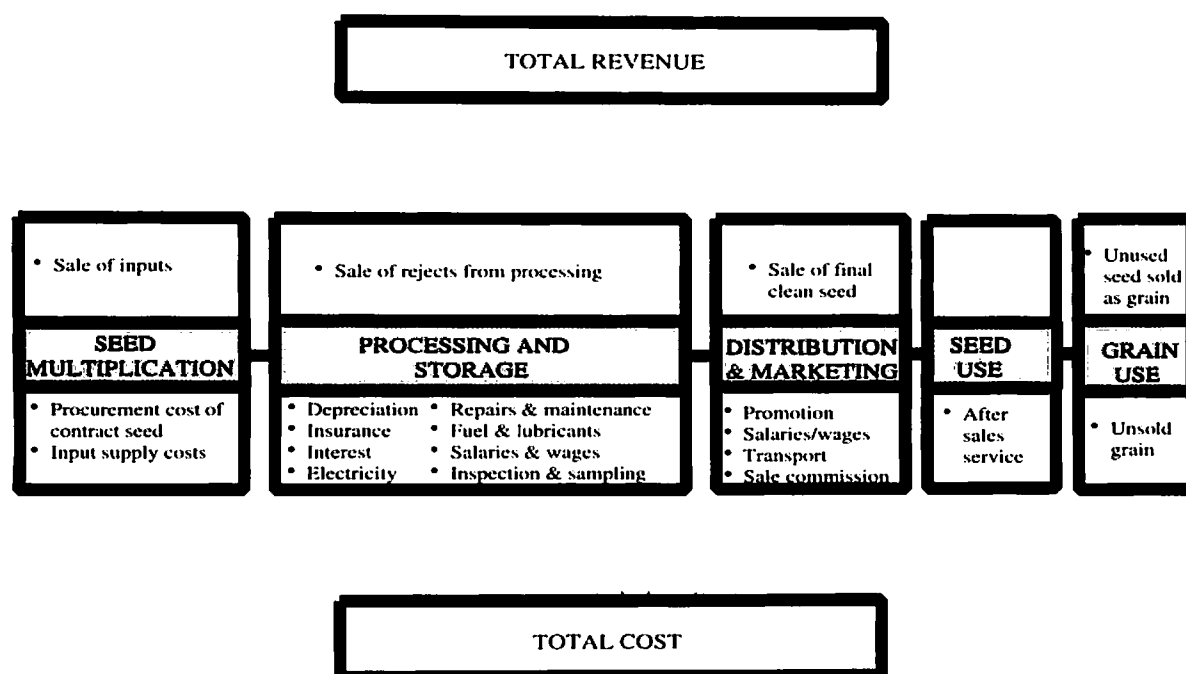


Figure 25. Components of total cost and total revenue in seed production.

Field-level Seed Production Cost

In many developing countries, producing certified seed on farms owned and operated by seed enterprises has proved to be costly and inefficient. An alternative approach has been to pass this farm-level activity to growers who produce seed on contract. Contract arrangements usually specify certain conditions to be adhered to, which include the following:

- Crop/variety/category of seed grown.
- Husbandry practices (time of sowing, weeding, spraying, harvesting, etc.).
- Roguing, field inspection, and certification standards.
- Farm-gate price and terms of payment.

The seed enterprise should pay a procurement price that must cover the grower's total cost plus a margin attractive enough to allow the grower abide by the terms of the contract and remain in seed production. The cost structure, expressed in Egyptian pounds (LE), of a typical wheat grower at Shirbeen Seed Center in Egypt during 1996 is shown in Table 10. For crops, in which seed is also the grain produced for food or other purposes (cereals, oil-seeds, and dry seeded legumes), the approximate price for contract seed usually takes the market price of grain as the basic production value. The general practice is that seed enterprises pay their growers a fixed premium (about 15%) above the grain price as an incentive for extra care and attention. They also cover costs associated with additional operations such as roguing. For the enterprise, other costs incurred in connection with procuring seed from contract growers include supervision costs and costs of physical elements such as packing materials, transportation, and handling. Finally, there are risks associated with financing the purchase of raw seed from growers and storing this seed until final distribution and marketing.

Table 10. Cost structure for a wheat grower in Egypt.

Description of item	Amount in Egyptian Pound (LE [†]) per feddan [‡]
Land preparation using tractor (hire)	40
Wages for two person-days for making rows	12
Foundation seed (60 kg)	65
Two people for broadcasting seed	10
Irrigation (5 months)	70
Roguing (10 person days)	50
Insecticide/labor for spraying	60
Superphosphate fertilizer (2 bags)	30
One person-day for phosphate application	5
Nitrate fertilizer (4 bags)	88
Two person-days for nitrate application	10
Twelve person-days or machine for harvesting	60
Threshing: four hours per feddan @ LE 20	80
Labor for feeding machine and packing seed	90
Transportation from field to farm store	20
Sub total costs	790
Sale of contract (raw) seed: 2.3t @ LE 740/t	1702
Sale of rejects after final cleaning: @ LE 200/t	460
Sub total revenue	2202
Profit	500
Profit as percentage of total cost	63%

[†] 1 US\$ = 3.5 LE

[‡] 1 feddan = 0.42 hectares

Source: Shirbeen Seed Center, Dakhalia Governorate, Egypt.

Depreciation Cost

Depreciation is a fixed cost estimated on annual basis. It represents the loss in value of fixed assets (e.g., buildings and machines) with the passage of time, whether or not these assets are used. Depreciation can be regarded as the amount of money that should be set aside each year as the asset is used. At the end of its useful life, this money, along with the remaining value of the asset (salvage value), could be used to replace it. Several options exist for determining depreciation. Each method requires an estimation of the service life of the asset. Two methods are described here:

Straight Line Depreciation

The simplest way of estimating depreciation is the straight-line method, which is represented as:

$$D = \frac{(P-SV)}{Y}$$

Where D = annual depreciation in \$ per year; P = purchase price in \$, SV = salvage value in \$, and Y = years of service

This method applies generally to capital items such as buildings and improvements, which include newly erected permanent warehouses and concrete drying floors; fixed equipment such as processing plants and silos; improvements, such as fencing around drying floors. An important characteristic of such assets is that they often do not have significant trade-in value at the end of their useful lives. If the enterprise no longer exists, these assets cannot be removed and sold at open market prices, but may just be left as benefit to an in-coming buyer. Therefore, the normal approach is to spread the cost over a fixed number of years so that the value reaches zero at the end of the final year. The salvage value for a processing facility having a purchase value of \$100,000, with an expected service life of 10 years, and annual depreciation charge of \$10,000 (10%) is zero at the end of Year 10 (Figure 26).

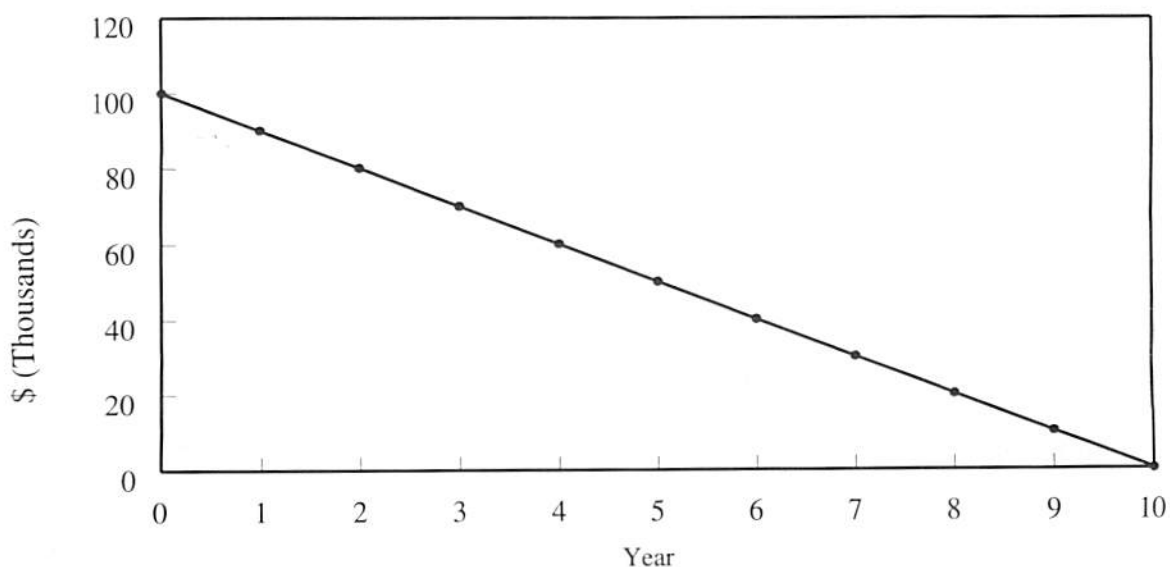


Figure 26. Straight line depreciation.

Diminishing Balance Depreciation

This method is generally applicable to machinery which can be traded-in or sold after a period of time. Therefore, it reflects a resale value if liquidated. In the diminishing balance method, the depreciation charge is taken as a specific percentage of the purchase price in the first year; the remaining balance represents a written down value for the asset. Subsequent years apply the same percentage depreciation to the respective written down values. The diminishing balance method using a fixed 25% annual depreciation charge for a plant having a purchase price of \$100,000 is illustrated in Figure 27. This method takes into account the fact that a new asset loses value faster in the first few years than in the later years.

Deciding which of the two methods should be applied in a given situation depends on the simplicity desired and the ease of trading in or selling the asset in question.

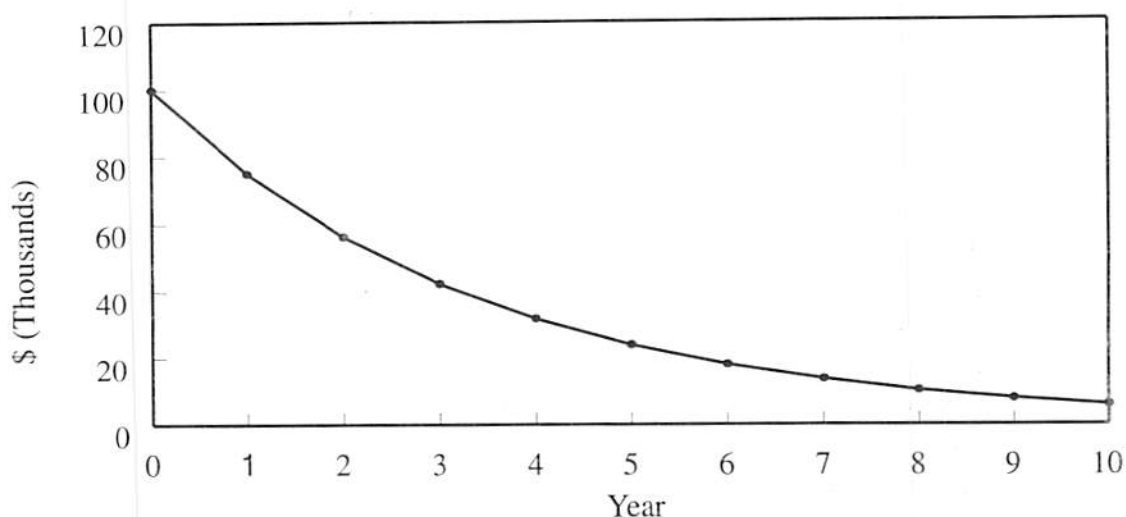


Figure 27. Diminishing balance depreciation.

Effect of Inflation

Both the straight line and diminishing balance methods ignore the effects of inflation. As explained earlier, the traditional idea of depreciation is to provide an untaxed reserve to help replace assets as they wear out over time. Unfortunately, during periods of severe inflation this principle becomes less valid. For instance, there may be cases when machines, which are several years old, are sold at prices higher than their original cost. The price of new machines may rise to such an extent that it becomes impossible to purchase a replacement with the salvage value plus the depreciation reserve. Under these circumstances, depreciation only becomes relevant if inflation is taken into account to calculate the amount of money that is going to be set aside.

Inflation accounting, however, requires more demanding data, on knowledge of current replacement and trade-in values, than conventional ways of estimating depreciation. Many entrepreneurs cannot afford time and trouble to follow this method of analysis.

Interest Charges

Interest rate applied on an asset depends on two factors:

- If the entrepreneur owes money on an asset for which payments are being made, the actu-

al prevailing rate of interest is used in the calculation.

- An interest charge is still made for an asset that is bought and fully paid for, because money tied up in an asset could otherwise be invested to yield a return. It is worth to note that interest charged on an asset, which is paid for, is a fixed cost.

Average annual interest charges are calculated using the following relationship:

$$\frac{(\text{Purchase Price} - \text{Salvage Value})}{2} \times \text{Interest Rate}$$

Insurance Cost

Insurance costs include any liability or replacement insurance carried on an asset. This is often estimated as a percentage of the procurement price of the asset where the chosen percentage could represent a certain proportion, say 10% of the rate of interest. The choice of insurance rate to apply is usually based on the probability of a real damage or loss and the value of the item insured.

Repair and Maintenance Costs

A seed enterprise, which has a mechanized component, must ascertain easy availability of spare parts and repair services locally. Alternatively, the enterprise may have to establish its own repair service and provide training for staff involved in repairing and maintaining the machines and equipment. A machine should be maintained to ensure that it performs efficiently to reach optimum working life according to its designed features. This includes following service schedules (periodic adjustments and lubrication) based on the manufacturer's recommendations in the operating manual. Failure to adhere to these precautions could lead to technical malfunction and result in high operating costs, accompanied with a shortening of machine working life. Repair and maintenance costs are usually estimated as a percentage of the purchase price of the asset. For working machines, such as seed processing plants, this cost is often expressed on hourly basis. Repair and maintenance costs between 1 and 5% of the purchase price per year are normal for most machines.

Fuel and Lubricant Costs

Enterprises may have machines which use fuel and lubricants. Fuel cost in say dollars/hour, is the fuel consumed by the machine in liters/hour multiplied by the current fuel price in \$/liter. Lubricant costs/hour may be averaged to 10% of the comparable fuel costs.

Electrical Energy Cost

Many plants use electrical energy to process seed. Calculating the cost of this energy requires some basic understanding of the principles of electricity. Every electrical appliance or machine requires a specified amount of power (in watts) to do work. The amount of electrical energy used is expressed in watt-hours (Wh), which is calculated by multiplying the electrical power of the machine in watts (W) by the number of hours (h) electricity flows through the machine. For commercial purposes, the kilowatt-hour (kWh) is the conventional unit of electrical consumption, where one kilowatt equals 1000 watts. The amount of electrical energy used can be represented by:

$$EE = \frac{P \times T}{1000}$$

Where EE = Electrical energy (kWh), P = Power (W), T = Time (h)

Since electricity is usually charged at the rate of, for instance, \$/kWh, the cost of operating a processing plant is easy to calculate by multiplying the total kWh by the cost in dollars per kWh. The cost of electrical energy used per hour is calculated by multiplying the power of the machine in kW by the rate charged per kWh.

Example: What will be the cost per hour to operate a 30000-watt processing plant if electricity costs \$0.2/kWh?

Solution: Power of processing plant = $30000/1000 = 30\text{kW}$
 Cost per hour = $30\text{ kW} \times 0.2\text{ $/kW} = \$6$

Seed Processing Cost

Owning a processing facility is usually a large capital investment for a seed enterprise. Selecting the wrong type of processing plant can, therefore, have a serious effect on profitability of the enterprise.

Criteria for Selecting Processing Facilities

Some criteria commonly used for selecting seed processing facilities include the following:

- **Name of manufacturer**

One important economic decision that a manager makes is selecting the components of a processing plant from reputable manufacturers. Well-established and reputable companies usually produce machines of good quality and durability. They possess sufficient resources to offer efficient after-sales service including warranties and operating information.

- **Design features**

Minor modifications in design may render a particular plant which is more suitable than others for a given situation. Particular attention should be given to bulk, energy consumption, types and range of sieves, indented cylinders, and aspirators to suit the kinds of seeds to be processed and the contaminants to be removed. Operation safety through, for instance, proper guarding of transmission and moving parts should be considered too. In cases where portable or mobile plants are needed, suitability for towing transport has to be investigated. Generally, the more options a particular design can offer, the greater the suitability of the plant for managers working under variable conditions for which flexibility is important.

- **Capacity and size**

Timeliness is considerably important in selecting the optimum size of a processing plant. A faster and more powerful plant may be needed in a situation where time is crucial. The unit cost of operation is determined, primarily, by the power required and the throughput. But the processing capacity has to be used to the optimum, both in time (number of hours worked) and throughput to make it economical.

- **Repair and maintenance**

All machines are liable to break down sometime in their working life. Buying a cheap plant may not be economical if spare parts are difficult to get or are expensive to purchase and replace. Therefore, in addition to quality and durability, the amount of time and money that will be required to repair a machine, in case it breaks down, has to be taken into account.

- **Ease of operation**

A processing facility should be well designed so that it is easy to operate and maintain. When dealing with seed that is sensitive to mechanical damage, there should be a minimum mechanical or manual handling associated with the processing operation.

Classifying Processing Costs

Several elements contribute to the cost of owning and operating a seed processing facility. The typical costs incurred can be divided into fixed and variable categories as already discussed.

- **Fixed costs**

These include purchase price of plant and equipment, depreciation, interest on investment, property taxes, shelter, insurance, and supervision salaries.

- **Variable costs**

These include costs of repairs and maintenance, fuel/power, lubricants, labor, and materials (bags, seed dressing, twine).

The owner has to pay the fixed costs regardless of whether the plant is used or not. The total of these fixed costs represents the annual ownership cost of the plant. This ownership cost can be expressed as a percentage of the purchase price of the machine. Variable costs (often referred to as operating costs), on the other hand, are only taken into account when the plant is in operation. The total operating cost in dollars per hour, therefore comprises the sum of all the variable cost elements mentioned above. To estimate the processing cost of seed, the total annual cost of the processing plant must be determined. This annual cost is the sum of the annual ownership cost (total fixed costs) in dollars per year and the total operating costs (total variable costs) expressed in dollars per hour. The total operating costs in dollars per hour can be converted to dollars per year (to correspond to the case of the annual ownership cost), by multiplying this amount by the annual use in hours known for the plant. The annual use in hours is estimated using the example in Table 11.

Table 11. Annual use of a seed processing plant.

Season	Working days	Shifts/day	Working hours/shift	Working hours/day	Working hours/season
	 Number				
Major	150	2	4	8	1200
Minor	50	1	4	4	200
Total per year	200				1400

The annual use relates to the effective processing season, which is normally the period between the dates of seed harvesting and the planting time. The effective annual use of a plant excludes the time lost in cleaning machines between varieties, time for repair and maintenance, holiday periods, etc. After estimating the annual use in hours, the next step is to calculate the cost of processing seed per unit, that is, one tonne of wheat. To do this, the cost of processing per hour is first determined and then this value is converted into the cost per tonne based on the throughput capacity of the plant. Consider a processing plant with the following specifications as an example:

A. Information known			
Purchase price:	\$110000	Economic life (L):	20 years
Price of building:	\$ 40000	Salvage value (S):	4500
Total new price (P):	\$150000	Working days/year:	200
Interest on capital (IR):	12%	Working hours/year or annual use (U):	1400
Power:	250000W	Capacity of plant:	2 t/hr

An example of the cost calculations involved is outlined in Table 12.

Table 12. Example of cost calculations in seed processing.

Cost description	Calculation method	Amount (\$)
B. Fixed cost (per year)		
Depreciation	$(150000 - 4500) / 20$	7275.00
Interest IR = 12% per annum	$(150000 - 4500) \times 0.5 \times 0.12$	8730.00
Insurance $(P) \times (IR/10)$	150000×0.012	1800.00
Salaries: two operators @ \$1000/month	(1000×12)	12000.00
Sub total per year		29805.00
Total fixed cost/hour	$29805 / 1400$	21.29
C. Variable cost (per hour)		
Repairs and maintenance 3%P/U	$(150000 \times 0.03) / 1,400$	3.21
Electrical energy @ \$0.2 per kWh	250×0.2	50.00
Oil and grease 1% energy cost	$250 \times 0.2 \times 0.01$	0.50
Wages of two casuals @ \$2/tonne/0.5 h	$(2/0.5) \times 1$	4.00
Total operating cost/hour		57.71
Total processing cost/hour	$21.29 + 57.71$	79.00
Processing cost/tonne raw seed	$79/2$	39.50
Cost/tonne clean seed, if rejects = 12%	$79 / (2 - 12\% \times 2) = 79 / 1.76$	44.89

An entrepreneur who is interested in hiring a processing facility needs to know the unit cost of processing seed. If the plant in this example was leased for custom processing at a rate of \$50 per tonne of raw seed, the profit per tonne would be $50 - 39.50 = \$10.50$. The profit of $10.50 \times 2 \times 1400$ per year equals \$29,400. Return on the initial investment, after providing for depreciation and interest, would equal 19.6% (i.e., $29400/150000$). If this plant is owned

by an enterprise, which processes its own seed, the cost of processing, including the rejects (i.e., \$44.89/tonne) should be charged. The re-sale value of the rejects will be used to offset the cost of processing.

Use of Processing Capacity

The cost of seed processed depends, to an extent, on the use of processing capacities. Total costs are divided by the annual use (effective hours worked during a year) to obtain the cost per hour. This means that the more hours worked, the less the processing cost per hour is, and correspondingly the less the cost per tonne of seed processed. To select a machine of appropriate capacity, it is important to determine the annual use in hours and the estimated total quantity of seed to be processed. If the annual use is 1500 hours and the total throughput is 1,500 tonnes, the capacity of plant required should be:

$$\frac{1,500}{1,500} = 1 \text{ tonne per hour}$$

It is often a mistake to construct very large processing plants with excess capacity, when there may not be sufficient seed to enable optimum use of such facilities. Consider the case of a country with several plants, for which the total hourly capacity is 25 tonnes per hour. Assuming these plants can work 200 days in a year at one shift of 8 hours per day, the total amount of seed required for optimum use of processing facilities is given by:

$$25 \times 200 \times 8 = 40,000 \text{ tonnes.}$$

In case the national output is only 15,000 tonnes, then, the total capacity actually required is given by:

$$\frac{\text{Total output in tonnes}}{\text{Annual use in hour}} = \frac{15,00}{1,600} = 9.4 \text{ tonnes per hour}$$

Therefore, there is an excess capacity equivalent to processing an additional amount of 25,000 tonnes. Similarly, we can express this wasted machine capacity in tonnes per hour by dividing the unused throughput in tonnes by the annual use in hours, as shown below:

$$\text{Excess capacity} = \frac{\text{Unused throughput}}{\text{Annual use}} = \frac{25,000}{1,600} = 15.6 \text{ tonnes/hour}$$

Note that processing 15,000 tonnes using 25 tonnes per hour total capacity requires only 600 hours of working time and not 1,600 hours. Since less than half the available capacity is used, the cost of processing each tonne also rises, since total actual costs are divided by 600 hours and not 1,600 hours.

Break-even Analysis in Seed Processing

The break-even analysis can be used to assess the financial viability of different processing options. In a situation where it is possible to hire seed cleaning services, the break-even analysis helps an entrepreneur to estimate whether owning a processing facility is more profitable than hiring one, when annual use is at a specific level. In this regard, the break-even

point is the number of tonnes of seed processed for which the costs of owning a plant are the same as the costs of hiring services to do the same job. Considering the above example of a processing plant with the an annual fixed cost of \$29805 and an operating cost of \$57.71 per hour, the total annual cost will be given by: \$29805 + (\$28.86 × tonnes of seed processed per year). Note that \$57.71 per hour equals 57.71/2 or \$28.86 per tonne, since the effective capacity of the plant is two tonnes per hour. The total annual cost and the cost per tonne for different quantities of seed processed per year are shown in Table 13.

Table 13. Annual use and cost for seed processing.

Tonnes of seed processed/annum	Total annual cost of processing in \$	Cost/tonne of seed in \$
50	31248	624.96
100	32691	326.91
150	34134	227.56
200	35577	177.86
250	37020	148.08
300	38463	128.21
500	44235	88.47
1000	58665	58.67
1500	73095	48.73
2000	87525	43.76
2500	101955	40.78
3000	116385	38.8

The analysis in Table 13 shows that the cost per tonne decreases as the number of tonnes processed per annum increases. This is because the fixed costs of the plant, which are independent of use, are spread over more tonnes of seed. Plotting the cost per tonne of seed against the number of tonnes of seed processed produces a cost curve illustrated in Figure 28. Taking into account the total fixed costs per annum (FC), the total variable cost (operating cost) per hour (VC_h), the rate of custom hiring per tonne (CR_t), and the annual break-even number of tonnes (n), the total cost for own processing will be equal to the total cost for custom hiring represented as:

$$FC + nVC_h = nCR_t \quad [\text{Eq. 1}]$$

Note that since the effective capacity of the plant is two tonnes per hour, the variable cost per tonne will be represented by:

$$VC_t = VC_h/2 = 0.5VC_h.$$

Equation 1 can be re-written as:

$$FC + 0.5nVC_h = nCR_t \quad [\text{Eq. 2}]$$

$$\text{Therefore, } n = FC/(CR_t - 0.5VC_h) \quad [\text{Eq. 3}]$$

The following values are substituted into Equation 3 to give the break-even point:

$$FC = \$29805/\text{year}, CR_t = \$50/\text{tonne}, VC_h = \$57.71/\text{hour} = \$57.71/2/\text{tonne}$$

$$\text{Break-even point (n)} = 29805/50 - 28.860 = 29805/21.14 = 1410 \text{ tonnes}$$

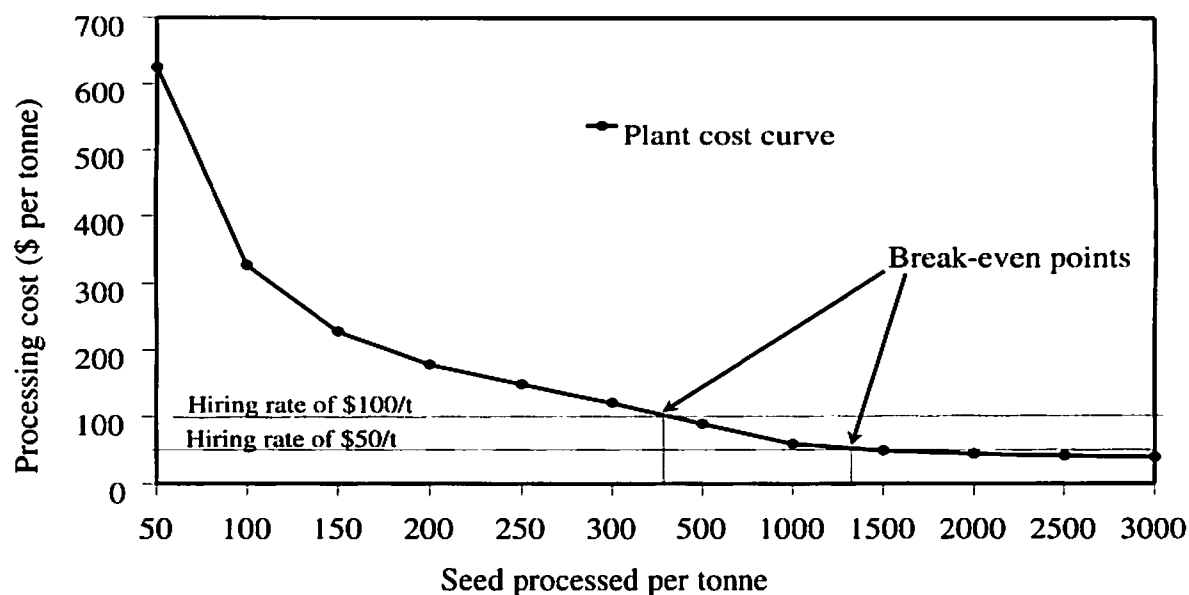


Figure 28. Processing cost curve and break-even points.

Using the same Equation 3, if $CR_t = \$100$ per tonne, the value of n becomes 419 tonnes. These calculations indicate that, it is ideally more economical to hire processing services at \$50 per tonne to process 1410 tonnes of seed per annum, than owning a plant to do the same. However, to process 1500 tonnes or more per annum, it is economically better to own a plant to do the processing operation. It can be seen that the break-even level falls to 419 tonnes for a custom-hiring rate of \$100 per tonne. This shows that break-even points are lower when hiring rates are higher; thus they require less seed to be processed to break even. Therefore, private operators can charge only up to a certain level beyond which hiring is no longer profitable, since managers will decide to purchase plants and clean their own seed.

Although for economic analysis custom hiring is a theoretical alternative, in practice it may not exist. Even where it does, other factors have to be taken into account when making a choice in a particular situation.

Advantages of Hiring

- At busy times, the custom operator does processing, leaving the producer to concentrate on other activities such as crop husbandry.
- The producer can choose between operators and select those with modern machines, techniques, and skills.
- Whilst the producer incurs no fixed or ownership costs, the operator at the same time takes care of repairs, maintenance, materials, labor, and supervision costs. The cost of owning a plant can be invested in other more profitable ventures.
- A producer with a small output can benefit from economies of scale offered by a large operator.

Limitations to Hiring

- There may not be sufficient commitment on the part of the operator to ensure that machines are well cleaned between operations. Therefore, There is a greater possibility of

admixture with seed of other crops or varieties.

- The cost a producer incurs in processing large quantities of seed annually may exceed the cost of owning a processing plant.
- The timeliness and flexibility in processing for a producer with a small output may be adversely affected, since operators usually tend to prefer large jobs to small ones. This delay could result in losses for the producer.
- The absence of direct supervision means the producer cannot directly monitor the quality of work done.

Ways to Reduce Costs in Seed Processing

Managers have to follow certain practices and take necessary precautions to keep the fixed (ownership) and variable (operating) costs of processing at reasonable levels. The following are suggested:

- Choice of components of a processing line is very important, since the initial cost of a plant is a major factor in determining the size of the fixed cost (depreciation) as well as other aspects of the operating cost. The plant has to match the needs of the enterprise. In certain situations, buying second hand equipment may be a worthwhile economic decision.
- A manager should ensure that there is sufficient work available to exploit optimum economic potential of the plant since the greater the quantity of seed processed in a year, the lower the cost per tonne. This could be done by (i) putting the plant under custom hire, (ii) joint ownership, or (iii) increasing the amount of seed produced.
- Since the operating cost is estimated using throughput per hour, the time required to perform any given operation is important. For instance, the time lost in feeding the plant with raw seed can be avoided by using the correct size of hoppers and if these are filled as quickly as possible using appropriate conveying or loading mechanism. However, reducing running time, by processing too quickly, can lead to mechanical damage of the seed. Correct design of complementary equipment such as seed hoppers, conveyor belts, storage bins, etc. is therefore, very important. Rigorous checking and repair work, if carried out during the off-season, can help reduce stoppage times during the peak period.
- To ensure that a plant performs efficiently and lasts as long as possible, the following precautions should be taken:
 - Carry out recommended maintenance on schedule.
 - Use trained and skilled operators.
 - Avoid overloading of the components.
 - Use proper shelter to protect the equipment from unfavorable weather conditions and other damaging agents.

Storage Cost

After harvest, stocks of seed are often held at a number of locations or points as the seed moves through the distribution and marketing channels. Farmers, merchants, and seed enterprises hold stock of seed in inventory before transferring it to another location or use in the marketing system.

The primary aim of storage is to maintain the germination capacity of the seed stock from the time it enters the store until the time it is withdrawn for planting or transferred to another location. After processing, seed stocks (a form of working capital) are normally held tem-

porarily in store until the next planting season. Working stocks are necessary to ensure that the farmer receives the desired quantities of good seed at the right time.

During storage, the marginal revenue should be equal to or exceed the marginal cost of keeping the seed in store. The marginal revenue is essentially the difference between the price of the seed at the time it enters the warehouse and the sale price when it leaves the store. The marginal cost of storage, on the other hand, involves the cost of storage space and the cost of handling/maintaining the quality of a unit of seed during the storage period.

A manager may choose between two means of storing seed, either in a store that is owned by the business or in a specialized storage agency for a fee. In both situations, the manager retains ownership of the seed and will choose to continue retaining this ownership as long as he or she expects that the benefits of storage (in terms of a higher expected selling price) exceeds costs of storing the seed. When non-infested seed, which has been dried to safe moisture content, is put in store, the costs of maintaining quality are likely to be low. These will rise and losses are likely to occur if infested seed or seed of high moisture content is put in storage. Such seed must be removed for further drying. Infested seed has to be monitored frequently, sampled, and fumigated. The cost of storing seed per tonne depends on several factors: the type and quantity of seed stored, the size of the seed storage facility, and the use or annual capacity of the storage facility.

Types of Storage Costs

Storage costs can be divided into fixed and variable components.

Fixed Storage Costs

These are direct costs which do not depend on the amount of seed stored or on the period of storage. Therefore, the greater the throughput per annum through a storage facility is, the lower the cost per unit of seed will be since the fixed cost is spread over a larger quantity of seed. Fixed costs of seed storage comprise the following:

- Interest on capital investments
- Insurance costs on capital
- Depreciation
- Repair and maintenance costs
- Administrative expenses

The interest charge depends on the rate at which the capital is borrowed. Interest charges, together with the depreciation charge, may constitute the largest components of fixed storage costs.

Variable Storage Costs

The costs of operating a seed store generally include the following:

- Interest on stock of seed (working capital) and consumables, which could be highly variable especially in situations where interest on working capital varies directly with prevailing rates of interest. This interest represents the opportunity cost of holding stocks of final processed seed. Therefore, It is important for a seed merchant to assess the turnover of different types of seed so as to avoid keeping capital locked up in stocks. The handling frequency, which is equivalent to the length of time a particular kind of seed is kept in storage, should be kept as short as possible, and the total quantity of seed stored should be increased to benefit from economies of scale.

- Insurance premium on inventory, which is expressed in \$ per unit per year, is based on the average cost of inventory on hand.
- Inspection and sampling fees, which are charged by a seed certification agency (expressed in \$ per unit inspected or certified).
- The costs of electricity, which may be quite considerable, in some cases, require close monitoring and supervision. An example of this is the case of storing a commodity such as potato seed, because of the need to maintain low temperatures during certain periods to prevent sprouting. At other times (such as the period just before release from store for planting), there may be a need to raise the storage temperature. The manager of such a storage facility needs to be effective in regulating the use of electricity to suit storage requirements and save running costs as necessary.
- Wages
- Miscellaneous expenses

Risk Premium

This is an indirect storage cost. It is the risk of a price fall resulting from holding stock over time. The risk premium results from holding stock with the uncertain expectation of a higher seed price. Carrying stock over from one year to the next is a source of risk for seed enterprises. While some may hold carryover stock due to unexpected changes in seasonal pattern or unexpected market conditions, others may be motivated to do the same with expecting high prices.

In many situations, seed enterprises minimize risks associated with carryover stock by choosing not to chemically treat all processed stock, if such seed could be sold finally as grain. Therefore, seed should be treated on demand when delivery and payment are certain. In cases where carryover stock is substantial, it is important that such stock is valued at a realistic price. It would be misleading and financially damaging if business estimates turnover using current seed prices when the stock may only be worth lower grain prices.

Calculating Cost of Storage

A method of calculating storage costs is illustrated with the following example (see also Table 14).

Consider a storage facility which holds its maximum storage capacity of 100,000 bags maize seed weighing 50 kg each. The capital investment is \$300,000 with an economic life of 50 years. Assume the cost of repair/maintenance at 3% of purchase value of asset, insurance on investment as 1.5%, interest on capital as 17%, and total administrative expenses as \$15000. Let interest on inventory (working capital) be 15% per tonne, insurance on inventory be 1% per tonne, and other variable costs (casual labor, inspection and sampling, power and lighting and miscellaneous expenses) equal \$20,000. The procurement price of seed is \$60 per tonne and the final selling price is \$100 per tonne.

Table 14. Calculating the cost of storage.

Cost description	Cost for one month of storage	Storage period (months)		
		1	2	3
Seed stored in tonnes	$(10^5 \times 50)/1000$	5000	5000	5000
Fixed Cost (in \$/tonne)				
Depreciation	$30 \times 10^4 / (50 \times 12 \times 5000)$	0.10	0.20	0.30
Repair cost	$(30 \times 10^4 \times 0.03) / (12 \times 5000)$	0.15	0.30	0.45
Insurance on capital	$(30 \times 10^4 \times 0.015) / (12 \times 5000)$	0.08	0.16	0.24
Interest on capital	$(30 \times 10^4 \times 0.17 \times 0.5) / (12 \times 5000)$	0.34	0.86	1.29
Administrative expenses	$15 \times 10^3 / (12 \times 5000)$	0.25	0.50	0.75
Total fixed cost		1.01	2.02	3.03
Variable Cost (\$/tonne)				
Interest on inventory	$(100 \times 0.15) / 12$	1.25	2.50	3.75
Insurance on inventory	$(100 \times 0.001) / 12$	0.008	0.016	0.024
Miscellaneous expenses	$2 \times 10^4 / (12 \times 5000)$	0.33	0.66	0.99
Total variable cost		1.59	3.18	4.77
Total storage cost (\$/tonne)		2.60	5.20	7.80

Economies of Scale in Seed Storage

Variable costs depend on the length of time seed is stored, with longer periods of storage associated with higher variable costs. However, since these costs do not necessarily vary in a linear manner with the volume of seed stored, there are obvious economies of scale in variable costs associated with the quantity of seed stored. Economies of scale in seed storage can be explained in two ways:

- For a given storage facility and a given seed crop, the cost per tonne decreases as annual throughput increases, because the fixed costs are spread over larger quantities of seed. The decreasing costs are also partly accounted for by variable costs which do not increase linearly with the volume of seed stored (Figure 29).
- For storage facilities of different sizes, the cost of storage per tonne declines when the size increases, assuming maximum throughput and optimum use of storage space (Figure 29). At maximum capacity, the storage costs per tonne in the 500, 1000, and 1500 tonnes stores warehouses are 1.20, 1.15, and 1 dollars, respectively. Large storage facilities, with high inventories, permit increased specialization, which result in lower costs per unit of seed stored.

The reasoning behind the concept of economies of scale in seed storage is illustrated in Table 15. If the throughput in this example increases to 180,000 bags or 9,000 tonnes of seed per annum, the fixed cost per tonne falls rapidly in all cases, since the total fixed cost, which remains the same, is distributed over a larger quantity of seed. It can also be seen that, the variable cost does not necessarily increase in direct proportion with the volume of seed. It partly accounts for the declining value of total storage cost per tonne of seed.

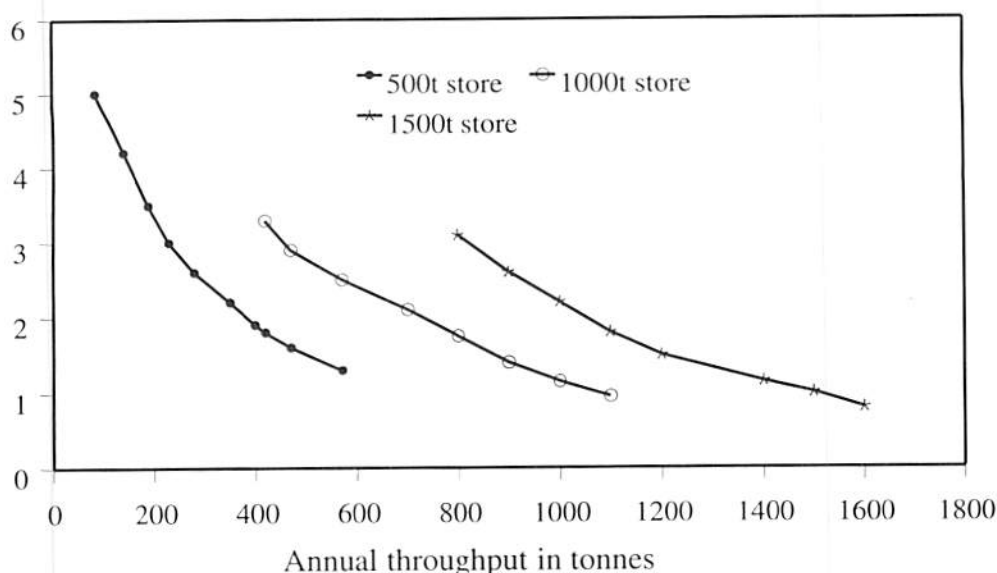


Figure 29. Storage cost curves for seed warehouses of different capacity.

Table 15. Economies of scale in seed storage.

Cost description	Cost calculated for a month of storage	Storage (months)		
		1	2	3
Seed stored in tonnes	$(18 \times 10^4 \times 50) / 1000$	9000	9000	9000
<u>Fixed Cost</u> (in \$/tonne)				
Depreciation	$30 \times 10^4 / (50 \times 12 \times 9000)$	0.06	0.12	0.18
Repair cost	$(30 \times 10^4 \times 0.03) / (12 \times 9000)$	0.08	0.16	0.24
Insurance on capital	$(30 \times 10^4 \times 0.015) / (12 \times 9000)$	0.04	0.08	0.12
Interest on capital	$30 \times 10^4 \times 0.17 \times 0.5 / (12 \times 9000)$	0.24	0.48	0.72
Administrative expenses	$(15 \times 10^3) / (12 \times 9000)$	0.14	0.28	0.42
Total fixed cost		0.56	1.12	1.68
<u>Variable Cost</u> (in \$/tonne)				
Interest on inventory	$(100 \times 0.15) / 12$	1.25	2.50	3.75
Insurance on inventory	$(100 \times 0.001) / 12$	0.008	0.016	0.024
Other variable costs	$2 \times 10^4 / (12 \times 5000)$	0.33	0.66	0.99
Total variable cost		1.59	3.18	4.77
Total storage cost (\$/tonne)		2.15	4.30	6.45

A conclusion from the above analysis is that for any given situation, the seed storage facility should be as large as possible and should be well used to achieve minimum cost per tonne. Although it is not advisable to have excess capacity without the required throughput, the size of a warehouse must correspond to sufficient quantity of seed needed to operate the facility efficiently.

To enable efficient use in certain situations, the warehouse needs to be located in a region where it can draw seed from contract growers within a wide geographic radius. In other cases, it may be cheaper to buy short-term storage to keep raw seed while awaiting processing and final storage. Seed stores are hardly ever fully used because of seasonality in production and distribution. However, a storage facility, which operates well below optimum capacity, can incur high costs per unit. So, the most critical factor in determining unit cost of storage is the extent to which storage space is used.

Consider a store for which the cost of storing seed amounts to \$1 per tonne when the storage space is optimally used in the year. If the available space is used for only six months, the cost per tonne of seed stored will rise to \$2. If the space is half filled with seed for six months, the cost may still rise further to \$4 per tonne. Furthermore, from Figure 29, it could also be seen that if the 1000-tonne warehouse holds the maximum throughput of 1000 tonnes per year, this will cost \$1.15/t. The price will rise to about \$2.20/t if this same volume of seed per year is kept in the 1500-tonne warehouse, since 1000 tonnes corresponds to less than the throughput capacity of the 1500-tonne storage facility per year. Renting storage space can be a good source of income if an enterprise cannot use available space with its own products during less busy periods. For instance, a cold store for potato seed could be rented to producers of perishable fruits if these products are harvested at a time when potatoes have already been issued for planting.

Marketing Cost

As an internal activity within the enterprise, marketing is the ability to: (i) determine what is actually happening in the seed market-place, (ii) influence the nature of such events (e.g., through advertising, promotional campaigns, extension, field days, on-farm demonstrations, etc.), and (iii) adapt the product and marketing effort to changing circumstances. In other words, the marketing department studies conditions prevailing in the market, and then, informs the production department about what seed-using farmers need. Marketing is, therefore, an active occupation which involves promoting the use of seed produced by the enterprise. Marketing extends beyond the physical and logistical exercise of getting seed to the right place at the right time. This is a process referred to as seed distribution, which is just one component of the total marketing function. Seed distribution involves a considerable amount of logistic planning in terms of transport infrastructure and interim storage.

Marketing Management

What actually happens in practice is that many seed organizations take on a rather passive role. They endeavor to improve their marketing management by reacting to signals which they receive from the market place. In other words, they use information which has been gathered from the market place to decide on which seed to produce, how to produce it, when to produce it, how to package it, when to sell it, and to whom to sell it. But, the key issue in an enterprise is to link marketing to production planning. This link is a vital element in any commercial seed company.

To begin with, it is important for a business to choose between becoming actively involved in trying to influence events and merely seeking to react to them. The choice of alternative strategy depends on desired objectives and efficiency considerations. As already mentioned, marketers often play down their role in trying to influence events in the market

place. However, an enterprise becomes active in influencing events if the objective is to increase market share or expand market opportunities. Efficiency is considered vital here, since it defines moving seed from producers to users at the lowest cost acceptable to the seed-using farmers.

Finding out the relevant prices and evaluating markets are often costly activities. It is unwise to invest resources into collecting information which is of limited value. Similarly, the market potential has to be assessed before spending heavily on advertising and promotion as these often drive up seed prices. But for a small enterprise, local intelligence and promotion may not be too costly or difficult. In developing countries, there is usually a need for governments to provide information as a public good. Even where such information is available, market research is still required to analyze existing information in the light of specific problems or needs.

Relationship between Production and Marketing

There is a very close relationship, or an interaction, between what the sellers and users of seed do. Everyone involved in the business seeks to add value to the seed. As it moves along the production-distribution chain the form and value of the seed changes.

The plans for seed marketing begin at the farm level (e.g., varieties placed on contract). In a commercial situation, the grower's contract is based on production plans made by the seed enterprise to meet certain demands and market prospects. The raw seed produced by the grower requires some mechanical processing to transform it into a final form suitable for farmers to use. They include the following:

- ***Location***

There is need to move the seed from its point of production. In this way, transportation transforms the seed in its physical location.

- ***Time***

The seed crop is harvested at a specific time but not used at that time. Therefore, there is need to store the annual production of seed to transform it into a regular flow to meet demand spread throughout the planting time.

- ***Quality***

The raw seed is mixed with unwanted material (e.g., weed seeds, stones, straw, etc.) which should be removed. Then, there is a need to process the seed.

- ***Payment***

Seed growers usually need immediate payment after delivering raw seed. There is, therefore, need for financing to pay in advance. There is a risk associated with financing. The normal expectation is that all raw seed procured will be sold later, at a higher price, to the next stage in the chain. This may not always be the case, and losses could incur.

All decisions regarding what to produce, how much to produce, when and to whom to sell, in what packaging form, and how are ultimately marketing decisions. All production activities and decisions ultimately serve marketing needs in terms of quantity, quality, and cost.

Problems of Seed Marketing

- ***Bulkiness***

Seeds of some crops occupy large volumes and have a high weight-to-value ratio. Transport and storage costs may be high in these species.

- ***Living product***

Since seed is living, it can deteriorate when kept under sub-optimal conditions; therefore it needs to be transported relatively quickly, especially in hot humid climates.

- ***Seasonal production and needs***

There may be heavy demand for storage since harvest may occur once a year. After harvest, the seed needs to be stored for use much later in the year. There is a need for working capital to finance purchase which will be locked up in stock until the sales time.

- ***Average size of production units***

In some cases, a large number of growers may produce seed, each selling a small quantity. Therefore, there is a transport problem in aggregating these into bigger quantities.

- ***Competition from farm-saved seed***

It may be difficult to organize an efficient marketing where farmers strongly believe they have to save their own seed.

Demand Assessment

Assessing the true demand for seed is critical to a seed enterprise. However, factors, which determine seed use, are complex since sometimes they are difficult to measure and quantify. These factors include price, frequency of purchase, quality, and promotion/awareness.

In many situations, estimates of seed requirements are based on planted areas, recommended seed rates, and national seed replacement rates (theoretical demand or total seed supply). This is a simple approach that produces theoretical estimates which are often of limited use. A better alternative is to assess effective seed demand, which takes account of past experience and efforts in promoting sales.

Estimating a market demand is relatively easier for hybrid seed than for self-pollinated crops, since seeds of hybrids are usually replaced each year. On the other hand, demand for seed of self-pollinated crops depends greatly on replacement rates, which are difficult to determine. High replacement rates are sometimes encouraged in national programs to introduce new varieties quickly, and to provide smallholders with clean and treated seed. To do this, seed may be offered cheap or included in a credit package. In some circumstances, high replacement rates may be a waste of resources since the same national output level could be maintained using a far lower replacement rate. This is a 'policy decision' which usually lacks a clear technical justification.

For self-pollinated crops, in particular, price elasticity of demand is considered important when setting seed prices (Figure 30). The demand (D) for certified seed is relatively elastic (line D_2), if the substitute in the form of farm-saved seed is close in yield and quality characteristics. This means that a moderate increase in the price (P) of certified seed, from P_1 to P_2 , could highly drop the quantity (Q) of seed purchased (from Q_4 to Q_3), since farmers may choose to use their own seed.

There is, therefore, a limit on how much enterprises can charge for certified seed of these crops. Demand is less elastic (line D_1), if certified seed is outstandingly superior or where farmers are obliged to purchase, as in the case of hybrids. In this case, the same moderate

increase in price from P_1 to P_2 results in a far smaller drop in the quantity of seed demanded (from Q_2 to Q_1).

For crops with high sowing rate (e.g., groundnuts), farmers become reluctant to buy expensive seed as this constitutes a major component in the costs of production. Conversely, those with a low seed rate, such as sorghum, millet, or sesame, may be less sensitive to price. In the case of forages, the demand for seed is a derived demand since it depends on the expected benefits from growing the forage crop. The demand for forage seed will grow as farmers turn increasingly to the use of forages to expand their areas. The decision of farmers to adopt forages will also depend on the awareness of benefits from increased animal production, improved soil fertility, or erosion control. The important point here is that one can only attempt to assess the demand for forage seed, if there is awareness about the use of improved forages in the first place.

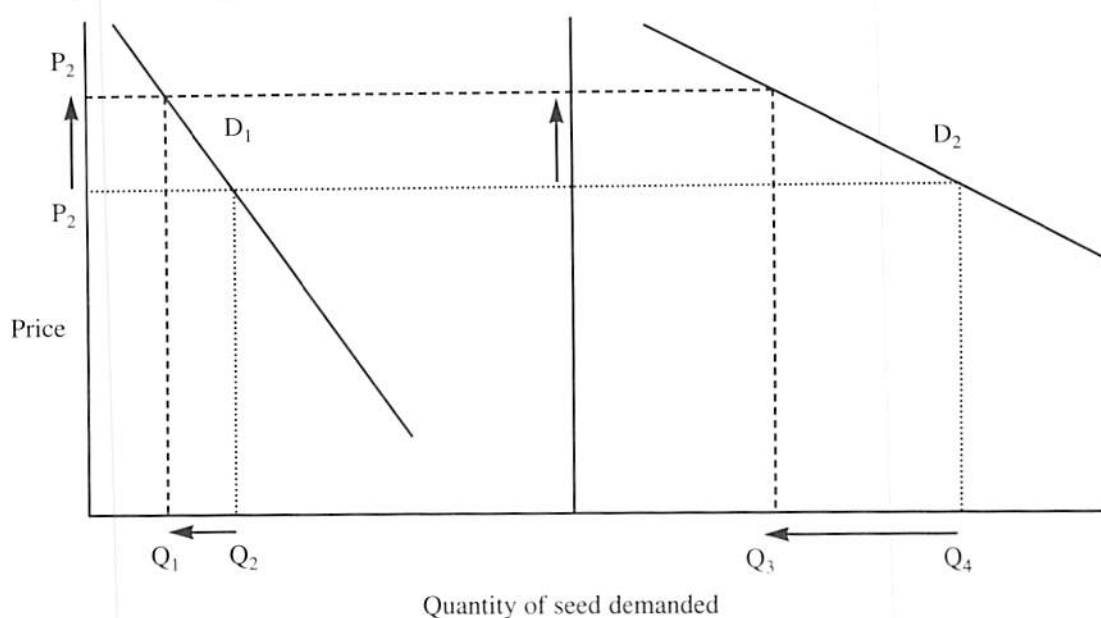


Figure 30. Price elasticity of demand for self-pollinating crops.

Estimating the Selling Price of Seed

As seed flows from the multiplication field through the seed enterprise to the end user, its form changes, and so does the value at the various stages of transaction. A typical seed production-distribution-use chain is represented in Figure 31. The seed obtained from the grower is processed and stored by the seed enterprise before it reaches the wholesaler, who, in turn, passes it on to the retailer who finally sells to the farmer who uses it for planting. The seed transaction ends here, although farmers may retain seed from subsequent harvests and exchange it among themselves as well as sell grain to final consumers.

An enterprise should prepare a cost sheet when calculating the price for certified seed. These estimates will include all direct and indirect expenditure to determine the true cost. The cost of seed per unit is, then, determined by dividing the total cost by the volume of seed produced. Table 16 is a simple cost sheet which summarizes estimates of costs and returns from the sale of certified seed of wheat by the Ethiopian Seed Enterprise (ESE) during the 1996/97 season.

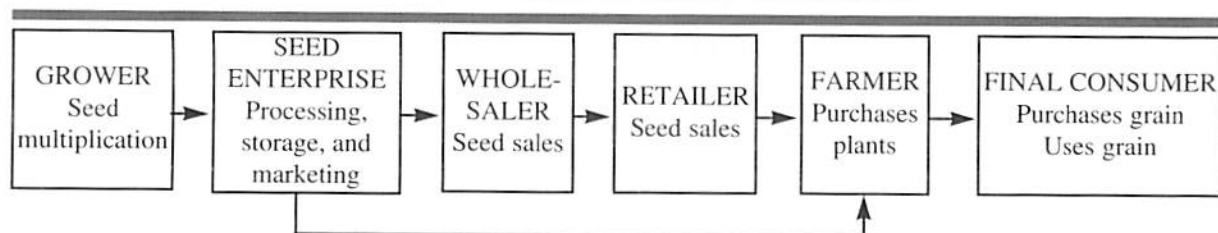


Figure 31. Seed production-distribution-use chain.

Table 16. Marketing cost of certified wheat seed in Ethiopia.

Description	Amount in Ethiopian Birr (EB)†/100kg	Cost price (%)
Seed Acquisition Cost		
1. Procurement cost	157.50	79.8
2. Packing materials cost	7.65	
3. Transportation cost	8.39	
4. Unloading and moving cost	1.34	
5. <i>Sub-total cost of unclean seed (1+2+3+4)</i>	174.88	88.7
6. Cost recovery of sales of by-products (rejects)	5.20	
7. Cost recovery from sales of used bags	4.00	
8. <i>Sub-total cost recovered from unclean seed procured (6+7)</i>	9.20	
9. <i>Net acquisition cost of seed (5-8)</i>	165.68	84
Variable Cost (Processing)		
10. Packing materials cost of clean seed	7.57	
11. Seed tag cost of clean seed	0.04	
12. Moving and loading cost of clean seed	1.07	
13. <i>Sub-total of packing, tags, moving and loading cost (10+11+12)</i>	8.68	4.4
14. <i>Cost of seed, packing material, tags, moving and loading (9+13)</i>	174.36	
Overhead Cost		
15. Fixed overhead cost	20.70	10.5
16. Variable overhead cost	3.17	1.6
17. <i>Sub-total overhead cost (15+16)</i>	23.87	12.1
18. Cost recovery from cleaning services	0.97	
19. <i>Net overhead cost (17-18)</i>	22.90	11.6
20. <i>Break-even or cost price of seed (14+19)</i>	197.26	100

† US\$ 1 = 0.146 EB; 1998 official rate.

Source: Ethiopian Seed Enterprise, Addis Ababa, Ethiopia

The fixed and variable overheads, mentioned in Table 16, comprise costs of several items including the following:

Fixed Overhead Costs

- Depreciation
- Property taxes
- Insurance
- Property maintenance
- Bank charges
- Salaries
- Fees
- Administrative and general expenses (advertisement and promotion, posts and telecommunications, license and registration, computer services, uniform and clothing, office supplies, etc.)

Variable Overhead Costs

- Interest on working capital
- Wages of casual labor
- Utilities
- Machinery repairs

The 'cost-plus' pricing method is commonly used if seed prices are set commercially. This estimates the various components of costs (variable, overhead, and capital costs) to arrive to a cost price or break-even price. A profit margin is added to the total cost to arrive at a base or selling price.

The break-even, or cost price, covers all costs of the enterprise, but does not include any profit margin. Once profit is added, the price of the seed increases. The cost price is basically the sum of the net acquisition cost of unclean seed, the variable cost of cleaning the seed and the net overhead cost.

One of the most significant variable costs incurred by seed enterprises is the cost of purchasing raw seed from contract growers. For the same crop, this cost does not normally differ greatly between enterprises. Market intermediaries incur costs that relate mainly to storage, transport, wages of sales staff, and administrative overheads. For agents, a sale commission is a fee that should cover any costs plus a reasonable profit.

There are often differences in fixed cost arising mainly from costs of capital investments and research. Large enterprises tend to have higher fixed costs because of investment in research (such as variety development) and the cost of specialized staff. Small-scale enterprises can easily enter the market for self-pollinated crops by purchasing foundation seed from the public sector and multiplying it through contract growers.

This ease of entry enhances competition so that the price of self-pollinated seed often reflects the marginal cost of production (the cost required to produce an extra unit of seed). For self-pollinating cereals, the grain price forms the basic production cost. This price is usually increased by a quality premium to compensate for additional costs to the seed producers (roguing, seed handling, etc.).

In the specific context of a free and competitive market, the forces of demand (D) and supply (S) should bring about equilibrium in price (P). The equilibrium price is the price at

which the quantity of grain demanded equals that supplied as illustrated theoretically in Figure 32. One of the key assumptions of the perfectly competitive model is that perfect knowledge of prices, information, and all relevant circumstances in the system exists.

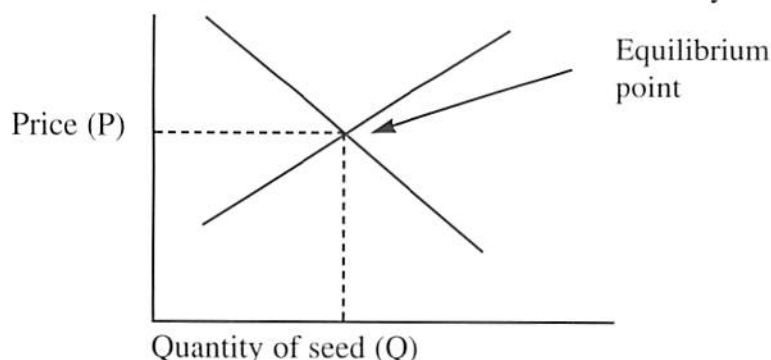


Figure 32. Supply, demand, and equilibrium pricing.

However, when there are constraints such as poor infrastructure and limited awareness about the value of improved seed, the free market economy may not assist a rapid development of the seed industry. Under these circumstances, government should intervene to facilitate available market information, improve infrastructure, and encourage greater mobility of factors of production. But regardless of creating awareness among farmers, their perceived value of improved seed becomes an overriding factor in adoption, particularly when quality of the product is in doubt.

For pricing hybrid seed, the lower price of open-pollinated seed could be used as a basis. When the price of open-pollinated seed increases, it is possible to set a higher price for hybrid seed. However, as the yield difference between hybrid grain and open-pollinated grain narrows, so does the price difference between hybrid and open-pollinated seed. For the price of hybrid seed to be set higher, its yield advantage must surpass that of open-pollinated seed by a large enough margin, which is sufficient to cover the high costs usually associated with cultivating hybrid seed.

Marketing Margins

A margin is the difference between the value of an equivalent unit quantity of seed, at one stage, and another in the production-distribution chain. This means that the total margin is the difference between the price received by a contract grower and the final retail price paid by the end user. Defined in this way, the margin of an enterprise can be regarded as an equivalent to the costs incurred for processing, storage, and marketing services that are applied to the seed. The prices paid for the seed should normally cover both the costs incurred in providing these services and any net profits that are earned.

In many cases, the seed goes through market intermediaries before it finally reaches the farmer who buys it for planting. The value of the seed changes since intermediaries, at every stage, incur costs and expect to earn some margin. The cost of the seed, therefore, builds up as it passes along the chain. Some enterprises may sell directly to seed users, with no intermediary in between. In this case, the difference between the cost price and the selling price represents the actual margin enterprises earn per unit of sold seed. These intermediaries buy seed expecting to sell it at future prices, which will cover costs and leaving some profit. The desire of all intermediaries to make a profit increases the total cost of marketing the seed. Since the main objective is to make seed affordable to farmers, an efficient supply

system can, then, be regarded as one that moves seed from producers to final users at the lowest cost. This cost should be consistent with the provision of services that the users desire and are prepared to pay for. These services include cleaning, treatment, packaging, transport, storage, and marketing.

Growers, processors, wholesalers, and retailers all need to have a precise idea of the costs they incur, and how these costs influence the expected selling price of seed and the profit they make at that point. There are important financial management issues to consider, if some of the cost items need to be financed by loans from external sources. The timing of such loans and the terms of payment, including interest, may have important financial implications on the business.

Margins Earned in the Chain

The actual margins earned in a production-distribution chain using the Ethiopian Seed Enterprise procurement price of 157.50 Ethiopian birr (EB) and break-even price of EB197.26 are shown in Table 17, assuming 20% grower margin, 10% ESE profit margin, 8% wholesale margin, and 5% retail margin.

Table 17. Selling prices of seed at various stages of marketing (Ethiopian birr/100 kg).

Seed grower's cost	131.25	Wholesale margin	17.36
ESE procurement price	157.50	Wholesale margin	8%
Seed grower's margin	26.25	Wholesale selling price	234.36
Seed grower's margin	20%		
ESE cost price	197.26	Retail margin	11.64
ESE cost margin	39.76	Retail margin	5%
ESE cost margin	25%	Retail selling price	246
ESE profit margin	19.74		
ESE profit margin	10%		
Selling price ex-ESE	217		

In other words, margins earned at each marketing stage are expressed as a percentage of the costs incurred by the intermediary at that stage (Table 17). For instance, 5% retail margin = (retail price - wholesale price)/(wholesale price). Margins earned at different stages from the grower to the final user of seed can be better visualized as illustrated in Figure 33 using estimates presented in Table 17.

Margins are sometimes presented as a percentage of the retail price, thus representing the share of the retail price going to the intermediary concerned. The growers' share is represented as (grower margin)/(retail price) = 100 (26.25/246) = 10.7%. The difference in the

Grower	Grower	Enterprise	Enterprise	Wholesaler	Retailer	
26.25	39.76	19.74	17.36	11.64		SEED USER
Stage A	Stage B	Stage C	Stage D	Stage E		
Grower margin=20%	Enterprise cost margin = 25%	Profit margin=10%	Wholesale margin=8%	Retail margin=5%		
131.25	157.50	197.26	217	234.35	246	

Figure 33. Margins at different stages of marketing from grower to seed user (Ethiopian birr).

price per unit (quintal) of certified seed between the contract farm and the retail stage is the overall margin per unit (unit margin or price spread = EB114.75). It is often expressed as a percentage of the retail price (the percentage margin = 47%). Provided the total volume of certified seed sold is known, this total quantity, multiplied by the unit margin, will give the appropriate aggregate margin for certified seed.

A temporary rise in the enterprise percentage margin does not necessarily imply that growers are being cheated by obtaining a smaller share of the retail price in a given period. Such a rise may be because of, an investment (necessitated by additional functions or changing pattern of business) which may lead to higher benefit for the grower in the future. However, changes in percentage margin over a long period of time at least require an explanation.

The crucial stage is normally represented by the margin at stage B (Figure 33), as this accounts for all overheads of the seed enterprise. Enterprises should be more efficient by making the margin, at this stage, as low as possible to create reasonable returns for the grower and intermediaries, while making seed cheap enough so the end users can afford to pay for it. The seed supply system cannot function efficiently if unnecessary overhead costs of an enterprise are either passed on to the grower, in terms of lower buying price for raw seed, or to the user, in terms of increased retail price of certified seed. In fact, no sale is expected from such a situation.

Conclusions

In competitive situations, the price structure is not open and discretionary. In fact, it is normally a challenge to keep every cost step as low as possible. To do so, the manager must have a proper understanding of the major components of the true cost of production, how these are incurred and how the magnitude can be estimated. Successful seed enterprises should be able to assess effective demand for the seed they produce and operate efficiently so as to offer prices that can generate attractive margins for growers, dealers, etc., while making seed available at prices the users can afford and are willing to pay. In particular, it is important for seed enterprises to have a good knowledge of how and why margins change. This is essential to stay in business, since the profit must be large enough to cover all factors of production. Managing the timing of operations well can be vital in realizing expected margins. This includes in particular, the timing of purchase of contract seed, of processing and storage, and of distribution. They influence the overall length of time the seed takes to reach the final users.

Further Reading

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Chapter 9. Cost Monitoring, Control, and Planning



Introduction

For managers to ensure cost-effectiveness in their enterprises, they need to have access to relevant information which can enable them to make informed decisions and take corrective action. Information on all cost transactions must be recorded and presented in a suitable and acceptable form for it to be useful for monitoring and control purposes. Recording details of daily financial transactions is a basic activity and many enterprises use routine records such as cash books, periodic progress reports, wage time sheets, and monthly cash summaries for this purpose. All these constitute management accounting practices. In addition, activities recorded in routine documents are usually summarized in traditional annual accounts at the end of the financial year.

Cost Monitoring and Control

This section examines two traditional statements which make up the annual accounts, namely the profit and loss account and the balance sheet.

Profit and Loss Account

A profit and loss account records the summary of financial transactions of an enterprise for an accounting period, normally a financial year. It includes an opening valuation of the enterprise's assets (stores of seed, stocks of other consumable materials, etc.) at the beginning of the year, the costs and trading revenue (cash receipts and payments as well as debts owed to and by the enterprise) during the year, and a closing valuation of assets at the end of the year. Any resulting profit/loss during the year is also included in the account.

Besides obvious profit, which arises when cash inflow exceeds cash outflow, 'profit'

recorded in the profit and loss account does not always need to be in the form of a positive cash flow because profit can be generated without cash changing hands. For example, there may be a change in valuation of assets due to an increase in the value of stocks held at the end of the year in comparison to the value of the same assets at the beginning of the year. This increase in valuation may cause a profit situation which is recorded on paper ('paper profit') but is not available in the form of cash at that moment. This distinguishes a positive cash flow from profit.

The profit and loss statement is derived from two types of accounts:

- i. Total A = (Opening valuation + business expenses during the year)
- ii. Total B = (Closing valuation + business receipts during the year)

It is unlikely for any enterprise that Total A = Total B at the end of the financial year. If an enterprise makes profit, then Total B must be greater than Total A.

Using these relationships, the profit and loss situations can be summarized as follows:

Case 1: (Total A + profit) = (Total B), if Total B is greater than Total A.

Case 2: (Total A) = (Total B + loss), if Total A is greater than Total B.

In Case 1, a profit figure has to be added to the expenses to make the two totals equal, while a loss figure has to be added to the receipts in Case 2 to make the two totals equal. This profit or loss figure is referred to as the balancing item. A simple format for a profit and loss account in the case of a profit situation is shown in Table 18.

Table 18. Sample of a profit and loss account.

Opening valuation (excluding asset subject to depreciation)	Receipts
Depreciation expense	Closing valuation (excluding asset subject to depreciation)
Other expenses	
Profit	
Total	Total

The profit and loss account reveals a net profit on which tax is usually levied and out of which the manager draws personal expenses.

Example:

At the end of the first year, a seed enterprise has a carryover seed stock of value \$2000. In the second year, \$50,000 worth of seed is purchased from contract growers and later sold to generate revenue of \$70,000. Administrative expenses in the year comprise \$5000 and depreciation charges of \$1000. If the closing valuation is \$5000, construct a profit and loss account for the enterprise at the end of the year.

The solution is shown in Table 19.

Table 19. Suggested profit and loss account of a seed enterprise.

<i>Opening valuation ('000\$)</i>		<i>Receipts ('000\$)</i>	
Seed	2	Seed sales	70
<i>General expenses</i>		<i>Closing valuation</i>	
Seed purchases	50	Seed	5
Overheads	5		
Depreciation	1		
<i>Profit</i>	17		
Total	75	Total	75

Balance Sheet

A summary of financial transactions during the year, as outlined in the profit and loss account, is often supplemented by a balance sheet showing what the enterprise has (assets) and what it owes (liabilities). However, while the profit and loss account reflects the performance of an enterprise over a period, the balance sheet provides information on the financial viability of the enterprise at a particular date, normally the last day of each financial year. The essence of the balance sheet is that it indicates what the business is worth at a particular time were it to be sold. All saleable items would have to be sold to provide money for the payment of what the enterprise owes to creditors.

Information Provided in the Balance Sheet

The balance sheet provides financial information on assets and liabilities, which can be divided into fixed and current components.

Assets: These comprise anything of value which the business owns. Assets are divisible into fixed and current assets.

Fixed assets

Durable items representing longer term investments and are used for more than one production year. The current valuation of these assets are included as part of the balance sheet.

These assets include the following:

- Land the enterprise owns
- Buildings
- Processing plant, machinery, and implements
- Motor vehicles
- Office equipment (furniture, telephones, computers, etc.)

Current assets

Other kinds of assets which are divisible into two categories: working capital and liquid assets.

Working capital (assets)

These are temporary assets normally intended for conversion into cash within a short time (a year or less). Examples include:

- Stock of clean seed for sale
- Stock of raw seed (uncleaned seed)
- Stock of consumable materials (packaging material, seed treatment chemicals, etc.)

As mentioned earlier, the valuation of seed stock is very critical particularly when the stock includes carryover seed.

Liquid assets

Items that can quickly be turned into cash. Examples include:

- Cash in hand to procure any of the above items
- Cash balances in the bank
- Debtors (debts owed to the business on current sales)
- Repayment of loans, for past services, etc.

Liabilities: These represent all sorts of debts for which the business is liable. These are also divisible into two categories, long-term and current liabilities.

Long-term liabilities

Claims not normally liable to early settlement, such as:

- Bank loan
- Private and family loans

Current liabilities

Claims on the business which may have to be met within a short period of time, usually not longer than one year. Examples include:

- Short-term loans
- Bank overdraft on current account
- Debts owed by the business on recent material purchases (creditors)
- Outstanding tax
- Salaries and staff benefits outstanding

Layout of Balance Sheet

The conventional format is one in which assets are listed on the left hand side of the balance sheet in order of liquidity (i.e., ease of conversion to cash). Liabilities, which are listed in order of priority, are set against these assets on the right-hand side. The net worth, which is calculated in the same way as 'profit' in the case of the profit and loss account, is also included on the right side. This is the balancing item or the difference between the assets

and the liability columns so the totals on both sides are the same. A generalized layout of a balance sheet is shown in Table 20.

Table 20. Suggested layout of a balance sheet.

<i>Assets</i>	<i>Liabilities</i>
Fixed assets	Long-term liabilities
Land	Bank loans-
Buildings	Personal loans
Plants and equipment	
Motor vehicles	Current liabilities
Office equipment	Short-term loans
	Bank overdraft
Current Assets	Short-term creditors
Stock of clean seed	
Stock of unclean seed	
Stock of consumable materials	
Debtors	
Repayments	
Cash at bank	
Cash in hand	Net Worth
Total assets	Total liabilities

It should be noted that much of the information presented in the profit and loss account is finally used to make the balance sheet. Additional information that is included in the balance sheet relates to long-term liabilities and valuation of fixed (depreciable) assets, which are not taken into account in the profit and loss account, although actual depreciation expenses are. To carry out a proper diagnosis of the financial viability of a business, it is necessary to take into account transactions recorded in the balance sheet at the beginning of the year (opening balance sheet), the profit and loss account, which summarizes the year's activities, and the balance sheet at the end of the year (closing balance sheet). It is essential that the opening and closing balance sheets reconcile correctly with the profit and loss account such that:

Opening Net Worth (Opening Balance Sheet)	+	Net Income (Profit & Loss Account)	=	Closing Net Worth (Closing Balance Sheet)
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The net income in the profit and loss account is not necessarily cash flow but provides information for developing a cash flow statement, which is an important issue in seed enterprises. The cash flow statement is discussed in detail later in this chapter.

Valuation of Assets

The valuation of assets is essentially a cost estimation. Values of assets presented in balance

sheets are normally based on historical costs and do not reflect true market values of these assets. Rather, the current value (book value) of the asset is taken as the original value of the asset minus the accumulated depreciation. Valuation in this manner usually creates difficulties when such assets are offered for sale, since at this point it becomes necessary to determine the actual value of the assets.

Again, the valuation of seed stocks is crucial especially if a significant proportion of the crop is unsold at the end of the sales season. This is both a policy and a technical issue. It is essential that enterprises develop a stock disposal policy based on quality thresholds for sale/disposal, which should be supported by an effective routine physical stock check. In particular, old stock should be valued at a realistic price and disposed of at the most opportune moment. Many seed companies have gone bankrupt on over-valued stocks since anticipated cash flows cannot be realized.

A seed enterprise may be utilizing an old processing plant that has been fully depreciated (i.e., the cost of the plant has been fully recovered through depreciation charges), giving a book value of zero. However, the asset will still have economic value since if it is being used to produce output and generate income. In such a case, it is necessary after full depreciation to re-value the asset at current cost and further depreciate it on a straight line basis over an estimated number of years of expected useful life. This practice reflects economic reality. It estimates the amount of depreciation that represents a reasonable reduction in the value of assets with time. It also reflects the ultimate replacement cost.

As discussed earlier, vehicles, machinery, and implements are normally valued at historic costs, minus the accumulated depreciation to the date of valuation. Depreciation is usually calculated using the reducing balance method to give trade-in values. Similarly, buildings and fixed equipment are valued at historic cost minus the accumulated depreciation to the date of valuation, but depreciation is usually calculated on the straight-line basis to give written-down values. The above methods have limitations during a period of inflation because price increases will result in historic cost depreciation not providing enough reserve to replace fixed assets when there is such a need.

Cost Planning

Managers need adequate information to plan, make decisions, and monitor performance. The manager's role is primarily to look into the future and plan necessary courses of action to attain certain set objectives. Any planning information used then becomes a basis for formulating appropriate monitoring and control systems which will permit the manager to assess performance and take corrective actions in the light of changing conditions.

Since planning is a key management function, budgeting plays a vital part in the entire work of the seed manager. The budgetary process provides a means of gathering information which is put into plans for implementation in the future. Budgeting is useful for an enterprise of any size. All entrepreneurs should be aware of uncertainties they face in their business ventures and plan accordingly. For instance, they should be able to control costs and forecast the maximum sales they can make and from which type of seed. However, budget formats for small-scale enterprises should be simple and do not need to be as elaborated as those of large seed companies.

Besides planning, budgeting also serves as a basis for performing evaluation and control analysis. Budgets are usually supported by other accounting tools such as the profit and loss

account and balance sheets as additional means of control. These are conventional financial statements, which contain valuable performance measures including expenditure, revenue or income, return on investment, capital use, outstanding liabilities, and owner's equity. Adjusting these measures and following changes offers a valuable means of monitoring and controlling enterprise performance.

Budgets

A good budget should have the following features:

- It should be realistic and achievable within the enterprise's available resources and existing organizational structure. A budget must be prepared to suit periods of time over which it is possible to monitor and control actual performance. Only in this way it is possible to compare targeted with actual performance over corresponding time.
- Administration of the budget should not be rigid, but should offer enough flexibility in making reasonable adjustments in the face of changing conditions.
- The budget should promote coordination between departments or functions by helping to bring together and balancing all available resources and manpower for the benefit of the organization as a whole. Formulating sales budgets should take into account technical information on yield potential, agro-ecological conditions, etc., which are used in production planning. This process will require active participation of both technical and commercial staff.

Budgets can be classified broadly into two main types:

- ***Operating budgets***

Operating budgets give detailed estimates of operational schedules in addition to information on performance measures (e.g., for labor, these could include not only figures for salaries and wages, but estimates of the number and different types of staff required, labor hours to be worked, experience and skill requirements). Operating budgets cover information and estimates on items such as raw seed procurement, estimates of labor, and materials required for seed processing. The final result of all the operating budgets or cost schedules is summarized into a budgeted income and expenditure statement for the enterprise.

- ***Financial budgets***

Financial budgets are less detailed and basically give the financial effects of the operating budgets. Financial budgets are prepared in the same manner as regular financial statements such as the balance sheet, but contain forecast values only. Financial budgets provide information on cash requirements for planned operations (cash flow budget) and capital requirements for planned operations (capital budgets). The size of the cash flow budget is crucial because it indicates whether there is sufficient cash available to put plans into effect. In other words, it is a useful means of stabilizing the enterprise's cash balances and for keeping these balances reasonably close to continuing cash requirements. This is particularly important when establishing a new enterprise or in expanding an existing business in which substantial reinvestment is needed.

Master Budget

Records of former performance or historical data form a fundamental basis for forecasting

used in financial and operating budgets. To make meaningful predictions, historical figures have to be supplemented by information on current situations relating to supply and demand conditions, pricing structure, replacement values, etc. Budget formation should not be restricted to senior management only. It is important that staff members at all levels provide input and participate in forecasting values or conditions used in developing the budget. A widespread view that encompasses all functions and management levels is more realistic than a restrictive top-management approach. The aim of the budgetary process is to develop a master budget, which incorporates financial and operational budgets developed by sub-units or departments within an organization. A general procedure for formulating a master budget is set out below and summarized in Figure 34.

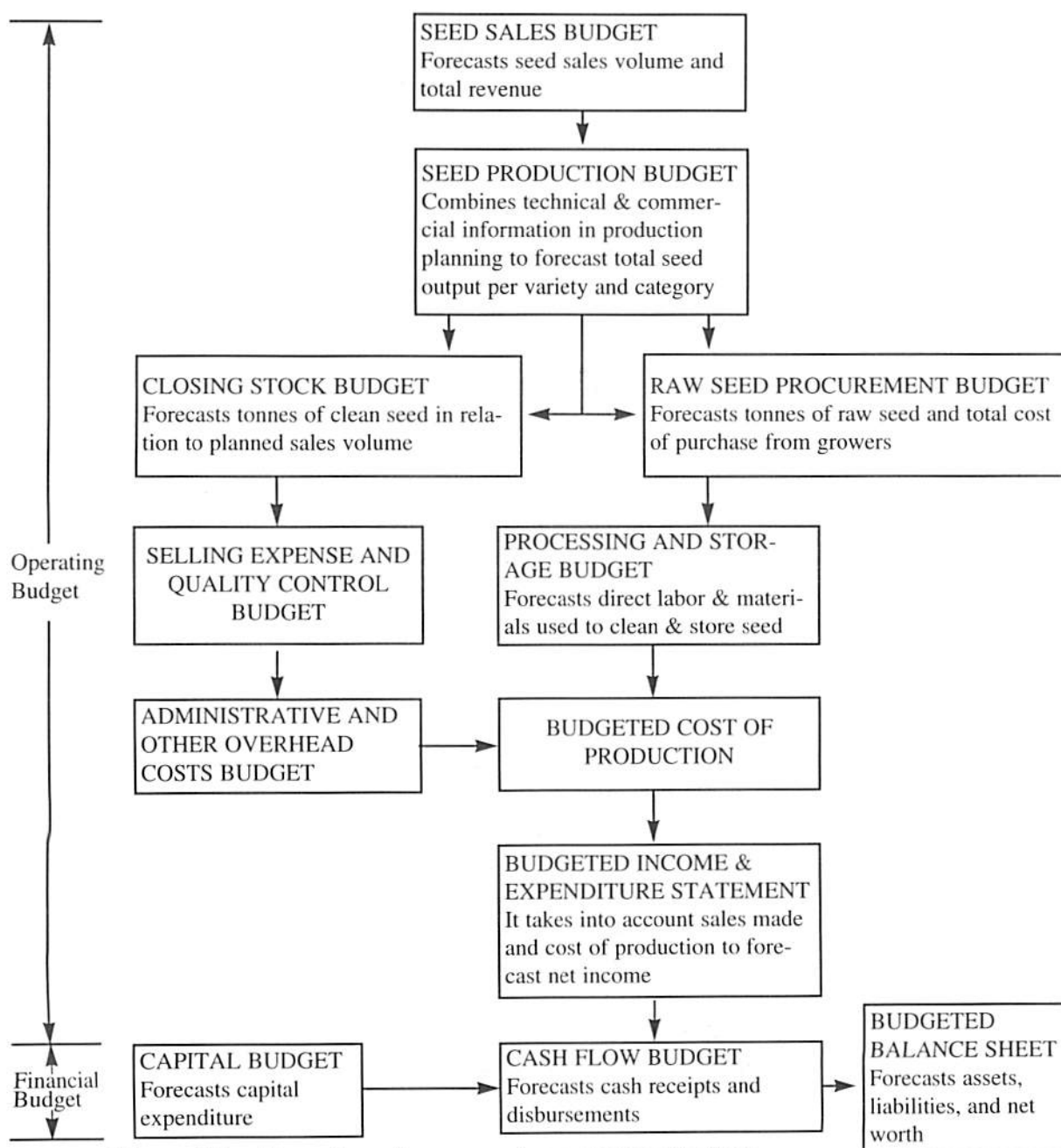


Figure 34. Procedure for preparing a master budget.

Here, seven steps are described for preparing the master budget of a seed enterprise.

Step 1:

Since seed production takes place in anticipation of future sales, the usual starting point in preparing a master budget is to forecast the total sales volume of seed as the key variable. This forms the basis upon which the sales budget and all other subsequent budgets, such as, the processing cost budget, marketing and administrative expenses budget, and production cost estimate are developed.

$$\text{Sales budget} = (\text{forecast tonnes of clean seed}) \times (\text{intended selling price per tonne})$$

All expenditure is expected to be ultimately dependent on the volume of seed sold. But forecasting a sales budget is not easy since it depends on farmers' future demands, which are difficult to predict, especially when a new variety is being introduced.

A reliable sales forecast must take into consideration the following factors:

- Past sales volume (historical data)
- Type of seed-using farmers and their purchasing power
- Quality of seed sold
- Market research results (e.g., price surveys)
- Pricing policies (market liberalization as against fixed or controlled pricing)
- Extension and promotional activities
- Effectiveness of sales outlets and sales staff
- Competition from other suppliers and market share
- Seasonal variations in climate, etc.

The sales budget of a hypothetical 'National Seed Company' (NSC) for 10,000 tonnes of seed is set out in Table 21.

Table 21. National Seed Company sales budget for the year ending on 31 December 1999.

Variety	Quantity	Selling price	Total amount
	<i>Tonnes</i>	<i>\$/tonne</i>	<i>\$</i>
A	4000	100	400,000
B	4000	100	400,000
C	2000	100	200,000
Total	10,000		1,000,000

The other main product sold by this company is material rejected from processing. Assuming that the proportion of rejects accounts for 10%, a sales budget for rejects is shown in Table 22.

Table 22. National Seed Company sales budget (rejects) for the year ending on 31 December 1999.

Variety	Quantity	Selling price	Total amount
	<i>Tonnes</i>	<i>\$/tonne</i>	<i>\$</i>
A	400	20	8000
B	400	20	8000
C	200	20	4000
Total	1000		20000

Step 2:

The next step is to formulate a production (seed multiplication) plan that could generate the forecast quantity of seed or sales volume (in this case, 10,000 tonnes of varieties A, B, C) shown in Table 21. This exercise requires the participation of technical, administrative, and commercial staff. To formulate a contract production plan, the number of growers has to be determined as well as the area in hectares and varieties to be produced, taking into account the on-farm yield potential of the varieties concerned. Other factors such as the location of growers, agro-ecological conditions, technical supervision, soil conditions, and climatic variation have to be considered as well.

It is advisable for enterprises to organize an annual planning meeting (preferably soon after seed distribution but well before sowing the next season's crop) to discuss the past season's activities and develop a production plan for the coming season. For such a meeting to be successful, all relevant staff must participate and discuss the results of the past season and the progress of on-going activities.

Step 3:

After determining the proposed volume of production, the next budget to prepare is the raw seed procurement budget. This budget assumes that the quantity specified in the production plan is procured at the time growers deliver it.

$$\text{Raw seed procurement budget} = (\text{forecast tonnes of raw seed}) \times (\text{intended buying price per tonne})$$

The procurement price for raw seed varies according to the type and category of seed, the market price for grain, the multiplication or quality bonus, etc. A raw seed procurement budget for NSC is illustrated in Table 23 (for simplicity, the procurement price is fixed at \$50/tonne) for all varieties.

Table 23. National Seed Company raw seed procurement budget for the year ending on 31 December 1999.

Variety	Quantity	Buying price	Total amount
	<i>Tonnes</i>	<i>\$/tonne</i>	<i>\$</i>
A	4400	50	220000
B	4400	50	220000
C	2200	50	110000
Total	11000		550000

Step 4:

Since raw seed has to be processed to give the final stock of clean seed, the processing, storage, and ending stock budgets have to be prepared in conjunction with the raw seed procurement budget. For processing, the costs of direct materials such as jute bags and seed treatment chemicals have to be estimated ensuring that the volume of seed can be handled by the existing processing capacity. In case of a shortage of capacity, custom cleaning has to be arranged especially where time is a critical factor.

Step 5:

After forecasting the final stock of clean seed, the next step is to determine budgets for sales, administration, and other expenses (overhead costs) which all come together with the processing and storage costs to give the forecast total production cost (Tables 24 to 27).

Table 24. National Seed Company processing budget for year ending on 31 December 1999.

Fixed cost/year	Amount	Variable cost/hour	Amount
	\$		\$
Depreciation	2750	Repairs and maintenance	0.50
Interest	3300	Electrical energy	5.00
Insurance	550	Packing material	3.00
Salary for two operators	4400	Oil and grease	0.10
		Wages for two casual workers	1.40
Total fixed cost per year	11000	Total operating cost per hour	10.00
Total fixed cost/hour (Assume 2200 working hours/year)		11000/2200 = 5	
Total processing cost/hour (fixed and operating cost)			15.00
Processing cost/tonne raw seed (assume machine capacity of 5 t/hr)			15/5 = 3
Processing cost for 11000 tonnes of raw seed (budgeted quantity)			33,000

Table 25. National Seed Company storage budget for year ending on 31 December 1999

Fixed cost/year	Amount	Variable cost/year	Amount
	\$		\$
Depreciation	300	Interest on inventory	4200
Repair cost	450	Insurance on inventory	100
Insurance on capital	30	Wages for casual labor	1700
Interest on capital	1200	Inspection and sampling fees	200
Administrative expenses	1020	Power and lighting	500
		Miscellaneous expenses	300
Total fixed cost	3000	Total variable cost	7000
Total storage cost (for 10,000 tonnes of clean seed)			10,000
Storage cost/tonne			10,000/10,000 = 1

Table 26. National Seed Company distribution and marketing budget for year ending on 31 December 1999

Fixed cost/year	Amount	Variable expenses	Amount
	\$		\$
Sales salaries	12,000	Sales commission (3% of sales)	30,600
Depreciation	3000	Delivery expenses (1% of sales)	10,200
Publicity/travel	600	Supplies (1% of sales)	10,200
Sub total fixed expenses	26,000	Sub total variable expenses	51,000
Total distribution and marketing costs (fixed and variable expenses)			77,000
Sales revenue of seed and rejects. (10,000t seed @ \$100/t and 1000t rejects @ \$20/t)			1,020,000

Table 27. National Seed Company administrative expense budget for year ending on 31 December 1999.

Fixed overhead cost	Amount	Variable overhead cost	Amount
	\$		\$
Salaries (supervision and store keeping)	90000	Wages	20000
Depreciation	5000	Travelling expenses	10000
Rent	3000	Power and lighting	4000
Property taxes	1000	Repairs and maintenance	6000
Property insurance	1000	Office and stationery	5000
		Telecommunications	5000
Total fixed overhead cost	100,000	Total variable overhead cost	50,000
Total overhead cost			15,0000

Step 6:

The final outcome of all operation budgets is summarized in a budgeted income and expenditure statement which takes account of the revenue obtained from sales of final processed seed minus the total production cost to generate an estimate of net income as illustrated in Table 28.

Table 28. National Seed Company budgeted income and expenditure statement for the year ending on 31 December 1999.

Budgeted item	Table number	Amount
		'000\$
Sales of certified seed	22	1000
Sales of rejects	23	20
Total sales revenue		1020
Minus:		
Raw seed procurement	24	550
Processing expenses	25	33
Storage expenses	26	10
Distribution and marketing expenses	27	77
Administrative expenses	28	150
Sub total operating expenses		820
Net income before tax		200
Tax expense (assume 25%)		50
Net income		150

The budgeted income statement (or budgeted profit and loss account) for the year ending 31 December 1999 contains projections of all revenues and expenses as well as expected net income covering that period so:

$$\text{Expected Net Income} = (\text{Budgeted Revenue}) - (\text{Budgeted Total Expenses})$$

Step 7:

Having developed the various components of the operating budget, the next step is to discuss the financial budget as the second major part of the master budget. The financial budget comprises three elements: the cash flow budget, the capital budget, and the closing balance sheet. The point of emphasis here is that unlike the operating budget, which covers operations for the budgeted period only, the financial budget takes into account activities from previous corresponding budgets to forecast current values. This means that to forecast cash flow budget and balance sheet for the ending year 1999, the respective opening cash and balance sheet values as at 31 December 1998 are considered.

The Cash Flow Budget

All short-term financial effects of transactions and activities outlined in the operating budget are brought together and represented in the cash flow budget. The objective of the cash flow budget is to ensure that sufficient cash is available at all times to meet the level of operations outlined in the various operational budgets. Three pieces of information are required to prepare the cash flow budget for any given period: the opening cash balance, cash receipts for that period, and cash disbursements for that period (Table 29).

Cash receipts comprise:

- Forecast revenue from seed sales for current and previous period sales ('accounts receivable' collections).
- Other cash sales (e.g., sales of rejects).
- Receipts from rent of services such as transport, processing or storage space.

Cash disbursements cover:

- Payment to contract growers for raw seed.
- Payment for salaries, wages, operating expenses and other overheads.
- Income tax.
- Payment for current and previous period purchases from suppliers ('accounts payable').

Cash budgets are useful tools for cash planning and control because they enable managers to avoid unnecessary 'idle cash' or cash deficiencies. Cash deficiencies should be identified in advance and steps taken (by arranging bank loans) to meet temporary cash shortages. Similarly, 'idle funds' should be invested to earn maximum interest. The major cash needed for a seed enterprise is money, which is required for promptly paying growers when they deliver raw seed. Steps have to be taken well in advance to have sufficient cash available for seed purchases if contract growers are to be encouraged to deliver seed as agreed. Similarly, there should be enough funds available to pay staff on time to keep work morale at a high level. A comprehensive program should be designed in respect of payment of sales commission at the marketing end.

Table 29. National Seed Company cash flow budget for year ending 31 December 1999.

Item	Amount
	'000\$
Cash balance on 1 January 1999 ¹	30
Cash receipts	
Accounts receivable ² (certified seed and rejects cash sales)	816
Long-term borrowing ³ (bank loan)	100
Cash payments	
Operating expenses ⁴ (Table 29)	809
Fixed asset acquisition ⁵	80
Tax payment ⁶	10
Cash balance on 31 December 1999	47

¹ Represents closing balance from cash flow account (Table 30).

² Assumes 80% of sales budget is actually paid and collected in cash ($1,020,000 \times 0.80 = \$816,000$).

³ NSC takes a bank loan during 1999 to purchase additional fixed asset worth \$80,000.

⁴ Note that depreciation does not entail a cash outlay and is therefore deducted from the operating expenses shown in Table 30.

That is, total expenses 820,000 (Table 28)

 minus 2750 (depreciation for processing in Table 24)

 300 (depreciation for storage in Table 25)

 5000 (depreciation for overheads in Table 27)

 3000 (depreciation for distribution and marketing in Table 26)

Operating cash 808,950

⁵ Asset acquired by bank loan.

⁶ Outstanding tax for previous year (see balance sheet for year ending December 1998) is paid in 1999.

Capital Budget

Expenditure on capital items involves a long-term commitment of resources. Therefore, managers make long-term decisions regarding investments when they have to consider constructing a new warehouse, buying a new seed cleaning plant, increasing the transport fleet, or adding a new variety to the production plan. The accuracy of the decision made in such cases is important because of the considerable financial involvement and risks that may be associated with the investment. The profitability of an investment decision depends on future increases in cash flows. The capital budget is the key instrument in controlling capital expenditures.

As discussed under financial appraisal, the same quantitative measures (payback period, internal rate of return, net present value) can be used in evaluating proposed capital projects. For instance, a decision made by the National Seed Company to take a bank loan of \$100,000 to procure new fixed assets worth \$80,000 is capital budgeting and may be the outcome of an investment appraisal analysis.

Budgeted Balance Sheet

The final step in developing the master budget is to prepare a budgeted balance sheet in which each forecast item takes into account corresponding opening balances of values in the preceding balance sheet. This is illustrated by using the opening balance sheet as at 31 December 1998 for NSC (Table 30) to make projections for an ending balance sheet as at 31 December 1999 (Table 31).

Table 30. National Seed Company balance sheet as at 31 December 1998.

Assets	Amount	Liabilities	Amount
	<i>'000\$</i>		<i>'000\$</i>
Current assets		Current liabilities	
Cash in hand	30	Accounts payable	Nil
Accounts receivable	350	Taxes payable	10
Sub total	380	Sub total	10
Fixed assets		Long-term liabilities	
Land	100	Bank loan	Nil
Buildings and equipments	500		
Accumulated depreciation	(50)	Sub total	Nil
Sub total	550	Net Worth (equity)	920
Total assets	930	Total liabilities	930

Table 31. Projected National Seed Company balance sheet as at 31 December 1999.

Assets	Amount	Liabilities	Amount
	'000\$		'000\$
Current assets		Current liabilities	
Cash in hand ⁴	47	Accounts payable ¹	Nil
Accounts receivable ⁵	554	Taxes payable ²	50
Sub total	601	Sub total	50
Fixed assets		Long-term liabilities	
Land ⁶	100	Bank loan	100
Buildings and equipment ⁷	580		
Accumulated depreciation ⁸	(61)	Sub total	100
Sub total	619	Net Worth (equity) ³	1070
Total assets	1220	Total liabilities	1220

¹ Assume all raw seed and other direct material purchases are paid for fully in their respective years.

² \$10,000 previous year + \$50,00 current year - \$10,000 payment.

³ This is the balance sheet value of assets available to the owner/share holders of the business after all claims against these assets have been met.
= \$920,000 previous year's net worth + \$150,000 net income

⁴ Cash balance on 31 December 1999 (Cash Flow Budget in Table 29).

⁵ \$350,000 previous year + \$1,020,000 budgeted sales - \$816,000 budgeted receipts.

⁶ From the beginning of the balance sheet.

⁷ \$50,000 previous year + \$80,000 new fixed asset purchase.

⁸ \$50,000 previous year + \$2750 + \$300 + \$5000 + \$3000 = \$61,050.

Gross Margin Budget

The gross margin or gross profit of an enterprise represents the value of output minus the variable costs (Table 32). Determining the causes of variation in gross margins is a useful analysis in cost control. It is important that managers investigate variances in gross margins so that corrective actions could be taken. The most common causes of differences between budgeted and actual gross margins are changes in sales price of seed, changes in sales volume, and prices of inputs. Once such changes are properly analyzed, it is possible to bring actual operations in line with budgeted expectations. The size of the gross margin of an enterprise is very important since this must be large enough to cover all fixed costs and still leave a profit.

Table 32. Example of gross margin calculation for certified seed production by a contract grower.

Item	Yield	Price	Amount	Percentage
	t/ha	\$/t	\$/ha	%
Revenue				
Seed yield	2.5	1500	3750	
Yield of by-product (straw)	2.1	300	630	
Total revenue			4380	
Variable cost				
Seed			100	11.0
Fertilizer			150	16.6
Pesticide			10	1.1
Machine hire			210	23.2
Labor hire			350	38.7
Interest			25	2.8
Other costs			60	6.6
Total variable cost			905	100.0
Variable cost/Revenue				20.7
Gross Margin A (\$ per hectare)			3475	
Imputed cost of family labor			300	
Gross Margin B (\$ per hectare)			3175	

Relationships between Gross Margin and Financial Year

Whilst gross margin data relate to activities carried out in the farming year, the financial transactions in an enterprise are recorded in terms of financial or accounting years. Problems can arise if the farming year is much different from the financial year because it becomes difficult to relate actual cash transactions to activities relating to the corresponding output. A situation in which the growers of an enterprise sowed seed between November and December during the 1998/99 financial year and harvested towards the end of that financial year until the beginning of the 1999/00 financial year is presented in Figure 35. In this case, the variable cost in the accounts of the 1999/00 financial year are partly for the following year's crop and partly for the previous year's crop, whilst the revenue will be solely for the previous year's crop.

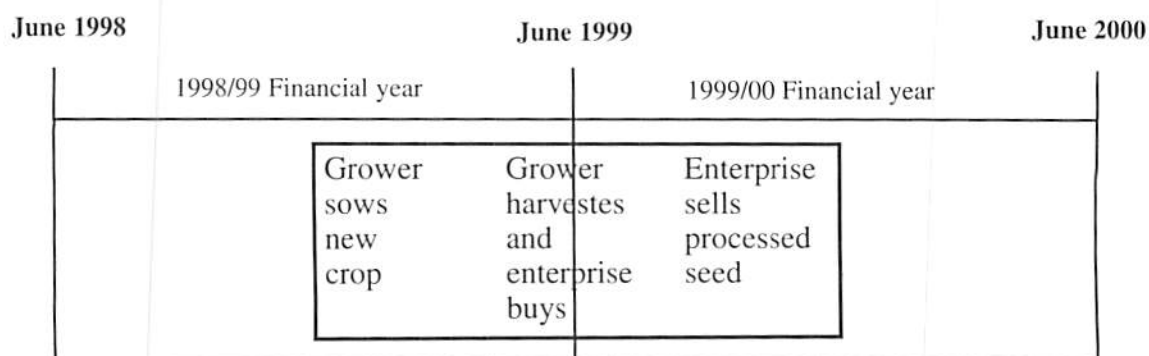


Figure 35. Relationship between farming year and financial year.

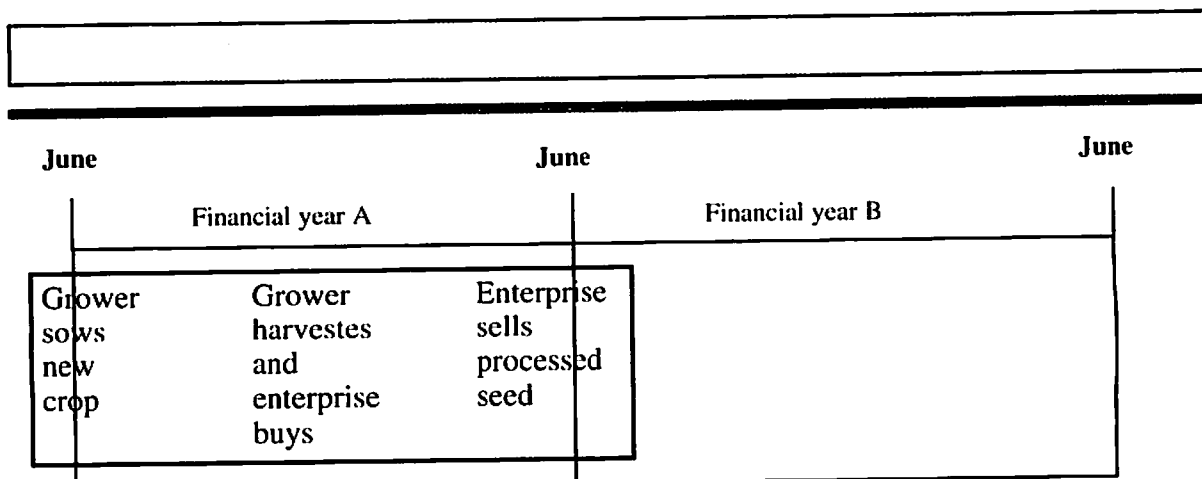


Figure 36. Relationship between farming year and financial year.

This problem can be lessened if the financial year corresponds closely to the farming year (Figure 36), especially if the farming activities of an enterprise can be completed within a year as for many cereals, but it is still difficult if there are two cropping seasons. Of course, in doing so it is important to consider the local situation and take into account relevant external factors such as the national financial year. Relationships between the cropping season, an enterprise's selected financial year, and the national financial year can have significant financial, information and organizational implications and are therefore worth investigating carefully.

Sensitivity Analysis of Gross Margins

Since the most common sources of change in gross margins are due to changes in the price of inputs and output, it is possible to substitute alternative prices, one at a time, and to recalculate the gross margin. Taking some information from Table 17, it is possible to carry out a sensitivity analysis for two scenarios: Scenario 1 where revenue increases by 10% and Scenario 2 where cost increases by 10% (Table 33).

Table 33. Sensitivity of gross margin to revenue and cost increases.

Item	Reference	Scenario 1		Scenario 2	
	(EB/100kg)	EB†/100kg	% of Reference	EB†/100kg	% of Reference
Revenue					
Seed sale	127.00	238.70	10	217.00	
Sale of by-products	5.20	5.72	10	5.20	
Sale of used bags	4.00	4.40	10	4.00	
Payment for cleaning services	0.97	1.07		0.97	
Total revenue	227.17	248.89		227.17	
Variable cost					
Cost of unclean seed	165.68	165.68			10
Packaging cost	7.61	7.61		182.25	10
Moving cost	1.07	1.07		8.37	10
Variable overhead cost	2.20	2.20		1.18	10
Total variable cost	176.56	176.56		2.42	10
				194.22	
Variable cost/Revenue	77.8%	70.7%	-9	85%	+9
Gross Margin (EB/100 kg)	50.61	73.33	+45	32.95	-35
Fixed overhead cost	20.70	20.70		20.70	
Net Margin (EB/100 Kg)	29.71	52.63	+76	12.25	-59

† 1 EB = Ethiopian birr (US\$ 1 = EB; 1996 official rate).

Effect if Scenario 1:

A 10% increase in overall revenue, assuming cost of inputs remain constant, results in a 9% drop in variable costs/revenue, a rise of 45% in gross margin and a 76% rise in net margin.

Effect if Scenario 2:

A 10% increase in overall cost of inputs, assuming the level of revenue remains constant, results in a 9% rise in variable cost/revenue, a 35% drop in gross margin and a 59% drop in net margin.

These results show that the enterprise is equally sensitive in terms of changes in gross and net margins for both a 10% rise in total revenue and total cost. However, it can be seen that even with a 10% rise in total cost, the enterprise is still profitable although the margins drop significantly.

Break-even Budget (Cost-Volume-Profit Analysis)

This is another kind of sensitivity budgeting. It uses cost and revenue information for planning purposes. Managers are constantly making decisions regarding costs (fixed and variable costs) and selling prices or revenue. These decisions are usually made in the short-run to determine:

- The quantity of seed in tonnes that should be produced.
- The number of laborers or machines that should be hired.
- Whether the enterprise should change its seed-selling price.
- The amount of money to be spent on promoting a new variety.

In addition to these short-run decisions, there are those taken over a long-term, such as the purchase of a new processing line or extending an existing warehouse. Regardless of short- or long run situations, the final decision the manager makes is based on predictions or expectations of cost-volume-profit relationships.

The cost-volume-profit analysis enables managers (of technical, commercial, and administrative departments) to set target profit levels, and then formulate coordinated approaches in predicting seed sales and production levels (sales and production budgets), costs, and selling prices. This means that prior to production, all managers must make decisions about expected sales levels, production targets, costs to be incurred, and the final selling price of the seed.

Underlying Assumptions of Cost-volume-profit Analysis

The following simplifying assumptions are made:

- Production activities of the enterprise generate a single type of output or product in the form of seed.
- The volume of production (number of tonnes) of the product is the only relevant factor affecting cost behavior. All other factors such as capacity levels of staff, technology, and technical efficiency are assumed to be constant.
- All costs are divisible into fixed and variable elements.
- Total fixed costs remain constant over the 'relevant' seed volume (output) range.
- Total variable costs vary linearly with (or are directly proportional to) seed output, since prices of items such as consumable materials and wage rates remain unchanged.

- Total revenue varies linearly with seed output, while selling prices of seed per tonne remain unchanged.
- This analysis applies to the relevant output range only. For instance, the linear relationship between total variable cost and total revenue with output are only valid within prescribed output limits, defined as the relevant range. These relationships may not hold for output volumes outside these limits.

Criteria Used in Cost-volume-profit Analysis

There are two main criteria used in cost-volume-profit analysis: break-even point and target profit.

Break-even point

The break-even point for a seed enterprise is the number of tonnes of seed produced for which the total revenue from sales equals exactly the total costs incurred. The break-even point can be determined both by calculation and by graphical methods.

Starting with the calculation method we can summarize the break-even point as:

Total Revenue (TR) = Total Fixed Costs (TFC) + Total Variable Costs (TVC)

that is, $TR = TFC + TVC$

then, $TR - TVC = TFC$.

It could be recalled that the relationship expressed by $(TR - TVC)$ is defined as the gross margin (GM).

The break-even point for an enterprise can be represented as Q_{bk} , the selling price per tonne of seed as S_t , the fixed cost per year as TFC, and the variable cost per tonne of seed as VC_t .

We can then express revenue derived from the production of the break-even quantity of seed,

TR_{bk} , as: $TR_{bk} = S_t Q_{bk} = TFC + Q_{bk} VC_t$

$TFC = S_t Q_{bk} - Q_{bk} VC_t = Q_{bk} (S_t - VC_t)$

Therefore: $Q_{bk} = TFC / (S_t - VC_t)$

It is clear that $(S_t - VC_t)$ or the selling price per tonne, minus the variable cost per tonne gives the gross margin per tonne (GM_t). Since the gross margin should be large enough to cover the fixed cost and generate some profit, the gross margin per unit is usually referred to as the contribution margin. In other words, the amount that each unit contributes towards covering the fixed costs at the break-even point and thereafter, towards generating profit, that is $(Q_{bk} = TFC / GM_t)$.

To calculate the required break-even point, the total fixed cost should be divided by the contribution margin.

Example:

A seed company produces and sells certified seed at \$100/tonne, for which it incurs \$50/tonne of variable costs and \$15,000 total fixed cost/year. Calculate the number of tonnes of certified seed that the company must produce and sell per year to break even.

Solution: Substituting in the equation: $Q_{bk} = TFC / (S_t - VC_t) = 15,000 / (100 - 50) = 300$ tonnes of seed. If all 300 tonnes of certified seed were sold, the total revenue would be

equal to $(300 \times 100) = \$30,000$. The total variable cost equals $(300 \times 50) = \$15,000$. At the break-even quantity of 300 tonnes of certified seed, the total revenue must be equal to the total cost ($TR = TFC + TVC$).

That is, $(300 \times 100) = 15,000 + (300 \times 50)$

$$30,000 = 15,000 + 15,000 = 30,000$$

Similarly, a graphical method could be used to derive the break-even point in two steps:

Step 1: (Table 34 and Figure 37)

- Total fixed cost (TFC) of \$15,000 remains constant over all levels of output.
- Variable cost (VC) varies at \$50/tonne over all levels of output.
- Fixed and variable cost functions combine to give a total cost function (TC).
- Plot TC, VC and TFC against quantity of seed in tonnes.

Table 34. Values of total cost, variable cost and total fixed cost.

Quantity of seed	Total fixed cost	Total variable cost	Total cost
tonne	'000\$	'000\$	'000\$
0	15	0	15
50	15	2.5	17.5
100	15	5	20
150	15	7.5	22.5
200	15	10	25
250	15	12.5	27.5
300	15	15	30
350	15	17.5	32.5
400	15	20	35
450	15	22.5	37.5
500	15	25	40

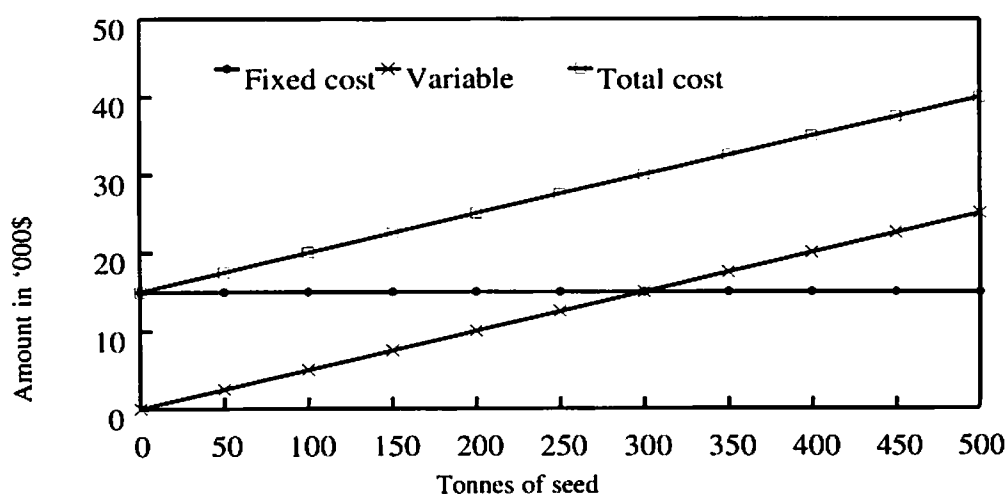


Figure 37. Determination of break-even point using total variable and total fixed cost.

According to Figure 37, TC is obtained by adding TVC and TFC for any output level. The TC function is equal to the vertical addition of TFC and TVC. It is exactly the same form (same slope) as the TVC, but is \$15,000 higher on the vertical axis.

Step 2: (Table 35 and Figure 38)

- Multiply output by the fixed selling price of \$100/tonne to give total revenue (TR).
- Plot TC and TR functions against quantity of seed.
- The point of intersection of the TC and TR functions is the break-even point.

Table 35. Values total cost and total revenue.

Quantity of seed tonne	Total cost '000\$	Total revenue '000\$
0	15	0
50	17.5	5
100	20	10
150	22.5	15
200	25	20
250	27.5	25
300	30	30
350	32.5	35
400	35	40
450	37.5	45
500	40	50

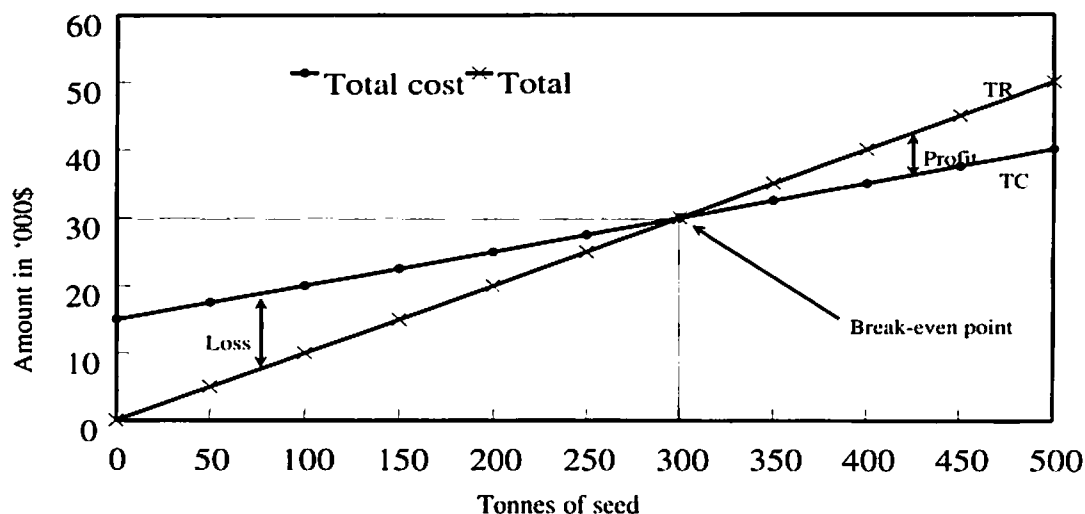


Figure 38. Determination of break-even point using total revenue and total cost.

An enterprise makes a profit for all output range where the TR function lies above the TC function, but makes a loss when the TC function lies above the TR function. At any volume of output the vertical distance between the TC line and the TR line measures the profit or loss made.

Targeted profit

The primary motive of a seed enterprise is to produce and sell seed in order to make a profit. This requires the enterprise to operate above the break-even point. In other words, an enterprise is profitable when it operates at an activity level where the total contribution margin covers total fixed cost (break-even point) plus a desired profit. The break-even point is given by:

$$Q_{bk} = TFC / (S_t - VC_t) = TFC / GM$$

If the desired profit level is π , then this can be added to TFC (to be covered by GM) to give a new relationship for the total quantity of seed, Q_{total} , that needs to be produced as:

$$Q_{total} = (TFC + \pi) / (S_t - VC_t) = (TFC + \pi) / GM$$

Example

If the Seed Company in the previous example were to earn a target profit of \$5000, how many tonnes of certified seed should it produce and sell?

Substituting in $Q_{total} = (TFC + \pi) / (S_t - VC_t)$

$$(15,000 + 5000) / (100 - 50) = 20,000 / 50 = 400 \text{ tonnes}$$

Note that the enterprise has to produce 300 tonnes of seed to break even. If it is to earn a profit level of \$5000, the enterprise needs to produce and sell an additional 100 tonnes of certified seed. But profit is not usually expressed in absolute amounts of money but as a percentage of total revenue earned from sales. So instead of an enterprise expressing its desired profit in a certain amount of \$, it may do so as a proportion of an intended revenue to be earned from sales of seed. This can be done in the following way:

Note that: $TR = TFC + TVC + \pi$

Expressing the desired profit as a certain percentage, y , of total revenue, the equation could be rewritten as:

$$TR = TFC + TVC + yTR$$

$$\text{or } TR = S_t Q_{total} = TFC + VC_t Q_{total} + yTR$$

Since $TR = S_t Q_{total}$, then profit yRT can be written as $yS_t Q_{total}$

$$\text{Therefore, } TR = S_t Q_{total} = TFC + VC_t Q_{total} + yS_t Q_{total}$$

$$TFC = S_t Q_{total} - VC_t Q_{total} - yS_t Q_{total}$$

$$TFC = Q_{total}(S_t - VC_t - yS_t)$$

$$Q_{total} = TFC / (S_t - VC_t - yS_t)$$

Example

If the Seed Company were to earn profit equivalent to 12.5% of sales revenue, how many tonnes of certified seed must be produced and sold?

Substituting in $Q_{total} = TFC / (S_t - VC_t - yS_t)$

$$15,000 / \{(100 - 50) - 0.125(100)\}$$

$$15,000 / (50 - 12.5) = 15,000 / 37.5 = 400 \text{ tonnes}$$

As it can be seen, the 400 tonnes of certified seed produced earlier actually generates 12.5% profit per sales revenue for the enterprise. This can be verified by dividing the absolute

profit level of \$ 5000 in our previous example by the total revenue from sales of 400 tonnes.
Profit per sales revenue = $5000/(400 \times 100) = 5000/40000 = 12.5\%$

An important extension at this point is that using the equations that have been derived, it is possible to select a selling price for certified seed under a break-even condition and under a condition where a desired profit level is anticipated.

Under break-even condition, $Q_{bk} = TFC/(S_t - VC_t)$

Hence, $(S_t - VC_t) = TFC/Q_{bk}$

$$S_t = TFC/Q_{bk} + VC_t$$

The seed selling price needed to break-even can be calculated if the desired sales level, variable cost per tonne of seed, and the total fixed cost can be forecast.

Under profit condition, $Q_{total} = (TFC + \pi)/(S_t - VC_t)$

Hence, $(S_t - VC_t) = (TFC + \pi)/Q_{total}$

$$S_t = (TFC + \pi)/Q_{total} + VC_t$$

In this case, it is possible to calculate the selling price needed to earn a specified level of profit if the forecast level of output, variable cost per tonne, and total fixed cost are known.

As in the case of break-even point, target profit can also be derived using a graphical method (Table 36 and Figure 39) using the following steps:

Step 1: Adding the target profit of \$5000 to the TC function to generate a total cost plus profit function can derive a new relationship.

Step 2: The TR, TC, and TC + profit functions can be plotted against the quantity of certified seed.

Table 36. Total revenue, total cost, and total cost plus profit functions.

Quantity of seed	Total revenue	Total cost	Target profit	Total cost+target profit
<i>tonne</i>	<i>'000\$</i>	<i>'000\$</i>	<i>'000\$</i>	<i>'000\$</i>
0	0	15	5	20
50	5	17.5	5	22.5
100	10	20	5	25
150	15	22.5	5	27.5
200	20	25	5	30
250	25	27.5	5	32.5
300	30	30	5	35
350	35	32.5	5	37.5
400	40	35	5	40
450	45	37.5	5	42.5
500	50	40	5	45

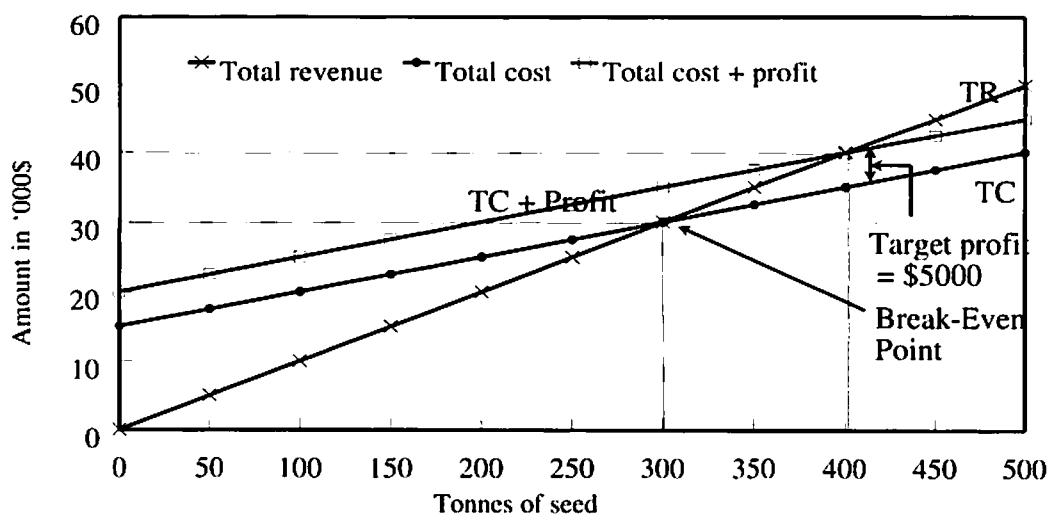


Figure 39. Determination of target profit.

Since the TR function intersects the TC function at the break-even point, more seed must be produced for TR to cover all costs including the target profit,. The specified quantity of seed output to cover the target profit is therefore represented by the intersection of the TR function and the TC plus profit function.

Effects of Changes in Sales Price, Fixed Cost and Variable Cost

The effect of changes in sales price, fixed and variable costs can be illustrated graphically for easier understanding, since information about costs, sales, and profits at any given output level can be read directly from the respective charts.

Change in sales price

Considering the effect of an increase in sales price from \$100 per tonne to \$120 per tonne, and a decrease from \$100 to \$80 per tonne, the total cost and the revenue functions can be plotted against output (Table 37 and Figure 40).

Table 37. Effect of changes in selling price of seed.

Quantity of seed tonne	Total cost '000\$	Total revenue when price is:		
		\$100/t '000\$	\$150/t '000\$	\$80/t '000\$
0	15	0	0	0
50	17.5	5	7.5	4
100	20	10	15	8
150	22.5	15	22.5	12
200	25	20	30	16
250	27.5	25	37.5	20
300	30	30	45	24
350	32.5	35	52.4	28
400	35	40	60	32
450	37.5	45	67.5	36
500	40	50	75	40
550	42.5	55	82.5	44
600	45	60	90	48

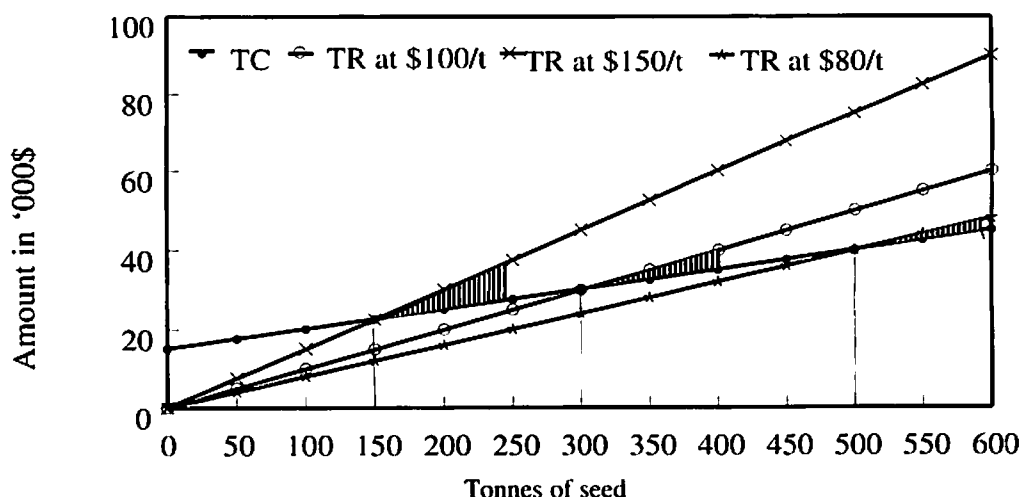


Figure 40. Determination of profit using total revenue.

When the sales price is increased, the enterprise needs to produce and sell a lesser quantity of seed to break even. The profit also increases substantially so the profit of seed per unit, beyond this new break-even point, increases more rapidly compared to profit per unit of output, beyond the original break-even point (note that the TC function is held constant while the TR becomes steeper as it shifts to the left). Conversely, a decrease in selling price requires a greater volume of output to break even accompanied by a reduced profit per unit of output beyond the new break-even point (TC function held constant while TR becomes flatter as it shifts to the right).

Change in fixed cost

Considering an increase in fixed costs this time from \$15,000 to \$25,000 and a fall in fixed costs to from \$15,000 to \$5,000, it is easy to obtain a new total cost function which shows an increase and a decrease in fixed costs. To study the effect of such changes, the TR and the total cost functions are plotted against seed output (Table 38 and Figure 41). The higher the total fixed costs, the greater the quantity of seed that must be produced to break even, the lower the total fixed cost, the less is the break-even quantity. However, it is important in this case to note that regardless of the direction of change in fixed costs, the profit per unit beyond the break-even point remains unchanged (see shaded portions). Any change in fixed cost is shared equally over the quantity of output while total revenue is held constant such that the change in total cost remains the same at all levels of output. This effect can be illustrated simply by keeping the TR function fixed, and moving the TC function vertically along the y-axis. It can be seen that distances between the TC and the TR functions remains the same at every level of output (Figure 41).

Table 38. Values of total revenue and total cost at different levels of fixed cost.

Quantity of seed <i>tonne</i>	Total revenue <i>'000\$</i>	Total cost when fixed cost is:		
		\$5000 <i>'000\$</i>	\$15,000 <i>'000\$</i>	\$25,000 <i>'000\$</i>
0	0	5	15	25
50	5	7.5	17.5	27.5
100	10	10	20	30
150	15	12.5	22.5	32.5
200	20	15	25	35
250	25	17.5	27.5	37.5
300	30	20	30	40
350	35	22.5	32.5	42.5
400	40	25	35	45
450	45	27.5	37.5	47.5
500	50	30	40	50
550	55	32.5	42.5	52.5
600	60	35	45	55

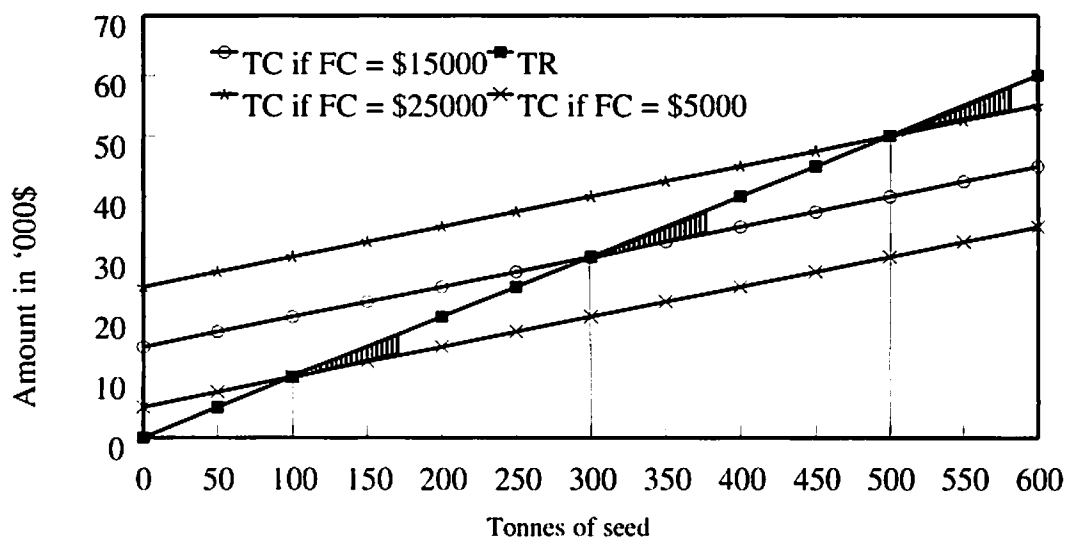


Figure 41. Determination of profit with changes in total cost.

Change in variable cost

Considering finally an increase in variable cost from \$50 per tonne to \$60 per tonne and a fall from \$50 per tonne to \$40 per tonne, it is also possible to obtain total cost functions which represent an increase and a decrease in variable costs. The effect of these changes can be examined by plotting the TR and total cost functions against the quantity of seed (Table 39 and Figure 42).

Table 39. Effect of changes in total variable cost.

Quantity of seed <i>tonne</i>	Total revenue <i>'000\$</i>	Total cost when variable cost is:		
		\$30/t <i>'000\$</i>	\$50/t <i>'000\$</i>	\$70/t <i>'000\$</i>
0	0	15	15	15
50	516.5	17.5	18.5	
100	10	18	20	22
150	15	19.5	22.5	25.5
200	20	21	25	29
250	25	22.5	27.5	32.5
300	30	24	30	36
350	35	25.5	32.5	39.5
400	40	27	35	43
450	45	28.5	37.5	46.5
500	50	30	40	50
550	55	31.5	54.5	53.5
600	60	33	45	57

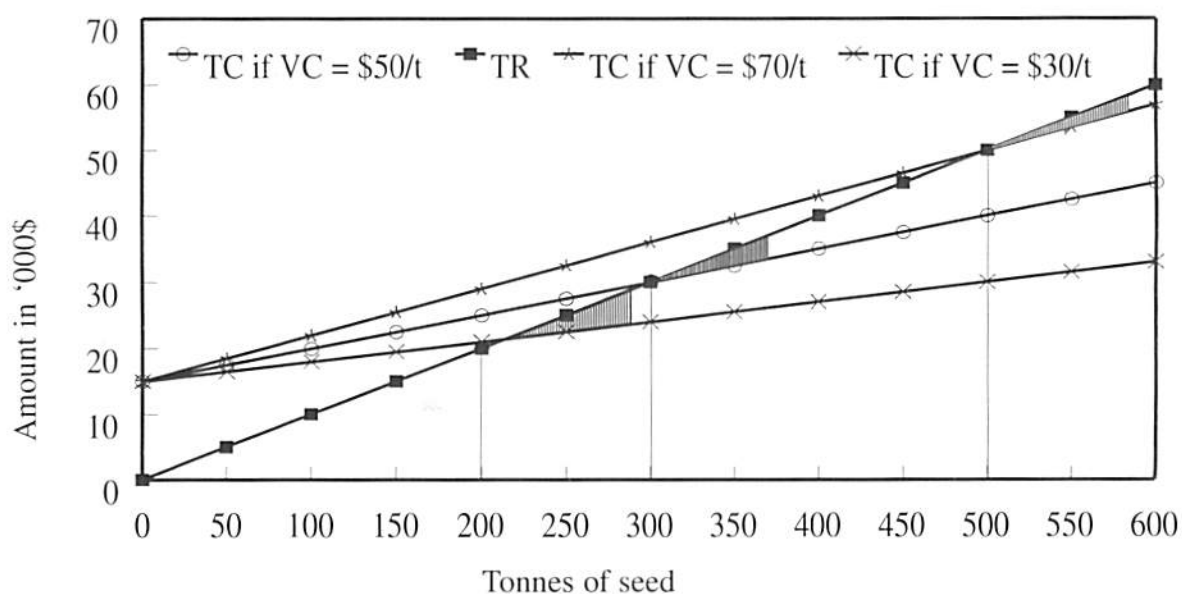


Figure 42. Determination of profit with changes in total variable cost.

The higher the variable cost per tonne, the greater the quantity of seed that must be produced and sold to break even. The lower the variable cost per tonne, the smaller this break-even quantity is. If the variable cost per tonne increases while total revenue is kept constant, there is a substantial fall in profit per tonne beyond the break-even point (see shaded portion). On the other hand, a fall in variable cost per tonne, keeping total revenue constant, is accompanied by a substantial increase in profit per tonne beyond the break-even point (Figure 42).

Partial Budget

This is budgeting carried out in relation to a partial change to a given enterprise production plan. The partial budget accounts for only those items of costs and returns which change and forecasts the effect in financial terms. Many seed growers normally allocate only a portion of their farm to seed production. The resources of labor, capital, or inputs are shared between seed production and other activities undertaken such as grain or livestock production. Any attempt to isolate the financial effects of seed production from the rest of the enterprise's activities is partial budgeting.

Complete or Whole-farm Budget

This is budgeting carried out in relation to the entire farm. It takes into account the costs and revenue from all activities including seed production, and forecasts the financial result of the whole business.

Conclusions

A seed enterprise cannot do well if it is unable to monitor and control costs. Since, in many cases, margins are small, particularly for enterprises dealing in self-pollinating crops. Management accounting is a key means of monitoring and control, for which access to good routine information is essential. Financial statements such as profit and loss accounts and balance sheets are prepared to meet this need. Good information is also required for cost planning, which forms the basis of monitoring and control systems. It is important for managers and staff, who are involved in the budget preparation, to give strong support to the budget and ensure its success. Budgets are not only used as tools for planning only, but should be interpreted correctly and used to the fullest potential during the operational stage of the enterprise. The budget should be used as a 'living' document so that any variances from expectation during the operational stage are investigated quickly and corrective actions taken in time. In this respect the budget is used as a monitoring tool as well. A quarterly review of accounts and variances is a useful routine procedure.

Further Reading

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Chapter 10. Privatization of the Seed Sector



Introduction

In the broad sense, privatization refers to the introduction of market forces into an economy to facilitate free trade. This means that privatizing the seed sector has to be closely linked to implementing overall national economic policies, which support the development of market economies. In the seed industry, privatization requires a re-definition of the functions of public and private sectors since both have specific roles to play depending on the situation. This chapter discusses the status of privatization of seed industries in developing countries, the steps that are followed in privatizing state-owned means of seed production, and the problems associated with this process.

Performance of Public Seed Producing Organizations

Over the past three decades, there has been significant state involvement in the seed industry because governments have regarded farmer sources and traditional varieties as incapable of providing the production gains required, or meeting national seed requirements arising from rapid population increases. Intervention from the state has been in the form of investments within large-scale national seed enterprises and state farms as mechanisms for the multiplication and distribution of modern varieties.

However, as private businesses become more active in national economies, many countries are now seeking ways of reducing the involvement of government in seed production

and are encouraging private companies to participate. In fact, much of the seed provision in developing countries already lies in 'private hands', since most farmers save their own seed and some also distribute it in farming communities using local means of exchange. However, these informal supply channels offer little quality assurance and may have no linkage to other technologies recommended for improving productivity.

On the whole, parastatal organizations have demonstrated limited success in their attempts to produce and distribute seed to small farmers. This partly explains why many developing countries now seek alternative seed supply systems as part of their privatization efforts. High operational costs and the use of inefficient delivery systems are among the major causes of the failure of parastatals. Probably, more emphasis on the technologies of seed production has been made in the past while neglecting those factors which contribute to seed use.

As an alternative to parastatals, many countries (several in Latin America, some in Asia, and a few in Africa) are developing new strategies aimed at encouraging farmers, small enterprises, merchants, and traders to cater for local seed needs.

Privatization of the seed sector in developing countries is part of the general World Bank/IMF Structural Adjustment policies aimed at commercial restructuring of public sector institutions. Those public seed producing organizations, which demonstrate a potential to earn profits, are usually restructured to operate commercially. Those that do not are either liquidated or are made to operate for strategic reasons such as producing seed of less-profitable important food crops.

Status of Privatization in Developing Countries

Although general problems associated with privatization are similar in most countries, factors influencing the privatization process itself, namely, political direction, economic status, progress in research, state of commodity markets, and agribusiness development, vary between countries. Besides the state of economic development, priorities and approaches that are taken also differ according to the history of the country as well as culture and traditions. These make the process of privatization complex.

Therefore, it is better not to make generalizations across countries, but to treat privatization on a case-by-case basis. However, sharing experiences among countries that are at different stages of privatization serves as a useful learning purpose. Lessons could be learnt from the experience of others, but it is difficult for countries to simply adopt entire models, which are developed elsewhere. The general status of privatization in developing countries is outlined in Figure 43.

Stages in Privalization			
1	2	3	4
• Formal sector comprises only public seed producing organizations; seed price determined by government • Private dealers market seeds of high-valued crops such as sugar beet, sunflower, potatoes, food legumes, forages, and vegetables • Little or no privalization experience	• Framework for privatization of public sector beginning to develop; some liberalization in seed pricing • Foreign and local seed companies active and competing with public enterprises in production, and/or marketing of seed	• Framework for privatization available and under discussion • Several foreign and local companies active and competing with public sector enterprises • Seed price determined by market forces	• Institutional framework for privitaization well established • Private companies dominate seed production, both large and small scale
Examples: Jordan, Syria, Cyprus, Libya	Examples: Ethiopia, Sudan, Tunisia, Lebanon, Ghana, Yemen	Example: Egypt, Morocco, Malawi	Example: Turkey, Pakistan

Figure 43. Status of privatization in developing countries.

Roles of Public and Private Investment in Seed Provision

Identifying specific roles for public and private sectors and partitioning national investment in seed provision will depend on local situations, which are determined primarily by the type of crop in question. Approximate levels of expected public and private sector participation in selected seed industry functions are illustrated in Figure 44. It shows the general situation in many countries where hybrids and self-pollinating seed crops are handled predominantly by the private and the public sectors, respectively.

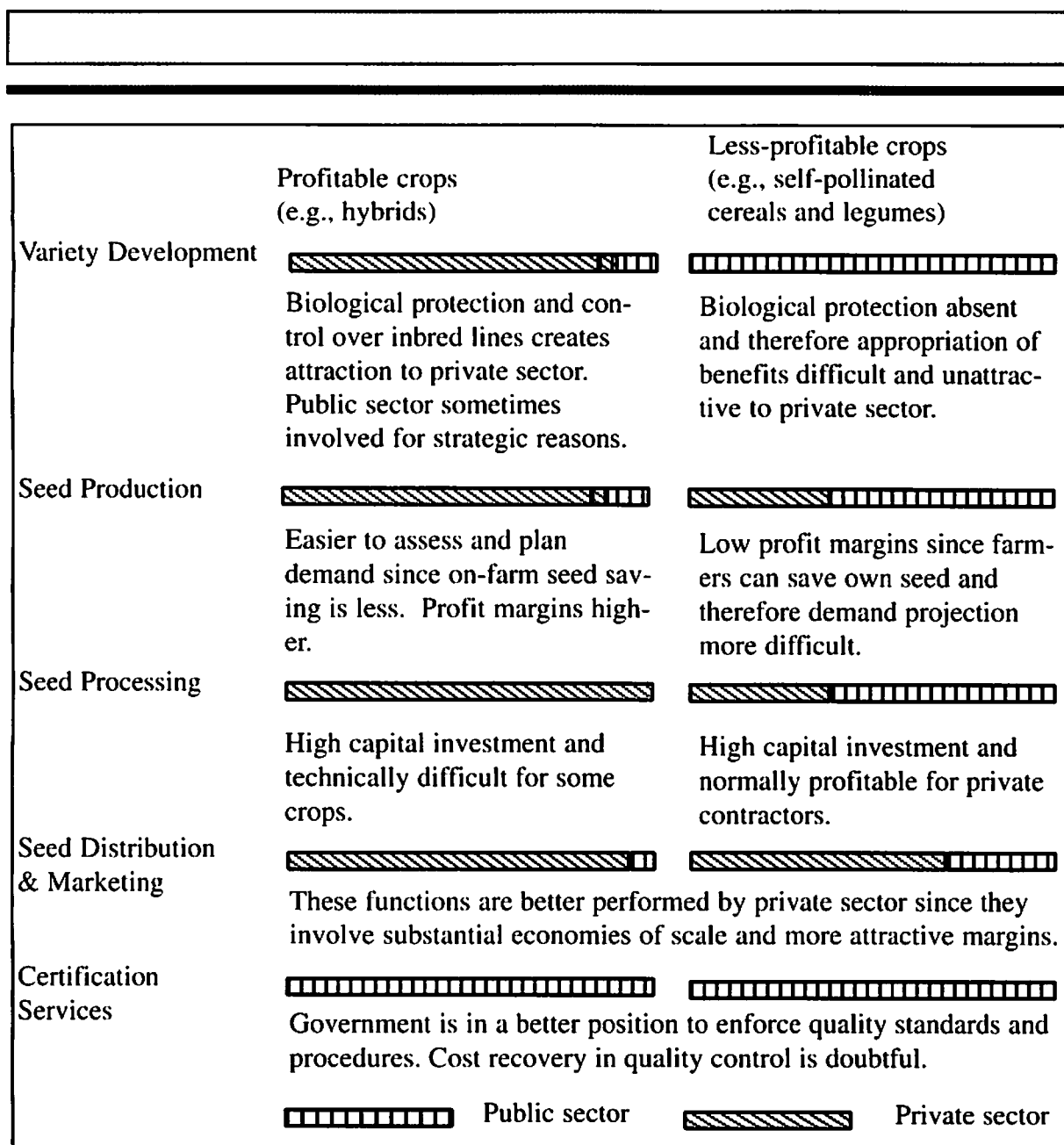


Figure 44. Roles of public and private sectors in seed provision.

Privatizing Public Sector Seed Operations

Methods

There are two common methods of privatizing public sector seed production. These relate to the entire seed industry and emphasize the relationships between public and private sectors of the industry.

- *Transformation process of market liberalization by creating conditions where public and private sectors can compete freely*
 - Creating new structures for public and private organizations (e.g., management/employee buy-outs, lease and management contracts).
 - Giving these new organizational structures greater autonomy that is free of government

intervention.

- Withdrawal of preferential subsidies and other forms of privilege that give undue advantage to the public over the private sector.
- Input and output prices determined purely by market forces.

The aim is to create a 'level playing-field' for all participants, both from the public and private sectors.

- ***Full transfer of assets and ownership of public sector production entities to the private sector***

- Creation of technically efficient and appropriate legal framework to transfer assets (holding companies). The choice of legal status to be determined by policy and local conditions.
- Sale of state-owned enterprise assets.

The primary goal is enhancing efficiency by creating clear ownership of assets and ensuring that acquired property rights are lasting and are protected by appropriate legislation.

Because of complexities associated with privatization, local circumstances should, by and large, dictate the sequence of methods adopted. Although, it seems logical to create stable market conditions first, which can enable efficient functioning of newly privatized businesses. Transfer of assets then follows this step where applicable. These methods should aim at *price liberalization and monetary/fiscal stabilization*. It is important that any short-term measures fit within long-term developmental perspectives. A too rapid process should be avoided since a sudden breakdown in supply or high unemployment are possible, thus subjecting the reform program to political opposition. *Privatization should be dynamic, but gradual and evolutionary* in scope, while safeguarding against side effects such as:

- ***Negative social effect on employees***

A social security and compensation package should be developed for employees who lose their jobs as a result of privatization.

- ***Deficiency/breakdown in seed supply***

A sudden withdrawal of public seed production should not lead to a breakdown in seed supply, particularly for strategic crops.

- ***Inappropriate margins***

The privatization process has to ensure a fair and competitive future seed market for all participants.

- ***Weak role by farmers' associations***

Privatization should not weaken, but strengthen farmers' associations to organize seed production and to carry out key functions such as advocacy and information exchange.

- ***Weak legislation***

There should be appropriate and firm legislation/regulations that protect seed producers and users.

- ***Less effective seed certification***

Privatization should be accompanied by a strong regulatory role of seed certification as a guarantee of protecting producers and users.

Stages

Privatizing state-owned seed operations is usually gradual and may last several years, particularly if the crop-mix includes self-pollinating cereals and grain legumes. A good start and future success depend primarily on commitment of the government towards privatization. An important initial step is establishing a committee, which can identify further steps towards privatization and formulate an action plan. Logical steps, which may be followed in privatizing public seed operations, are suggested in Figure 45.

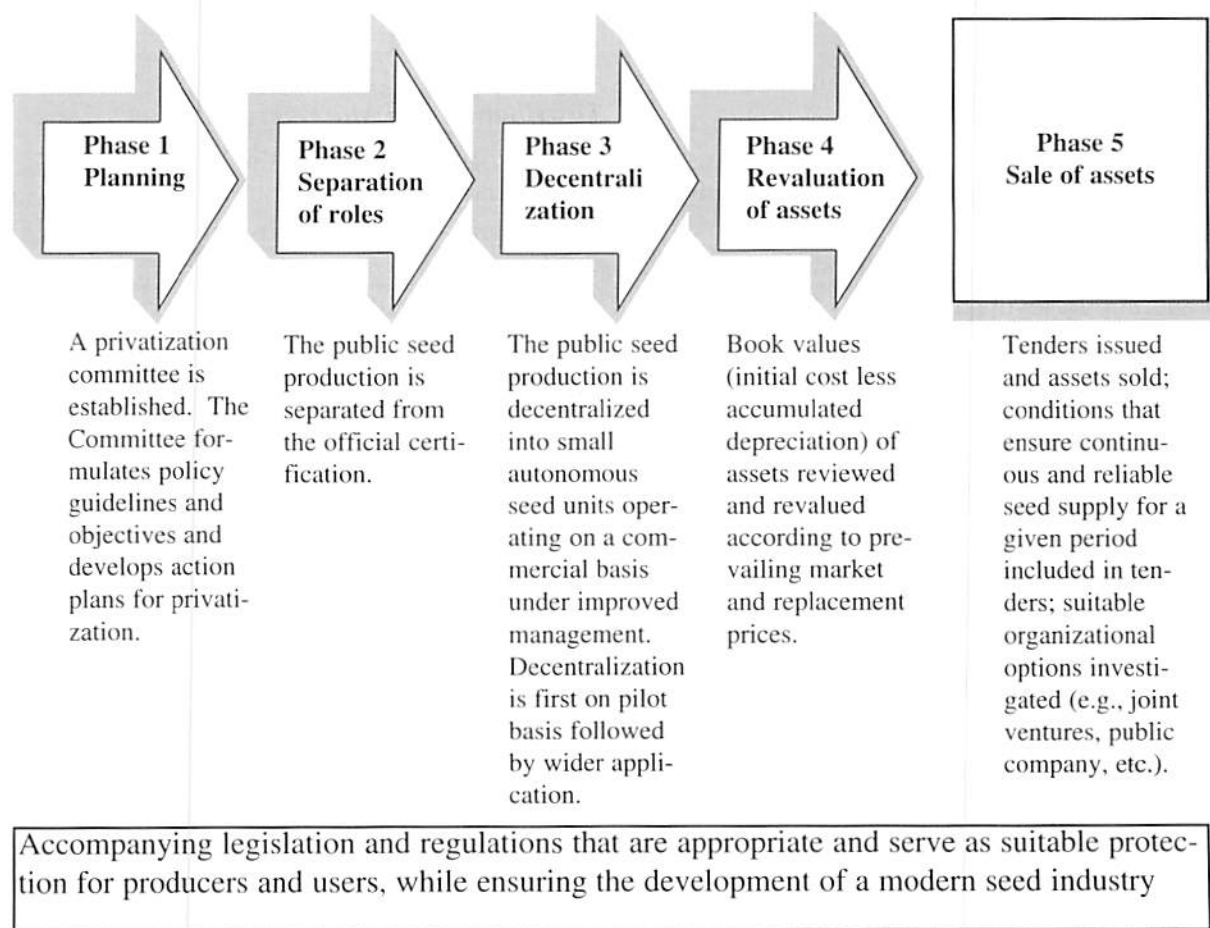


Figure 45. Stages in privatizing public seed sector operations.

The process of privatization may be faster in the case of high-valued crops, particularly those for which hybrids exist. Governments may wish to continue state ownership in those crops where no private interest is expressed (e.g., minor and less-profitable crops). Even in such cases, appropriate measures can still be taken to improve efficiency, reduce costs, and commercialize operations as much as possible.

Pre-conditions

It is important that certain preconditions are met before public seed organizations are considered suitable for privatization. A checklist of important factors, which should be taken into account, is presented in Figure 46.

Production • Continuous access to basic seed assured • Efficient operations put in place	Management and Staffing • Improved management structure put in place • Staff qualifications assessed • Recruitment and training procedures improved • Performance indicators and incentives identified
Planning, Monitoring and Control • Modern finance, accounting and controlling systems established • Proper budget planning and control introduced • Profitability assessed taking all costs into account • Timely reporting system initiated • Proper internal and external auditing system introduced • Capital replacement capacity assessed debt and equity levels assessed.	Distribution and Marketing • Capacity to conduct market analysis ensured • Appropriate seed purchase and selling price mechanisms established • Sales force established

Figure 46. Pre-conditions for privatizing state-owned seed organizations.

Cost and Financing

Privatizing public seed production involves restructuring existing entities such as seed centers. This is costly and has to be financed out of a specified budget. Major cost components of restructuring usually comprise the following:

- **Direct cost of restructuring**
 - Updating machinery and office equipment.
 - Cost of spare parts and laboratory equipment.
 - Training program for middle management staff in modern management tools.
 - Cost of social plan for redundant employees.
- **Cost of establishing stock company (where applicable)**
 - Public sector shares.
 - Private sector shares.

After privatization, there is usually a problem of acquiring sufficient funds for required investments and for financing working capital. A strong capital base is vital for new companies to survive during the crucial phase that immediately follows privatization. Finance for restructuring could be obtained from a mix of sources including the following:

- **Credit**

Sources of credit are often limited because of the relatively weak financial markets in many developing countries.
- **Share capital**

Revenue from sale of shares will depend on the availability and readiness of the public to acquire shares in the new companies.
- **Redundancy fund**

The cost of a social plan for redundant employees may need outside finance, as this may not be accomplished under on-going restructuring activities.

Problems

Several problems can be encountered in privatizing state-owned seed activities. Some of these could actually pose as barriers to the entry of new entrepreneurs into seed production. Key problems are illustrated in Figure 47 and each one is explained later in detail.

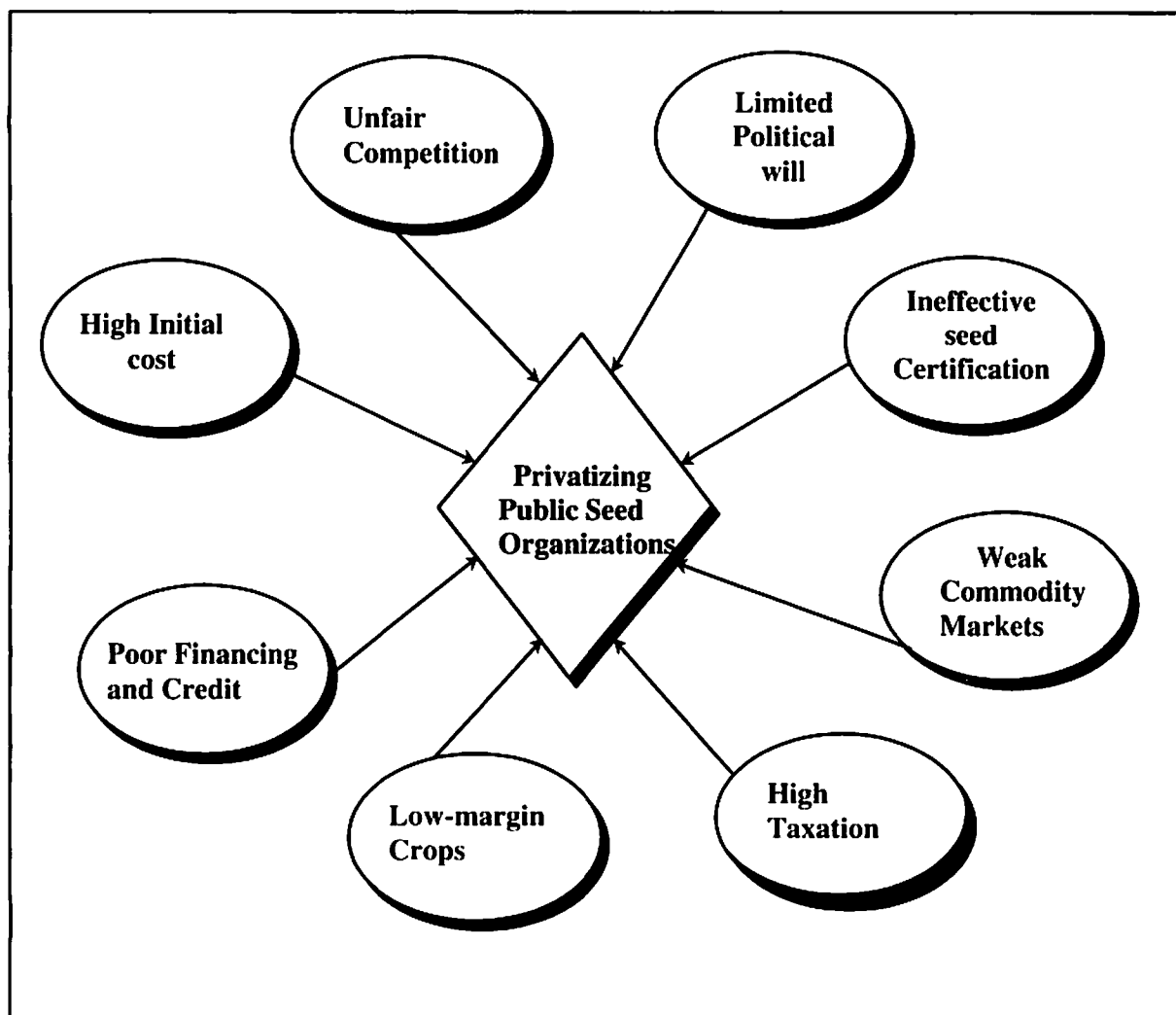


Figure 47. Problems in privatizing public seed operations.

- ***Unfair competition***

Many public seed sector organizations receive substantial subsidies from government and do not calculate the true cost of seed production. Not all costs (depreciation of assets) are taken into account in calculating the selling price of seed. There is therefore often a situation of unfair competition between a heavily supported public sector and a private sector that does not receive similar subsidies and other state incentives.

- ***Less organized commodity markets***

A commercial seed industry needs support from a viable commodity market. This is particularly relevant for crops that are linked either to the development of value added or agro-

based industries (e.g., tomato paste factories, breweries, and flour mills), or serve as basic production cost in the determination of the seed price (e.g., the grain market for many cereal crops). Many commodity markets are not competitive and lack transparency because political considerations and economic conditions inhibit the forces of demand and supply. For example, there has to be a viable grain market for seed production of cereals to be commercially viable.

- ***Limited political will***

Privatization cannot succeed without political will and support from national governments. Support is needed in reviewing outdated laws and making these more adaptable to current situations and, in particular, for promoting business activities in the seed sector.

Clear guidelines on privatization need to be established and distorting policies (for example, fixed pricing of seed to make it cheaper than the cost of producing it) should be avoided. These guidelines should ensure fair competition and stimulate both public and private interests, as well as give guidance to foreign investment and repatriation of profit.

The private sector may require favorable credit terms such as tax holiday periods (paying no tax on profits) for a number of years, since initial investment costs may be quite high. A market and pricing policy, which imposes minimum sales price for seed, should be considered.

Where possible, plant breeders' rights should be considered. Seed Councils should have more functional roles in helping to bring private and public sector agencies together that are interested in seed production.

Other areas that require government support include training of private and public sector staff in aspects of seed industry development, establishing seed associations, developing and making available reliable agricultural statistics, financing seed security stocks, ensuring remote areas have access to good seed, and continuing applied research in low-profit self-pollinating crops.

- ***High cost of initial investment***

High cost of initial investment (e.g., acquiring processing plants and storage facilities) may represent a barrier to entry into the seed business by private individuals. Where applicable, incentives should be provided, for example, by leasing state-owned land at reasonable cost to the private sector for seed production, allowing use of state-owned marketing channels and renting/hiring of public sector storage or processing facilities.

- ***Poor financing and credit arrangements***

Small farmers are often regarded as a credit risk, although they usually need assistance in financing part of their farming operations. Restricted access to institutional credit is generally a barrier to participation in commercial farming.

- ***Ineffective seed certification***

A well-functioning quality control system provides an incentive and guarantee to the private sector to participate in seed production. This could be in the form of an independent certification service that is separated from seed production and supported by other services such as a variety release mechanism and a national catalogue. The aim is to have a control system that eliminates fraud and ensures that quality seed reaches the farmers.

- ***Producing low margin seed***

Besides country-specific features such as pricing policies and subsidies, there are crop-related issues to consider in efforts to privatize the seed industry. While the production of hybrid crops (for example, maize) and high margin crops such as vegetables is easier to privatize, the situation is more difficult when one deals with high volume, low margin crops such as many self-pollinating cereals including barley, wheat and rice. Although these crops are the most important source of food in many countries, private interest in seed production is generally weak. One means of encouraging private sector interest in seed production of these crops is by maintaining a strong research base with open access for private companies and by making public varieties (including breeder and foundation seed) equally available to both sectors. An effective royalty payment scheme should be considered, although collection of royalties is not easy.

Formation of Small-scale Seed Enterprises

Privatizing public sector means of seed production does not entirely solve the problems small farmers face, since the new commercial companies generally deal in improved varieties of high-valued crops. On the other hand, a majority of small farmers usually rely on less profitable cereals and food legumes, which do not attract private sector investment. These farmers save their own seed using indigenous knowledge and traditional practices. But these are far from meeting needs in terms of quantity, quality, and food security.

It is obvious that the only effective way of meeting seed needs of resource poor farmers is to produce and distribute better seed within farming communities. In addition to privatizing big parastatals, the privatization policy should take into account the welfare of small farmers in terms of improved seed supply. The question is, how? An answer may lie in small-scale seed enterprises that are owned and run by the farmers themselves having incentive structures that encourage village-level investment and commitment. By definition, the functions of a seed enterprise extend beyond field multiplication to include post-harvest handling, cleaning, storage, and marketing. Small-scale enterprises are defined as *those enterprises that are owned and managed by a few people who make major decisions*.

Small enterprises seem most ideal in smallholder communities because seed selection and use is location-specific, with particular varieties confined to small agro-ecological niches. Reduced transport, distribution, and supervision costs are therefore major advantages.

Types of Small-scale Seed Enterprises

As mentioned before, small-scale seed enterprises should be owned and managed by a few people, with each person bearing responsibility for several functions. Such enterprises may take various forms including the following:

- Individuals such as key farmers and families producing seed for sale in the community.
- Small companies formed as a partnership among few businessmen or farmers.
- Farmers Cooperatives.
- Seed Producers' Associations.
- Community-based groups supported by NGOs.

Enterprise Formation

Forming a small-scale seed enterprise involves two key elements:

Identification

Since seed production and marketing require specialized knowledge, skills and resources, it is important to identify individuals and groups who are prepared to invest in this sort of business and do it well. Therefore, they should have some experience in seed production and be concerned about selling good seed and maintaining reputation among seed-using farmers. Within the community such entrepreneurs could be leading farmers, extension agents, traders or merchants, and other businessmen.

Support

Potential investors in small-scale enterprises may need incentives if they are to produce seed of less profitable crops that are not attractive to large seed companies. Support could take the following forms:

- Government supported research in minor crops.
- Access to basic seed of crops grown by the enterprises.
- Low or interest-free credit, grants, and temporary subsidies to get started.
- Tax-free holiday period.
- Training in best husbandry practices and quality seed production.
- Arrangements to acquire basic equipment (e.g., simple seed cleaner), storage facilities, and materials (e.g., bags, fumigants, and labels).

Support to seed enterprises should be for a specified period until the enterprise succeeds in producing and marketing good seed, and demonstrates profitability.

Organization and Financial Management of Enterprises

To be successful, a seed enterprise must have the capacity to grow, clean, store, and market good seed effectively. This may require access to basic seed of new and existing varieties. These various activities are coordinated and controlled by components of the organizational structure. A typical small-scale seed enterprise is illustrated in Figure 11, where only few key people supervise the entire operation of the enterprise. This means that these essential staff must have wide knowledge of both technical and economic issues involved in the production and marketing of seed. There are two special management features of seed enterprises:

- As a biological process, seed multiplication is not characterized by significant economies of scale like in controlled processes such as conventional manufacturing because of several external factors which can cause sudden changes. These include variations in climatic conditions and disease/pest infestation.
- Seed is a living material and has to be handled carefully so that this living condition is maintained right through all processes from harvesting to the next planting time. This is important particularly in warm and humid climates where it is difficult to bring seed to a safe level of moisture content soon after harvest and to keep it in store.

These factors mean that many decisions should be made promptly and on the spot, for which delegation of responsibility to relevant support staff is very crucial. Seed production is seasonal and therefore requires good financial planning. For instance, funds have to be secured

and made available to pay growers promptly after they deliver raw seed if they are to remain loyal to the terms of the contract agreement.

Where demand is uncertain, it is financially risky for small enterprises to deal with seeds which can lose viability quickly and cannot be used otherwise (e.g., vegetable and forage seed). Even for cereals, their alternative use as grain is only possible if seed of low viability is not treated with chemical. It is advisable in such situations to treat seed on demand and leave all remaining stock untreated so that this is sold as grain if necessary.

Financial management is particularly difficult in situations of acute inflation since input loans and seed prices become difficult to determine. In such situations, it is better to recover loans in kind and keep working capital in foreign exchange if possible.

On the whole, successful small-scale enterprises are those that:

- Are formed by a combination of new ideas with attractive attributes of existing local systems of seed production.
- Have a lasting impact, by showing a capacity to survive in the long-term.
- Are not continuously dependent on external support.
- Have a potential to benefit from close links with appropriate formal sector seed activities so that the farmers benefit from investments in variety research and associated technologies.
- Serve as dependable sources of good seed.
- Supply small farmers with better quality seed that contributes to higher productivity and prosperity in the community.

Conclusions

Privatization is not an end in itself. It does not on its own guarantee that new seed enterprises will continue to survive in the future. It is important that measures taken fit well within a country's economic development, culture, traditions, and institutional structure. In particular, achieving the goals of economic and social development and implementing the right private-public balance is a formidable challenge in some countries where the state plays the leading role in economic and social development. The pace of privatization will continue as more countries adopt economic reform policies or become signatories to related international agreements. The general approach to privatization will be one based on a segmented seed market, where larger companies, including restructured public enterprises, will focus on high-profit crops, while appropriate small-scale enterprises deal with less profitable seed crops.

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Appendix 1. Present value of \$1 due at the end on n periods (present worth factors) $Pv = \frac{Fv}{(1+r)^n}$

Periods	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%
1	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833	0.820	0.806	0.800
2	0.907	0.890	0.857	0.826	0.797	0.769	0.756	0.743	0.718	0.694	0.672	0.650	0.640
3	0.864	0.840	0.794	0.751	0.712	0.675	0.658	0.641	0.609	0.579	0.551	0.524	0.512
4	0.823	0.792	0.735	0.683	0.636	0.592	0.572	0.552	0.516	0.482	0.451	0.423	0.410
5	0.784	0.747	0.681	0.621	0.567	0.519	0.497	0.476	0.437	0.402	0.370	0.341	0.328
6	0.746	0.705	0.630	0.564	0.507	0.456	0.432	0.410	0.370	0.335	0.303	0.275	0.262
7	0.711	0.665	0.583	0.513	0.452	0.400	0.376	0.354	0.314	0.279	0.249	0.222	0.210
8	0.677	0.627	0.540	0.467	0.404	0.351	0.327	0.305	0.266	0.233	0.204	0.179	0.168
9	0.645	0.592	0.500	0.424	0.361	0.308	0.284	0.263	0.225	0.194	0.167	0.144	0.134
10	0.614	0.558	0.463	0.386	0.322	0.270	0.247	0.227	0.191	0.162	0.137	0.116	0.107
11	0.585	0.527	0.429	0.350	0.287	0.237	0.215	0.195	0.162	0.135	0.112	0.094	0.086
12	0.557	0.497	0.397	0.319	0.257	0.208	0.187	0.168	0.137	0.112	0.092	0.076	0.069
13	0.530	0.469	0.368	0.290	0.229	0.182	0.163	0.145	0.116	0.093	0.075	0.061	0.055
14	0.505	0.442	0.340	0.263	0.205	0.160	0.141	0.125	0.099	0.078	0.062	0.049	0.044
15	0.481	0.417	0.315	0.239	0.183	0.140	0.123	0.108	0.084	0.065	0.051	0.040	0.035
16	0.458	0.394	0.292	0.218	0.163	0.123	0.107	0.093	0.071	0.054	0.042	0.032	0.028
17	0.436	0.371	0.270	0.189	0.146	0.108	0.093	0.080	0.060	0.045	0.034	0.026	0.023
18	0.416	0.350	0.250	0.180	0.130	0.095	0.081	0.069	0.051	0.038	0.028	0.021	0.018
19	0.396	0.331	0.232	0.164	0.116	0.083	0.070	0.060	0.043	0.031	0.023	0.017	0.014
20	0.377	0.312	0.215	0.149	0.104	0.073	0.061	0.051	0.037	0.026	0.019	0.014	0.012
21	0.359	0.294	0.199	0.135	0.093	0.064	0.053	0.044	0.031	0.022	0.015	0.011	0.009
22	0.342	0.278	0.184	0.123	0.083	0.056	0.046	0.038	0.026	0.018	0.013	0.009	0.007
23	0.326	0.262	0.170	0.112	0.074	0.049	0.040	0.033	0.022	0.015	0.010	0.007	0.006
24	0.310	0.247	0.158	0.102	0.066	0.043	0.028	0.019	0.013	0.008	0.006	0.005	0.005
25	0.295	0.233	0.146	0.092	0.059	0.038	0.030	0.024	0.016	0.010	0.007	0.005	0.004
30	0.231	0.174	0.099	0.057	0.033	0.020	0.015	0.012	0.007	0.004	0.003	0.002	0.001

Appendix 2. Present value of an annuity of \$1 per period for n periods (annuity factors) $P = \frac{1}{r} (1 - \frac{1}{(1+r)^n})$

Periods	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%
1	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833	0.820	0.806	0.800
2	1.859	1.833	1.783	1.736	1.690	1.647	1.626	1.605	1.566	1.528	1.492	1.457	1.440
3	2.723	2.673	2.577	2.486	2.402	2.322	2.283	2.246	2.174	2.106	2.042	1.981	1.952
4	3.546	3.465	3.312	3.170	3.037	2.914	2.855	2.798	2.690	2.589	2.494	2.404	2.362
5	4.330	4.212	3.993	3.791	3.605	3.433	3.352	3.274	3.127	2.991	2.864	2.745	2.689
6	5.076	4.917	4.623	4.355	4.111	3.889	3.784	3.685	3.498	3.326	3.167	3.020	2.951
7	5.786	5.582	5.206	4.868	4.564	4.288	4.160	4.039	3.812	3.605	3.416	3.242	3.161
8	6.463	6.210	5.747	5.335	4.968	4.639	4.487	4.344	4.078	3.837	3.619	3.421	3.329
9	7.108	6.802	6.247	5.759	5.328	4.946	4.772	4.607	4.303	4.031	3.786	3.566	3.463
10	7.722	7.360	6.710	6.145	5.650	5.216	5.019	4.833	4.494	4.192	3.923	3.682	3.571
11	8.306	7.887	7.139	6.495	5.988	5.453	5.234	5.029	4.656	4.327	4.035	3.776	3.656
12	8.863	8.384	7.536	6.814	6.194	5.660	5.421	5.197	4.793	4.439	4.127	3.851	3.725
13	9.394	8.853	7.904	7.103	6.424	5.842	5.583	5.342	4.910	4.533	4.203	3.912	3.780
14	9.899	9.295	8.244	7.367	6.628	6.002	5.724	5.468	5.008	4.611	4.265	3.962	3.824
15	10.380	9.712	8.559	7.606	6.811	6.142	5.847	5.575	5.092	4.675	4.315	4.001	3.859
16	10.838	10.106	8.851	7.824	6.974	6.265	5.954	5.669	5.162	4.730	4.357	4.003	3.887
17	11.274	10.477	9.122	8.022	7.120	6.373	6.047	5.749	5.222	4.775	4.391	4.059	3.910
18	11.690	10.828	9.372	8.201	7.250	6.467	6.128	5.818	5.273	4.812	4.419	4.080	3.928
19	12.085	11.158	9.604	8.365	7.366	6.550	6.198	5.877	5.316	4.844	4.442	4.097	3.942
20	12.462	11.470	9.818	8.514	7.469	6.623	6.259	5.929	5.353	4.870	4.460	4.110	3.954
21	12.821	11.764	10.017	8.649	7.562	6.687	6.313	5.973	5.384	4.891	4.476	4.121	3.963
22	13.163	12.042	10.201	8.772	7.645	6.743	6.359	6.011	5.410	4.909	4.488	4.130	3.971
23	13.489	12.303	10.371	8.883	7.718	6.792	6.399	6.044	5.432	4.925	4.499	4.137	3.976
24	13.799	12.550	10.529	8.985	7.784	6.835	6.434	6.073	5.451	4.937	4.507	4.143	3.981
25	14.094	12.783	10.673	9.077	7.843	6.873	6.464	6.097	5.467	4.948	4.514	4.147	3.985
30	15.373	13.765	11.258	9.427	8.055	7.003	6.566	6.177	5.517	4.979	4.534	4.160	3.995

Glossary

Adoption

Decision made by farmers to take up and use new seed or a new variety.

Annuity

A fixed amount paid or received annually or at other intervals for a stated period of time.

Asset

Anything of value owned by a business, which could be in the form of possessions or claims held with others.

Balance sheet

A summary tabulation of assets and liabilities of a business at a specific point in time, usually the last day of the financial year. In the balance sheet, the total value of assets must equal the total value of liabilities.

Barter exchange

A system by which all goods and services are exchanged directly in-kind without the use of money.

Birr (ETB)

Ethiopian currency unit. At the time of writing, 8.3 birrs were equivalent to 1 U.S. dollar (\$US).

Border price

The unit price of a traded good at a country's border. These are free on board (fob) price for exports, and cost insurance freight (cif) price for imports.

Break-even analysis

A numerical or graphical analysis of the relationship between total cost and total revenue, such that break-even takes place when total cost equals total revenue.

Break-even or cost price

Price of a product at which all costs of production are covered exactly.

Breeder seed

The seed of new varieties produced by research stations. From its cultivation comes foundation or basic seed, which is generally the first generation made available for multiplication by the commercial sector.

Budget

A planned estimate of income to be generated by a business, against which is set cost estimates to be incurred during a future time period.

Capital

Investments in items such as machinery, equipment and buildings (capital goods) and in education and training (human capital), which are used to contribute to productive activities. Capital also includes money secured by the business as loan.

Capital budget

That part of the business's budget which is concerned with the planning and control of expenditures on capital items.

Cash flow

Movement of funds through the business in the form of receipts and payments over a defined period.

Certification

A system of maintaining quality of seed according to official standards specified by an agency set up for this purpose. The agency makes several inspections to ensure these standards are met.

Certified seed

The first generation of seed from an official multiplication process, which is made available to farmers for normal grain production.

Collective action

Cooperative efforts using local customs in the community to solve conflicts or enforce codes of conduct, practice or collective behavior.

Consumer surplus

The surplus satisfaction a consumer enjoys from paying a lower price for a good than a higher price he or she can afford and would have been willing to pay.

Contingent pricing

An indirect method which involves asking individuals what they are willing to pay for an environmental benefit or what they are willing to receive as minimum compensation to tolerate environmental costs.

Contract grower

A farmer who grows seed with formal agreement and on commission for a larger organization.

Creditor

The party to whom a debt is owed. In the case of a loan, the lender is the creditor.

Debtor

The party who owes a debt to the business. In the case of a loan, the borrower is the debtor.

Demand

The need or desire for a good or service, which the customer can afford and is willing to pay for.

Depreciation

The amount of money kept aside each year as a fixed cost to represent the loss in value of a fixed asset with the passage of time.

Derived demand

Demand for an input (e.g., seed), which depends indirectly on the existence of a demand for the product (e.g., crop) that it helps to produce. In other words, the demand for seed is derived from the demand for the crop it helps to produce.

Diffusion

A process by which a new variety is spread within a farming community over time and space.

Diminishing returns

The decline in output resulting from adding successive units of a variable factor of production while keeping the level of other inputs constant.

Discount rate

The interest rate used in determining the present value of a future cash flow by discounting.

Discounting

The process of deriving the present value of a future income, assuming that a given amount now, will be worth more than the same amount to be received in the future.

Distribution channel or mechanism

The route or means used to distribute a good from the producer to the consumer of that good.

Economic accounting price

Economic accounting price or **shadow price** is used in economic analysis for a cost or benefit in an enterprise when the market price is adjusted to reflect the true or opportunity cost to the nation.

Economies of scale

Factors which cause the average (or unit) cost of producing a commodity to fall as output of the commodity rises.

Ecosystem

An ecological system in which a natural community and its environment functions as a unit.

Elasticity of demand

A measure of the proportionate change in quantity demanded for a good with respect to a proportionate change in price.

Enterprise

One or more easily identifiable parts of a business under common ownership or control, for which there are specific potential returns.

Enterprise diversification

A situation in which a business holds a combination of investments or enterprises a risk reducing strategy.

Environmental impact analysis

Analysis of the environmental effects of a proposed investment in a project or enterprise.

Equity

The remaining amount left in an enterprise after deducting total liabilities (excluding claims to shareholders) from total assets.

Exchange rate

The price of a currency in terms of another currency.

Externality

Spillover effects of an enterprise (usually negative and not included in the valuation of the enterprise), which are felt outside by other parties.

Farm gate price

The price a farmer receives for his or her product at the boundary of the farm. This price excludes any costs for transport or marketing service.

Fauna

Animal life characteristic of a particular region or environment

Feddan

A unit of area measurement used in Egypt. One feddan equals 0.42 hectares.

Financial analysis

Analysis carried out for a proposed business enterprise using current market prices.

Flora

Plant life characteristic of a particular region or environment.

Formal seed sector

Organized institutions engaged in the multiplication, processing, distribution, and quality control of improved seed and use mainly market-oriented means of exchange.

GDP

Gross Domestic Product. A measure (aggregate value at market prices) of flow of total goods and services produced within a given country over a specified period of time, normally a year.

GNP

Gross National Product. The total money value of all final goods and services produced in an economy over a year (GDP) plus net income from investments abroad including interest, rent, dividends and profit.

Gross margin

Value of an enterprise's output less its variable costs.

Hectare (ha)

An area measurement equivalent to 10, 000 square meters

Hedonic pricing

An indirect method of valuation, which infers the prices that individuals are willing to pay for environmental benefits.

Hybrid (F1)

A variety produced by crossing distinctly different parental lines. The first generation is a superior variety with high yield potential, but this genetic-makeup declines substantially in subsequent generations. The progeny of hybrids should therefore not be planted. New seed has to be bought every year.

ICARDA

International Center for Agricultural Research in the Dry Areas.

Improved variety

Variety bred by breeders by incorporating superior genetic characteristics leading to high yield potential and agronomic attributes such as resistance to biotic and abiotic stresses. Seed of such a variety is commonly referred to as improved seed.

Independent enterprises

Those enterprises which are not mutually exclusive, so that accepting one enterprise does not necessarily exclude the acceptance of another.

Inflation

Persistent increases in the general level of prices, which reduces the purchasing power or worth of money over time. During inflation, the quantity of money in circulation rises relative to the quantity of goods and services offered.

Informal seed sector

Farmers who produce and save their own seed of local or improved varieties, and use mainly traditional forms of exchange.

Intangible costs and benefits

These are costs or benefits associated with goods and services (e.g., health, education and natural beauty), which are not likely to pass through the market system and therefore do not bear a direct price, although they are of value to society.

Internal transfer

The transfer of seed from one enterprise to another within the same business and which does not involve cash transactions.

Investment appraisal

Process of assessing the financial viability of a proposed business undertaking.

IRR

Internal rate of return. This is the discount rate that makes the present value of the revenue stream exactly equal the present value of the cost stream (i.e., net present value = 0). It is the maximum interest that an enterprise can pay to cover all investment and operating costs.

Internal rate of return is referred to as financial rate of return in financial analysis, and economic rate of return in economic analysis.

Landrace

A traditional variety of a crop characteristic of a particular locality.

Lease

A legal contract agreement, which allows use of an asset for a specified period of time in return for periodic payments of rent to the owner of the asset.

Leverage or gearing

Also referred to as the debt:equity ratio, the financial leverage indicates the relative importance of loans in the capital structure of an enterprise.

Liability

Total value of claims on the assets of a business by the various parties who supply funds to it.

Liquidity

The ease with which an asset can be converted into money.

Lump sum

These are large amounts invested or paid in an instant, instead of in small installments over time.

Marginal cost

The cost associated with producing an extra unit of output.

Marginal revenue

The additional revenue obtained from the sale of an extra unit of output.

Market failure

The inability of the market mechanism to allow formal trade in certain goods and services because these are difficult to trade and as a result do not pass through the market and therefore have no market price.

Marketing margin

The difference between the value of an equivalent unit quantity of good at one stage and another in the distribution chain.

MNCs

Multinational corporations. These are large enterprises operating in a number of countries and having production or service facilities outside the countries of their origin.

Mutually exclusive enterprises

Enterprises are said to be mutually exclusive if accepting one enterprise automatically excludes the acceptance of a second enterprise, although both can be rejected. In other words, they are competing enterprises that do the same job.

Net worth

Value of assets available to the owner of the business after all other claims against these assets have been met.

NGOs

Non-governmental organizations. These are usually not for profit making (charitable) organizations by statute.

Nominal price

The price of a product measured in terms of the prevailing price levels without taking account of the effects of inflation. Nominal prices are converted to **real** terms when the prices are adjusted for inflation.

Open pollinated varieties

These are varieties produced as a result of natural pollination as opposed to hybrid varieties, which are a result of controlled pollination.

Opening and closing valuations

Determining monetary values of seed stocks in the business at the beginning and end of the financial year respectively.

Opportunity cost

What a good or service earns in its best alternative use. It represents the benefit foregone by using a scarce resource for one purpose instead of for its next best alternative use.

Output

The value of goods and services produced by an enterprise. It represents the value 'added' by the products of the business, in this case, the difference in value between the final processed seed and the raw seed recovered.

Overdraft

A loan facility on a current account at a bank, which permits a customer to overdraw up to a certain agreed limit for a specified period of time. Interest is normally payable on this loan facility.

Overhead costs

Indirect costs such as depreciation, rent, supervision salaries and other administrative costs, which cannot be associated directly with specific units of final output.

Parastatal

Organization usually set up and to some extent supported by the national government, although nominally independent and commercial.

Parity price

Equivalence of a commodity price expressed at one location (e.g., farm gate) to its price expressed at another location (e.g., harbor).

Partial budget

A budget that relates to only part of an enterprise, as opposed to a **complete** budget, which deals with the entire enterprise.

Private sector

Commercial sector made up of privately owned enterprises of varying sizes, which may not have close relations with public sector operations.

Privatization

A process of promoting private sector participation in an economy. It involves the introduction of market forces to facilitate free trade.

Profit

Surplus remaining in the business after all costs have been met (i.e., total sales revenue minus total costs). If there is a deficit, this is called a loss.

Profit and loss account

A record of financial transactions and the resulting enterprise profit or loss for the financial year. It includes an opening valuation of stock, the costs and revenue for the same period and the closing valuation of stocks at the end of the financial year.

Property right

A legal ownership right over a specific property.

Public good

A good or service that is freely available to everyone in a particular community, such that it is non-excludable and non-rival in consumption.

Public sector

State-owned, non-commercial institutions and enterprises.

Purchasing power

The extent to which a given monetary unit or a given amount of money can buy goods and services. The greater the amount of goods and services bought with a given amount of money, the greater is its purchasing power.

Risk

That part of uncertainty (where uncertainty is the state of not knowing what the exact outcome of an event would be) that could be measured and is therefore associated with some measure of probability.

Risk analysis

A systematic analysis of the degree of risk attached to an investment or enterprise activity.

Risk averse

An attitude towards risk where one prefers the alternative associated with least risk when all available alternatives have seemingly the same expected return. **Risk neutral** is the case in which one is indifferent and equally accepts any of the alternatives because they have the same expected return, while **risk taking** involves selecting the alternative associated with the greatest risk.

Risk premium

The additional return on an investment required as a compensation for risk of loss if the investment fails.

Roguing

The process of removing plants by hand that do not appear healthy or sufficiently characteristic of the variety being grown for seed.

Salvage value

Also called **residual** or **terminal** value. This is the value remaining in an asset at the end of a project or at the end of its economic life.

Self-pollination

A method of fertilization through which a plant forms seeds using its own pollen, and without pollen from other plants. Varieties of self-pollinating crops such as rice, wheat and barley tend to maintain their genetic characteristics through subsequent generations than cross-pollinating varieties do. Farmers therefore find it easy to save seed from self-pollinating crops.

Sensitivity analysis

An analytical technique to test systematically how output or earning capacity of an enterprise would be affected by specific changes in some key variables.

Shares

A number of equal portions of the financial capital of a limited company, which entitles the holder to a proportion of the of distributed profits as a return.

Stock company

A company in which the capital is divided into small units or shares, such that investors can contribute varying amounts to the total capital. The profits are divided between the stockholders in proportion to the shares they own in the company.

Throughput

A measure of the rate of production, in terms of the total quantity of seed going through the enterprise during a specific financial year (i.e., opening stock at the beginning of the year plus total seed received during the year minus closing stock at the end of the year).

Traded goods

These are goods that are traded internationally (imports and exports) and their values reported in the national accounts. Domestic resources or other goods and services, which are produced locally, but are not easy to trade because of their nature, are referred to as **non-traded** goods or services. **Tradable** goods are those goods that could be traded but are not because government regulation or other restrictions.

Tragedy of the commons

This refers to a situation in which no one has an interest in conserving common property for the future when it benefits each person to exploit as much as possible.

Transaction costs

Costs incurred in using the market system of exchange especially those relating to information problems. Examples include costs associated with discovering and evaluating markets, finding out the right prices, negotiating, and managing employees.

Variable cost

Costs which can be readily allocated to a specific enterprise and vary in approximately direct proportion to changes in the scale of that enterprise.

Vertical integration

The placing of successive stages in production and distribution under the control and ownership of a single enterprise.

Wholesaler

A business that buys products in relatively large quantities from manufacturers for resale in smaller quantities to **retailers**, who in turn sell to final consumers. In this way wholesalers serve as intermediary between the producers and retailers of a product in the production – distribution chain.

Working capital

Working capital or current asset is an item of value, which is held to be converted to cash within a short time, usually within a year. Inventory items held in anticipation of future sales (for example, seed in store) can be classified as working capital.

Yield potential

The theoretical maximum yield which a variety is genetically capable of giving, as usually determined under optimum conditions in a research station.

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