A PROFESSIONAL PAPER

ANALYSIS OF APPROPRIATE HIVE TECHNOLOGY FOR APICULTURAL PROJECT DEVELOPMENT IN THE REPUBLIC OF MOLDOVA

Submitted by

Chad M. Pfitzer

College of Agricultural Sciences

In partial fulfillment of the requirements

For the Degree of Master of Agriculture

Colorado State University

Fort Collins, Colorado

Summer 2004
COlORADO STATE UNIVERSITY

July 12, 2004

WE HEREBY RECOMMEND THAT THE PROFESSIONAL PAPER PREPARED UNDER OUR SUPERVISION BY CHAD M. PFITZER ENTITLED ANALYSIS OF APPROPRIATE HIVE TECHNOLOGY FOR APICULTURAL PROJECT DEVELOPMENT IN THE REPUBLIC OF MOLODVA BE ACCEPTED AS FULLFILING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF AGRICULTURE.

Committee on Graduate Work

____________________________________

____________________________________

____________________________________

Adviser

Department Head/Director
ABSTRACT OF PROFESSIONAL PAPER

ANALYSIS OF APPROPRIATE HIVE TECHNOLOGY FOR APICULTURAL PROJECT DEVELOPMENT IN THE REPUBLIC OF MOLDOVA

Beekeeping enterprises can prove profitable if they utilize various types of proven technology; but for insurance of greater sustainability, they should always mesh with local cultural and economic realities. In most instances, beekeeping is already practiced in some fashion on a limited scale; thus, the initial objective of any apicultural development inquiry is the identification of the most appropriate technology for that setting. When beekeeping is to be used as an economic catalyst, identifying appropriate technology for development programs for a specific locality predicates all other activities. This research helps to determine the appropriate hive technology and subsequent support structures necessary for use in apicultural development efforts in The Republic of Moldova.

Chad Michael Pfitzer
College of Agricultural Sciences
Colorado State University
Fort Collins, CO 80523
Summer 2004
TABLE OF CONTENTS

| LIST OF TABLES | ix |
| LIST OF FIGURES | ix |

CHAPTER 1: INTRODUCTION

1.1 Preface ................................................................. 1
1.2 Problem Statement .................................................. 1
1.3 Objectives of the Research ...................................... 1
1.4 Major Issues .......................................................... 2
   1.4.1 Compatibility of Apicultural Development Initiatives to Contemporary Moldova ....................... 2
   1.4.2 Net Present Worth ................................................ 3
      1.4.2.1 Competing Technologies .................................. 3
      1.4.2.2 Competing Scales ......................................... 4
   1.4.3 Implications for Apicultural Development Initiatives ......................................................... 4
      1.4.3.1 Appropriate Technology .................................. 5
      1.4.3.2 Educational Components ................................ 5
      1.4.3.3 Institutional Infrastructure .............................. 6

CHAPTER 2: THE SETTING OF APICULTURAL DEVELOPMENT IN THE REPUBLIC OF MOLDOVA

2.1 Introduction ........................................................... 7
2.2 The Bee-Human Relationship ....................................... 7
2.3 The Evolution of Moldovan Apicultural Activity ............... 8
   2.3.1 Russian Influence ............................................. 8
   2.3.2 Soviet Annexation ............................................. 9
   2.3.3 Collectivization in the Moldavian S.S.R .................... 9
   2.3.4 Moldovan Independence .....................................10
2.4 Trends in Consumption of Apicultural Products ............... 11
   2.4.1 Domestic Consumption ....................................... 11
   2.4.2 International Production, Consumption, and Trade .... 12
2.5 Economic Situation .................................................. 13
2.6 Geographic Location ................................................ 14
2.7 Climate ................................................................. 16
2.8 Soils and Topography ............................................... 16
2.9 Water Resources ..................................................... 17
2.10 Prominent Development Issues .................................... 17
   2.10.1 Establishing Democratic Organizations ................. 18
   2.10.2 Increasing Economic Activity ............................. 19
   2.10.3 Strengthening Rural Households ......................... 20
   2.10.4 Integrating Agro-forestry .................................. 20
   2.10.5 Promoting Environmental Stewardship/Conservation ... 22
   2.10.6 Ensuring Sustainability ..................................... 22
2.11 Summary ............................................................. 23
CHAPTER 3: COMPARATIVE ANALYSIS OF COMPETING HIVE TECHNOLOGIES

3.1 Introduction.................................................................................................................. 24
3.2 Movable-Frame Hive Components................................................................................. 24
  3.2.1 Inputs...................................................................................................................... 25
    3.2.1.1 Nectar and Pollen.............................................................................................. 25
    3.2.1.2 Sugar................................................................................................................ 26
    3.2.1.3 Labor.................................................................................................................. 26
    3.2.1.4 Medication........................................................................................................ 27
    3.2.1.5 Transportation................................................................................................. 27
    3.2.1.6 Queens.............................................................................................................. 27
    3.2.1.7 Bee Colonies................................................................................................... 28
    3.2.1.8 Woodenwares................................................................................................. 28
  3.2.2 Major Outputs......................................................................................................... 29
    3.2.2.1 Honey............................................................................................................... 29
    3.2.2.2 Beeswax........................................................................................................... 29
3.3 Comparative Analysis of Competing Hive Technologies.............................................. 30
  3.3.1 Traditional Hives ..................................................................................................... 32
    3.3.1.1 Assumptions...................................................................................................... 33
    3.3.1.2 Incremental Income....................................................................................... 33
    3.3.1.3 Intangible Benefits......................................................................................... 34
    3.3.1.4 Incremental Variable Costs............................................................................ 34
    3.3.1.5 Incremental Fixed Costs................................................................................. 34
    3.3.1.6 Intangible Costs.............................................................................................. 35
    3.3.1.7 Risk.................................................................................................................. 37
    3.3.1.8 Aggregate Benefits and Costs....................................................................... 37
  3.3.2 Langstroth Hives ..................................................................................................... 38
    3.3.2.1 Assumptions...................................................................................................... 41
    3.3.2.2 Incremental Income....................................................................................... 41
    3.3.2.3 Intangible Benefits......................................................................................... 42
    3.3.2.4 Incremental Variable Costs............................................................................ 45
    3.3.2.5 Incremental Fixed Costs................................................................................. 45
    3.3.2.6 Intangible Costs.............................................................................................. 46
    3.3.2.7 Risk.................................................................................................................. 48
    3.3.2.8 Aggregate Benefits and Costs....................................................................... 49
3.3.3 Sources of Data Used in the Research..................................................................... 49
  3.3.3.1 Grant Proposal for Peace Corps Project “Apiiculture for Rural Development”... 49
  3.3.3.2 Literature......................................................................................................... 49
    3.3.3.2.1 The Hive and the Honey Bee................................................................. 49
    3.3.3.2.2 Economic Analysis of Agricultural Projects........................................... 50
    3.3.3.2.3 Bee Hive Construction............................................................................. 51
  3.3.4 Performance Criteria.............................................................................................. 51
3.4 Summary....................................................................................................................... 51
CHAPTER 4: CONSIDERATION OF REQUIRED SUPPORT MECHANISMS

4.1 Educational Component Considerations.................................................................53
  4.1.1 Poorly trained, poorly paid personnel who lack transportation
  4.1.2 Regulatory and input-dispensing duties that impinge on time
    spent on educational programming..............................................................55
  4.1.3 Advice that is poorly timed...........................................................................55
  4.1.4 Illiterate clientele.........................................................................................56
  4.1.5 Counter-productive governmental policies, wars, drought,
    civil unrest, and need for land reform..........................................................56
  4.1.6 Social and cultural factors that make female audiences
    difficult to reach..............................................................................................58
  4.1.7 Lack of monitoring and evaluation...............................................................58
  4.1.8 Poor selection of local leadership..................................................................58
  4.1.9 Advice that is not research based.................................................................59
  4.1.10 Environmental concerns............................................................................60

4.2 Institutional Infrastructure Considerations..........................................................60
  4.2.1 Mindria Albinii Beekeepers Cooperative.......................................................60
    4.2.1.1 Organization Information.................................................................60
    4.2.1.2 Site History.........................................................................................61
    4.2.1.3 Objectives..........................................................................................61
    4.2.1.4 Deliverables.........................................................................................62
      4.2.1.4.1 Short-term.........................................................................................62
      4.2.1.4.2 Long-term.......................................................................................62
    4.2.1.5 Project Information................................................................................62
    4.2.1.6 Beneficiaries.........................................................................................63
  4.2.2 Beekeepers’ Association of the Republic of Moldova.....................................64
    4.2.2.1 Organization Information.................................................................64
    4.2.2.2 Site History.........................................................................................65
    4.2.2.3 Objectives..........................................................................................67
    4.2.2.4 Deliverables.........................................................................................67
      4.2.2.4.1 Short-term.........................................................................................68
      4.2.2.4.2 Long-term.......................................................................................68
    4.2.2.5 Project Information................................................................................68
    4.2.2.6 Beneficiaries.........................................................................................69
  4.2.3 Comparative Analysis....................................................................................69

4.3 Additional Considerations.....................................................................................70
  4.3.1 Expansion......................................................................................................70
    4.3.1.1 Assumptions........................................................................................72
    4.3.1.2 Incremental Income.............................................................................72
    4.3.1.3 Intangible Benefits..............................................................................72
    4.3.1.4 Incremental Variable Costs.................................................................73
    4.3.1.5 Incremental Fixed Costs.....................................................................73
    4.3.1.6 Intangible Costs..................................................................................73
    4.3.1.7 Risk.....................................................................................................74
    4.3.1.8 Aggregate Benefits and Costs.............................................................74
  4.3.2 Profitability.....................................................................................................75
  4.3.3 Vertical Integration.........................................................................................76

4.4 Summary..............................................................................................................77
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction........................................................................................................78
5.2 Conclusions.........................................................................................................78
   5.2.1 Compatibility of Apicultural Development Initiatives to
          Contemporary Moldova ........................................................................78
   5.2.2 Net Present Worth....................................................................................80
       5.2.2.1 Competing Technologies.................................................................80
       5.2.2.2 Competing Scales...........................................................................80
   5.2.3 Implications for Apicultural Development Initiatives.........................81
       5.2.3.1 Appropriate Technology.................................................................81
       5.2.3.2 Educational Components...............................................................82
       5.2.3.3 Institutional Infrastructure..............................................................83
5.3 Recommendations.............................................................................................84
   5.3.1 Government Policies..................................................................................85
       5.3.1.1 Moldovan.......................................................................................85
       5.3.1.2 American......................................................................................86
   5.3.2 Building Institutional Infrastructure.........................................................88
       5.3.2.1 Cooperative Extension.................................................................89
       5.3.2.2 Research.......................................................................................90
5.4 Summary..........................................................................................................91
APPENDIX 1: PEACE CORPS INFORMATION

A. 1.1 Peace Corps Agriculture/Agribusiness Development (AAD) Project Information
A. 1.2 Peace Corps SPA Information
A. 1.3 Peace Corps Partnership Program Information
A. 1.4 SPA Approval from Peace Corps Moldova
A. 1.5 Peace Corps Master’s International Information

APPENDIX 2: NGO INFORMATION

A. 2.1 MABC Beekeepers Cooperative Information (Supplemental)
A. 2.2 CESO Information
A. 2.3 ACDI/VOCA Information
A. 2.4 CNFA Information
A. 2.5 Statute: The Beekeepers’ of the Republic of Moldova
A. 2.6 Letter from the Sadova Mayor’s Office
A. 2.7 Contract between the Beekeepers’ Association of the Republic of Moldova and the State Beekeeping School
A. 2.8 Apiculture for Rural Development: Contributions and Budget
A. 2.9 Moldovan Association Legal framework and Taxation Information

APPENDIX 3: ADDITIONAL BACKGROUND INFORMATION

A. 3.1 Bessarabian History
A. 3.2 Moldovan Government’s Official Statement on Agricultural Development
A. 3.3 Langstroth Hive Information
A. 3.4 Product Price List
A. 3.5 Langstroth Super Price List

REFERENCES
LIST OF TABLES:

2.1: Moldovan Apicultural Data..........................................................................................12
2.2: German Apicultural Data............................................................................................12
2.3: American Apicultural Data..........................................................................................12

3.1.1: Value of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing traditional technology over a 20-year period (US$)..........................................................................................................................33
3.1.2: Woodenware requirements for one traditional hive.................................................34
3.1.3: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing traditional technology over a 20-year period (US$)..........................................................................................................................36
3.1.4: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), from one traditional hive over a 20-year period (US$).........................................................................................37
3.2: Honey Production by Various Sizes of Colonies..........................................................40
3.3.1: Value of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing Langstroth technology over a 20-year period (US$)..........................................................................................................................41
3.3.2: Woodenware requirements for one Langstroth starter hive..................................45
3.3.3: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing Langstroth technology over a 20-year period (US$)..........................................................................................................................48
3.3.4: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), from one Langstroth hive over a 20-year period (US$).................................................................................................48
4.3.1: Value of incremental income from honey production, and incremental costs (fixed and variable), for one would be full-time project participant employing Langstroth technology over a 20-year period (US$).........................................................................................................................71
4.3.2: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), for one would-be full-time project participant employing Langstroth technology over a 20-year period (US$).................................................................................................74

LIST OF FIGURES:

2.1 Map of The Republic of Moldova..................................................................................15

3.1 Movable-frame with embossed comb used in both Langstroth and traditional hive systems.................................................................................................................................30
3.2 Internal view of a honey extractor loaded with frames..................................................31
3.3 Front view of a traditional hive (w/ pollen basket)..........................................................32
3.4: Front view of Langstroth hives.....................................................................................38
3.5: Integral Components of the Langstroth Hive.................................................................39
3.6: Uncapping of honey comb (in a movable-frame) from a Langstroth hive...............40
3.7: Peace Corps Website Promotion: “Apiculture for Rural Development”....................67
CHAPTER 1
INTRODUCTION

1.1 PREFACE

Beekeeping enterprises can prove profitable if they utilize various types of proven technology; but for insurance of greater sustainability, they should always mesh with local cultural and economic realities. In most instances, beekeeping is already practiced in some fashion on a limited scale; thus, the initial objective of any apicultural development inquiry is the identification of the most appropriate technology for that setting. When beekeeping is to be used as an economic catalyst, identifying appropriate technology for development programs for a specific locality predicates all other activities. This research helps to determine the appropriate hive technology and subsequent support structures necessary for use in apicultural development efforts in The Republic of Moldova.

1.2 PROBLEM STATEMENT

Apicultural development initiatives in the Republic of Moldova are marginalized due to a reliance on outdated hive technology.

1.3 OBJECTIVES OF THE RESEARCH

The objective of this research is to show the potential of apiculture as a development tool in the Republic of Moldova. To realize this goal, the following specific objectives are pursued:

(1) To introduce the Republic of Moldova as an appropriate location for apicultural development efforts.
(2) To showcase apiculture as an appropriate development tool.
(3) To display the financial and economic disparity between the use of traditional and Langstroth hive technology.
(4) To identify and consider issues affecting future development initiatives.
1.4 MAJOR ISSUES

According to First MondayNewsletter: ADRA Network Journal, the general prerequisites for apiculture development projects, “must involve attainment of vital inputs, education, observation, experimentation, research, documentation, relationship building, training, patience, understanding, and financial support. Most importantly, if beekeeping is to be an established tradition or a commercial enterprise, implementing a development program takes time” (Jump, 2003). The realization of the stated research goals should help to shed light on where the potential of Moldovan apicultural development initiatives lie in regard to these important fundamentals. This research will strive to underscore the compatibility of appropriate hive technology to the developmental needs of contemporary Moldovan apiculture programs. But technology is only as good as those who use it; subsequently, out of necessity the research must also examine the educational requirements necessary for an effective transfer of technology. Furthermore, infrastructure to support such an initiative must also be identified as a structural requirement. But prior to any analysis, careful venue considerations need be made to insure this proposed technology transfer program is appropriate.

1.4.1 Compatibility of Apicultural Development Initiatives to Contemporary Moldova

The Republic of Moldova is a relatively new and unstable nation. From superpower status, as one of the 15 republics comprising the Soviet Union, to one of an obscure underdeveloped transition economy, Moldova is now influenced by development activities by many countries outside the region’s historical power structure. Moldova is a country in need of outside assistance and controlled development, as the collapse of the Soviet Union created an economic vacuum in most of the former republics.

All nations exist with acute needs for “development” of one sort or another, even if these are not identified as such. Development is defined here as a gradual growth through perpetual change. Furthermore, “sustainable development”, being the dynamic process which enables all
people to realise their potential, and improve the quality of life in ways which simultaneously protect and enhance the Earth's life support systems, is generally synonymous with development throughout this research. Competing development agendas force people to make choices. Generally, choices for combating particular problem areas are made by contemplation of resource availability, future profitability, and necessary structural mechanisms. This research contemplates all of these factors without attempting to fully grasp the major socio-economic nuances at play. Since, designing a program of action around speculation would ultimately prove foolish, this research will focus more intently on evaluating the necessary technological requirements for apicultural development programs, in Chapter 2.

1.4.2 Net Present Worth of Competing Technologies

Net present worth is chosen as the discounted cash flow measure to be used as an analytical tool for this research. It is simply the present worth of the incremental net benefit or incremental cash flow stream generated by an investment. The analyses found in this research are not intended to shadow specific project models, but instead are simply used to find out whether or not a particular type of hive technology is profitable. The discount factor used in all examples is set at 12 percent. This is taken as a standard for developing nations and probably discounts too much. Because no one knows exactly what the opportunity to capital is in any particular case, and because it is generally assumed to be between 8 and 15 percent, 12 will be used as the measure for this research. Chapter 3, the crux of the research, is where this net present worth scenario lies.

1.4.2.1 Competing Technologies

The research uses net present worth to analyze two competing hive technologies: one developed and utilized extensively throughout areas with heavy Russian influence (referred to as “traditional”); and the other, developed and used utilized extensively throughout the western world for over 150 years (referred to as “Langstroth”). Both systems have many similarities as
movable-frame hive systems. But, subtle differences exist within the construction design, which makes analysis necessary to find out which system is more appropriate (profitable) for development projects. The aggregated benefits and costs (both incremental and intangible) are displayed for both technologies at the end of analyses for each model. The final disparity between these two competing systems should allow for clear choices to be made in apicultural development programs in regard to preferred hive design.

1.4.2.2 Competing Scales

Project scale is contemplated with the use of net present worth. A beekeeper working at a normal rate of expansion in accordance with realistic constraints is compared to another producer introducing the more intense hive expansion program required of a marketing cooperative. In this analysis, scale comparisons are more subjective than with the previous scenario of two technologies competing head-to-head. In this instance, the example is intended to convey a comparison of two different structural institutions used to clarify the importance of scale. It is not meant for use in endorsement of one hive system over another.

1.4.3 Implications for Apicultural Development Initiatives

Once an appropriate project technology is identified, educational components supported by institutional infrastructure, help project participants to more effectively utilize the introduced equipment. Appropriate technology, educational components, and institutional infrastructure form an intimate trinity for the overall apicultural development focus: one will not function properly without strong linkages to the other two. The implications for development initiatives is a superstructure of institutions, hopefully not competing for scarce resources, but instead working side-by-side fulfilling vital roles in education, extension, and research with both the government and private sector. Apicultural development is in the infant stage as an explicit catalyst for change in the agriculture sector. Generally speaking, it has yet to be formally recognized as an efficient, low input, green, sustainable enterprise. Numerous apicultural
development programs have led many people to underutilize relatively expensive technology. In relation to the potential, little return was realized from their investment. These projects fail because they try and go too far, too fast. Equipment is made available, but technical assistance is poor or lacking. In any beekeeping development project, the transfer of knowledge, or teaching people, is the most difficult aspect. Because, very little research has been done in this field; as such this research is vital for addressing the simple problem of choosing among appropriate development tools for a particular locality.

1.4.3.1 Appropriate Technology

Appropriate technology is defined here as hardware that can be made at an affordable price by ordinary people using local materials to do useful work in ways more efficiently than another competing technology. Also, upon introduction, the recognition that a particular hardware should do the least possible harm to both human society and the environment is an important consideration. Furthermore, the hardware should closely match the “factor endowment” (land, labor, capital) of the particular country where the technology-transfer is to take place. In the case of Moldova, this generally should also be profitable and affect as many people as possible. But, technology also implies the use of knowledge and systems, to support and complement the use of the actual hardware.

1.4.3.2 Educational Components

Beekeeping is highly transferable concept. But in order to ensure the proper use of a technology, an experiential teaching-learning process must be introduced into the process in conjunction with the actual hardware as a means for developing vital human capital. Extension methodology has been used extensively in other parts of the world, and as this research is not focused on comparing various forms of educational methodology, cooperative extension education is promoted as a necessary component of the development program. Other sectors of Moldovan agricultural development programs rely upon traditional training and visit
methodology, generally implemented through the NGO (non-governmental organization) sector to organizations such as associations or cooperatives. This research will consider constraints to the educational component in Chapter 3, albeit within a limited scope.

1.4.2.3 Institutional Infrastructure

As education is vital to technology-transfer, so is the proper institutional infrastructure to provide support for educational initiatives. These institutions should not overlap excessively or compete with one another; whether found in either the government or private sector, they should simply be acknowledged, utilized, and developed where necessary. The research does not provide much in the way of answers for this subject, as apiculture is a relatively new idea as a development platform. In Chapter 3, examples of current projects will help further enlighten the use of institutional structures in these processes.
CHAPTER 2
THE SETTING OF APICULTURAL DEVELOPMENT IN THE REPUBLIC OF MOLDOVA

2.1 INTRODUCTION

In order to more effectively understand the research presented in chapter 3, the conclusions drawn from it in Chapter 4, and the subsequent recommendations, a background discussion of the general state of affairs in contemporary Moldova is necessary. This is supplemented first by a discussion of the bee-human relationship. These discussions are then applied to a historical summation of apicultural developments relevant to the region. This abridgment renders the current state of apicultural technology, education components, and institutions from a view of historic nature. Also important in background discussion is the resource base necessary to sustain apicultural activity. Information on current consumption, production, and trade, as well as that of the economic and resource base, leads to identification of prominent development issues.

2.2 THE BEE-HUMAN RELATIONSHIP

Unlike most animals and plants used in agriculture, the honey bee (Apis mellifera) of today is the same as it was thousands of years ago. Humans have not domesticated the honey bee; therefore, a particular bee-human relationship exists throughout the world, where the beekeepers of an area manipulate bee colonies in ways concurrent with their factor endowment. In many areas, this relationship is carried out without either complex technology or a knowledgeable understanding of bee culture. Prior to the advent of beekeeping, the bee-human relationship revolved around colony destruction, or “bee-killing”, for extraction of honey and brood (eggs). Today, beekeepers worldwide tend to utilize relatively simple technology in hive construction and methodology, and build their own hives if none are commercially available at a low cost. For producers who lack access to up-to-date information, this process leads essentially
to subsistence level beekeeping. Beekeeping implies the manipulation of a bee colony and is predicated on some understanding of the animal. It can either be based on relatively simple technologies or more complicated ones, but the latter requires an intimate knowledge of management practices to fully develop its potential.

2.3 THE EVOLUTION OF MOLDOVAN APICULTURAL ACTIVITY

In many areas throughout the world, the bee-human relationship is as it was centuries ago; but in others, primarily found in the industrialized countries, the bee-human relationship uses hive manipulation technologies. Moldova has had a long relationship with imperial influences outside from afar. Most strikingly obvious is the relationship with Russia and the ultimate assimilation of the region to its sphere of influence under the banner of the Soviet Union. Many traditional technologies and institutions from the past persist to this day.

2.3.1 Russian Influence

Much of the land lying within the contemporary borders of “The Republic of Moldova” previously held sporadic hinterland status under Imperial Russia as “Bessarabia” (appendix 3.1) after 1812. As with many imperial buffer regions throughout history, Bessarabia was colonized by Russian settlers who introduced many customs, traditions, and technology.

Beekeeping is a traditional agricultural activity worldwide, and societies within the realm of Russian influence have generally institutionalized it as an economic tool. Bees and honey have been important in Russia throughout historical times. Developments in Russia after the revolution would set the tone for future developments throughout eastern and central Europe. According to the American Bee Journal, “In 1934, the Soviet government established a new department within the Ministry of Agriculture, the purpose of which was the management of agricultural production, including honey. Large collective farms were established, and part of the role of some of the kolkhozes was the production of honey” (Wenning, p. 634, 2003).
According to *The Hive and the Honey Bee*, “The Soviet State [gave] much encouragement to beekeeping in both public and private sectors. Activities [were] organized by means of a centrally planned and controlled network of organizations throughout the 15 Republics of the Union” (Crane, p.18, 1992). Beekeeping was utilized as part of the agricultural developmental policy for newly acquired lands within the Soviet sphere of influence after WWII.

### 2.3.2 Soviet Annexation

The communist political and economic ideology of state control came to what is now know as “The Republic of Moldova” as a result of the 1938 German-Soviet Nonaggression Pact, which divided Central and Eastern Europe into German and Soviet spheres of influence. Soviet forces occupied Bessarabia in June 1940. In August, the Soviet government created the Moldavian Soviet Socialist Republic with reconstituted borders to supposedly reflect the ethnic make-up of the country. It was denied access to mineral resources in the north, and access to the Black Sea in the south. More importantly though, were the changes being forced on Moldavian rural society. Post WWII, official policy toward the newly formed Moldavian SSR was devoted to integration of the republic’s economy, politics, and culture into that of the Soviet Union. Private land rights were abolished, and the government established collective and state farms on expropriated farmland.

### 2.3.3 Collectivization in the Moldavian S.S.R.

Previously, the regional economy had been one based on traditional agriculture with private ownership; but, collectivization emphasizing common property, the application of technical knowledge, mechanization, chemical inputs, and central marketing, dramatically increased output of Moldovan commodities for use in the Soviet agro-industrial complex. Production quotas and prices were set by the state. Unfortunately, the mechanisms of central control endemic to Soviet bureaucracy neither fostered nor encouraged independent thought among the common laboring class; therefore, very few local people learned any production
and/or product marketing skills. The state and collective farm structures remained in existence through a combination of government subsidized loans, barter arrangements for basic inputs, and eventually due to the inflated ruble of the 1990s, shrank any debt into insignificance. Individuals were allowed to keep bees at home to produce honey, for home consumption or barter, promoting a subsistence economic system at the village-level which continues to this day. Another residual effect of the Soviet era, specifically relating to contemporary apicultural development efforts, is endemic inefficiencies derived from the use of traditional Russian technology in apiaries throughout the Moldova.

2.3.4 Moldovan Independence

The Republic of Moldova declared independence from the USSR in 1991 and many of the institutions that existed under Soviet control ceased to exist. The collectives disbanded, due to the disruption of markets and degradation of infrastructure, and the state honey market dissolved. Hive numbers declined dramatically, and the abandonment of whole apiaries followed. According to Moldova Azi, “Before independence, there used to be over 1 million bee families officially registered in this republic. [Now], the figure has shrunk down to about 40 thousand families” (Basa-Press, 2003). Small apiaries, typically run by former Soviet managers, mostly older people, remain throughout the country. These are predominantly antiquated and producing at marginal levels. Generally speaking, the laborers who previously worked in state apiaries have gravitated toward subsistence agriculture and abandoned beekeeping. However, the problem goes deeper than a simple lack of bee colonies and young producers: those who remained in the industry continued to use traditional hive system. As agriculture goes, so goes Moldova. According to the U.S. State Department, The Republic of Moldova is now the “poorest country in Europe” (U.S. State Department, 2004).

The Moldovan government’s official stance on agricultural development emphasizes modernization, increased output and efficiency, and open markets (appendix 3.2). Without
agricultural development, the rehabilitation of the greater Moldovan economy is impossible. The government supports formation of development-centered agrarian institutions and markets as a mechanism for efficient rural reform. Foreign investment is sought for assistance in these undertakings. A large NGO sector has formed providing many of the services typically associated with cooperative extension in lieu of government action.

2.4 TRENDS IN CONSUMPTION OF APICULTURAL PRODUCTS

Effective demand is important in establishing market mechanisms throughout the country. The following sections detail the production and consumption trends for Moldova, Germany, and for comparative purposes, the United States.

2.4.1 Domestic Production and Consumption

According to “The World Fact Book”, Moldova has a population of approximately 4.5 million people with a stable growth rate of just over one percent a year: population density of 341 people per square mile makes it the most densely populated republic of all the former soviet republics (CIA, 2002). Average life expectancy is slightly below 65 years of age. Each Moldovan consumes on average approximately 400 grams of honey annually (table 2.1). Many citizens currently barter for honey. Most excess production goes to the central market in Chișinău and is sold for cash. Production has been on a gradual decease since the collapse of the state apiaries. A positive balance of trade in honey is a normal occurrence, although quite small until recently. Beehive stocks in the last two years have dropped dramatically due to winter kill even though the FAO reports show a slight increase of stocks in 2002.
2.4.2 International Production, Consumption, and Trade

**Table 2.1: Moldovan Apicultural Data**

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey Production (Mt)</td>
<td>2,601</td>
<td>2,031</td>
<td>2,020</td>
<td>2,185</td>
<td>1,885</td>
</tr>
<tr>
<td>Honey Domestic Supply (Mt)</td>
<td>2,281</td>
<td>1,631</td>
<td>1,630</td>
<td>1,656</td>
<td>350</td>
</tr>
<tr>
<td>Honey Exports (Mt)</td>
<td>320</td>
<td>418</td>
<td>410</td>
<td>533</td>
<td>1,554</td>
</tr>
<tr>
<td>Honey Imports (Mt)</td>
<td>0</td>
<td>18</td>
<td>20</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Balance of Honey Trade (Mt)</td>
<td>320</td>
<td>400</td>
<td>390</td>
<td>529</td>
<td>1535</td>
</tr>
<tr>
<td>Honey Exports ($1,000)</td>
<td>457</td>
<td>395</td>
<td>327</td>
<td>477</td>
<td>2,126</td>
</tr>
<tr>
<td>Honey Imports ($1,000)</td>
<td>0</td>
<td>10</td>
<td>19</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Balance of Honey Trade ($1000)</td>
<td>457</td>
<td>385</td>
<td>308</td>
<td>469</td>
<td>2106</td>
</tr>
<tr>
<td>Honey Supply/Cap/Yr (Kg)</td>
<td>.5</td>
<td>.4</td>
<td>.4</td>
<td>.4</td>
<td>N/A</td>
</tr>
<tr>
<td>Beehive Stocks</td>
<td>150,000</td>
<td>148,000</td>
<td>145,000</td>
<td>150,000</td>
<td>155,000</td>
</tr>
</tbody>
</table>


**Table 2.2: German Apicultural Data**

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey Production (Mt)</td>
<td>16,306</td>
<td>20,266</td>
<td>20,409</td>
<td>25,951</td>
</tr>
<tr>
<td>Honey Domestic Supply (Mt)</td>
<td>96,284</td>
<td>92,754</td>
<td>93,118</td>
<td>97,878</td>
</tr>
<tr>
<td>Honey Exports (Mt)</td>
<td>13,547</td>
<td>17,149</td>
<td>22,307</td>
<td>20,273</td>
</tr>
<tr>
<td>Honey Imports (Mt)</td>
<td>93,552</td>
<td>89,617</td>
<td>95,016</td>
<td>92,200</td>
</tr>
<tr>
<td>Balance of Honey Trade (Mt)</td>
<td>(80,005)</td>
<td>(72,468)</td>
<td>(72,709)</td>
<td>(71,927)</td>
</tr>
<tr>
<td>Honey Exports ($1,000)</td>
<td>32,899</td>
<td>35,418</td>
<td>38,606</td>
<td>34,737</td>
</tr>
<tr>
<td>Honey Imports ($1,000)</td>
<td>136,481</td>
<td>112,473</td>
<td>104,894</td>
<td>110,395</td>
</tr>
<tr>
<td>Balance of Honey Trade ($1000)</td>
<td>(103,582)</td>
<td>(77,055)</td>
<td>(66,288)</td>
<td>(110,395)</td>
</tr>
<tr>
<td>Honey Supply/Cap/Yr (Kg)</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Beehive Stocks</td>
<td>899,000</td>
<td>902,000</td>
<td>950,000</td>
<td>930,000</td>
</tr>
</tbody>
</table>


**Table 2.3: American Apicultural Data**

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey Production (Mt)</td>
<td>99,930</td>
<td>94,000</td>
<td>99,945</td>
<td>84,335</td>
</tr>
<tr>
<td>Honey Domestic Supply (Mt)</td>
<td>154,945</td>
<td>171,748</td>
<td>185,089</td>
<td>146,675</td>
</tr>
<tr>
<td>Honey Exports (Mt)</td>
<td>5,024</td>
<td>5,043</td>
<td>4,746</td>
<td>3,409</td>
</tr>
<tr>
<td>Honey Imports (Mt)</td>
<td>60,039</td>
<td>82,791</td>
<td>89,890</td>
<td>65,749</td>
</tr>
<tr>
<td>Balance of Honey Trade (Mt)</td>
<td>(55,015)</td>
<td>(77,748)</td>
<td>(85,144)</td>
<td>(62,340)</td>
</tr>
<tr>
<td>Honey Exports ($1,000)</td>
<td>8,809</td>
<td>8,121</td>
<td>6,388</td>
<td>6,861</td>
</tr>
<tr>
<td>Honey Imports ($1,000)</td>
<td>81,020</td>
<td>91,685</td>
<td>96,018</td>
<td>76,350</td>
</tr>
<tr>
<td>Balance of Honey Trade ($1000)</td>
<td>(72,211)</td>
<td>(83,564)</td>
<td>(89,630)</td>
<td>(69,489)</td>
</tr>
<tr>
<td>Honey Supply/Cap/Yr (Kg)</td>
<td>.5</td>
<td>.4</td>
<td>.4</td>
<td>.4</td>
</tr>
<tr>
<td>Beehive Stocks</td>
<td>2,688,000</td>
<td>2,620,000</td>
<td>2,513,000</td>
<td>2,515,000</td>
</tr>
</tbody>
</table>

Only in the last few years has Moldova tried to export honey. Main export partners for 2000-2001 were Germany, the Czech Republic, and Russia. Export honey generally sells for wholesale prices and shipped in bulk. Honey imports are mainly used to fill demand, at retail prices, for supermarkets in larger cities. The main importers in 2000-2001 were Romania, the Netherlands, Germany, and Russia. Moldova was historically a net honey exporter within the Soviet Union. The largest honey exporting year since independence, despite decreased production, was 2002. Very little is currently exported, but this is expected to increase if neighboring Romania is admitted as a European Union (EU) expansion country in 2007. Germany is the big player on the world stage for consumption of apicultural products (table 2.2), and effective demand may forge linkages between German wholesale buyer and Moldovan producers because of geographic proximity.

2.5 ECONOMIC SITUATION

Moldova is a typical post-Soviet transition economy. Like many other former Soviet republics, Moldova has experienced economic difficulties. Since its economy is highly dependent on the rest of the former Soviet Union for energy and raw materials, breakdowns in trade have had serious effects on economic growth. After the Russian ruble devaluation of 1998, Moldova's economy underwent a prolonged recession, from which it is only now beginning to emerge.

According to “The World Fact Book”, Moldova’s GDP was $1.6 billion (US) or $448 per capita in 2002 (CIA, 2002). Agriculture comprises 26 percent of the economy. Moldova produces vegetables, fruit, wine, grain, sugar beets, sunflowers, meat, milk, tobacco, and honey. Industry comprises 24 percent of the economy. Moldova produces processed foods and beverages, including wine and refined sugar, as well as processed fruit and vegetable products,
including vegetable oil. It also produces dairy and meat products, tobacco items, metal processing and machine tools; textiles and clothing, shoes, and furniture.

2.6 GEOGRAPHIC LOCATION

Sitting on the western edge of the vast Eurasian steppe, Moldova is located entirely within a black soil region once known as the crème-de-la-crème of the Soviet’s breadbasket region. Moldova, bordered on the north, east, and south by Ukraine and on the west by Romania (figure 2.1), is a landlocked country that covers an area of about about 13,000 square miles (roughly the size of Maryland): the second smallest republic of the former USSR, after Armenia. According to the Basa-Press, “The territory is situated in between the 45° 28' Northern latitude in the South, 48° 28' Northern latitude in the North and 26° 40' Western longitude in the West, 30° 06' Western longitude in the East” (“The Moldova Country Guide”, 2004). Ironically this latitudinal position places it equivalent to the central Dakotas, one of America’s most productive apicultural regions.

A 1995 article in The Economist, in reference to its compact, size called Moldova “a perfect laboratory for reform, where small economic activities can be more efficiently implemented and observed” (Kasiak, p.47, 1995) Research conducted at land-grant institutions is particularly relevant due to similarities in latitude between Moldova and the United States.
FIGURE 2.1: Map of The Republic of Moldova.

2.7 CLIMATE

Moldova’s climate is virtually identical to that of eastern Nebraska/South Dakota, but without excessive wind and swings in barometric pressure, due to proximity of the Black Sea to the south. January is the coldest month with average daily temperatures between 23° to 27°F. As the hottest month, July typically sees temperatures from 68° to 104°F. Precipitation in Moldova ranges from 14 inches per year in the south (semi-arid zone) to excesses of 20 inches per year in the center and north (humid continental zone) of the country. Local weather conditions are generally considered ideal for apicultural activity, except for unseasonal winter temperatures posing an acute risk of bee-kill via hive asphyxiation.

2.8 SOILS AND TOPOGRAPHY

The terrain of Moldova is primarily a hilly semi-forested plain interspersed with deep river valleys. The average elevation is 482 ft above sea level. The Codry (forested) Hills occupy the central portion of Moldova, rising to a maximum elevation of about 1,410 ft. Cultivated crops have largely replaced the natural grass cover of the steppes in the north and south. Three-quarters of the country is covered by chernozem, an exceptionally fertile type of soil that is considered ideal for agriculture. The term chernozem is defined by Goodes World Atlas as “a mollisol or steppe soil that has thick, black organic rich surface horizons and a high base supply (Ustoll M5)” (Goodes World Atlas, 1988). Generally, Moldovan soils are similar to those found on the central Great Plains. Unfortunately, the country’s soil suffered tremendous stress throughout the Soviet era, when industrial and agricultural development proceeded without regard for environmental protection. Topsoil degradation resulted from the use of poor farming practices, excessive use of pesticides, and industries lacking emission controls. Moldova is now burdened with this legacy of ecological mismanagement, severe erosion, and dangerous pollution levels.
2.9 WATER RESOURCES

Moldova has limited access to major water resources. The largest rivers include the Danube (100 yard shoreline), the Dniester, and the Prut. There are more than 3,000 small reservoirs. However, they are often highly contaminated with agricultural waste. According to the Basa-Press, “The underground water reserve is estimated to be 400-800 million cubic meters” (“The Moldova Country Guide”, 2004).

2.10 PROMINENT DEVELOPMENT ISSUES

Beekeeping is a truly extraordinary development activity. It is highly transferable and relatively labor-intensive as compared to other agricultural development enterprises. It increases rural employment and supplements household incomes. Apiculture is green and relatively low-impact, thus it will not strain the resource base. Bees are intensive plant pollinators and apicultural projects typically emphasize the use of bees for increasing field and tree crop production in the locality. Apiculture fits well with the concept of appropriate-scale agricultural development for addressing contemporary development issues such as increased food and economical security, equitable income distribution, reduced unemployment, improved forestry techniques, conservation practices, and environmental stewardship. Long-term, expanded economic activities would include pollination services for crops and orchards, processing and marketing of outputs, and production and sale of inputs (woodenwares, colonies, and queens) and outputs (candles, pollen, propolis). For example, candles could be produced en masse for services and holidays at the local Russian Orthodox Church. Moldova is 98 percent Orthodox Christian, and virtually every village has at least one church. Priests, monks, and churchgoers all hold beeswax candles in high reverence for their qualities. This market is a largely overlooked and holds huge potential: untapped in almost every corner of the country. If implemented correctly, small-scale beekeeping projects could increase economic activity at both the household
and community-level. Development of democratic organizations, to administer and sustain heightened economic level of production at the community-level, is the first and most important issue with regards to Moldovan projects emphasizing a technology-transfer dynamic. Establishment of strong, democratic organizations is vital to project success.

2.10.1 Establishment of Democratic Organizations

Establishing sustainable organizations seems like a simple proposition, but it can be very difficult, particularly in Moldova, where historically, autonomous government has been a generally foreign concept. The organization must be transparent and the players well informed of the intentions of the organization. Potential members must see that the benefits in adopting a particular approach are attainable. Individuals must emerge who are willing to assume a leadership role and take the agreed-upon vision to the next steps. A level of trust and confidence must evolve within the group. The creative tension between visionaries and doers must be harnessed effectively so that the group is not prevented from moving forward. Participants must be convinced that the initial risks and costs in adopting the proposed approach are outweighed by the potential benefits to be obtained. Roles of members, management and governing structure should be clear to all. Everyone involved should have confidence that the proposed organization is the best alternative available.

Cooperatives and associations are two potential models of appropriate organizational structures for apiculture development projects. A cooperative, an enterprise or organization owned by and operated for the benefit of those using its services, comprises a legal entity owned by its members, with no passive shareholders, rendering service at cost, deriving benefits proportional to use, and giving limited return on member equity. American farmers often maintain producer or marketing cooperatives, some of which are government-sponsored, which promote, and sometimes, distribute specific commodities. Associations (appendix 2.9) are organizations of persons having a common interest, and in Moldova, legal entities. Associations
are not as complex as cooperatives and do not have as much formal support by the state or the NGO sector.

By pooling resources and ideas, members of cooperatives and associations are better situated to bargain preferred terms in both the marketplace and political arena. Furthermore, both organizations also advance the interests of their members by sponsoring training and educational seminars, and by promoting industry-wide standards and goals. In Moldova, cooperative and association structures are similar, but the prior is not as large or as well planned as the latter. Associations can be formed with very few people, and act as a lead-in organizational structure where interest in a cooperative has yet to coalesce. Village product collection points for honey and wax, as similar to the many farmers’ elevators located in small towns throughout the Midwest would form a natural community center for cooperative or association type activities. These organizations are vital for bringing people together to solve community problems. The organizational structure can not only be useful for procuring foreign aid and creating a structure for educational programs, but to promote democracy through a method where organizational leaders are held accountable for the decisions, through periodic closed-voting procedures. Teaching organizational accountability is an imperative lesson for development efforts to embrace. Examples of each organizational structure, within the context of current apicultural development initiatives, are compared more extensively in Chapter 3.

2.10.2 Increasing Economic Activity

Honey and wax are the basic outputs of apicultural activities. Both need value-added processing to increase their wholesale value. Village collection/processing points, woodworking shops, lumber mills, and central markets are used as vertical exchange points of inputs (woodenware, bee colonies, queens, smokers) and outputs of various materials at various stages of production. Relative to most other agricultural pursuits, beekeeping is a soft technology. All
the inputs necessary for carrying out a beekeeping venture can be made locally. Smokers, protective clothing, veils, and hives can be made by village metal-smiths, tailors, and carpenters. Thus, a beekeeping project can create work and income for many local citizens, even those not involved directly with the manipulation of bees.

2.10.3 Strengthening Rural Households

Beekeeping not only supports rural areas economically, but it also supports the rural family, which is a primary focus of contemporary extension efforts. Although beekeeping is not an inherently male occupation, in most cultural settings it is perceived as such. However, while men work directly with the bees, the whole family is often involved in processing of these products. In Moldova, food security is considered at the household level. Food security is the notion that all people, especially the most vulnerable, have dignified and unthreatened access to a quality and quantity of culturally appropriate food that will fully support their physical, emotional, and spiritual health. Moldova is a relatively poor country by western standards. According to “The World Fact Book”, “80 percent of the population lives below the poverty line of $4.00 (US) a day” (CIA, 2002). Any additional food or income, from either apiculture or an associated trade, helps immensely in ensuring family financial stability.

2.10.4. Integrating Agro-Forestry

Many agro-forestry projects utilize a beekeeping component for crop, orchard, and forest pollination. Indiscriminate pollination is one of the largest benefits of a beekeeping enterprise to other agricultural activities. Bees feed themselves from the existing nectar and pollen resources in the area by foraging far beyond the small amount of land on which the hives are located. Pollination is not a mutually exclusive activity in regard to other resources used in agricultural production, as nectar and pollen go almost entirely unused. Typically, apiculture’s largest contribution to the larger agricultural economy is through the pollination of fruits, vegetables, pasturage, and crops such as sunflower, buckwheat, alfalfa, and clover. This contribution is only
possible if enough bees and forage exist in the immediate area to affect the level of pollination; hence the need for a combination of either more beekeepers and/or large-scale implementation of high-technology apiculture is acute. Plants benefit from insect pollination by an increased seed set. This results in increased seed production and better quality fruits. Increased yields of both fruit and honey, subsequently result in greater village level food security. According to First Monday: ADRA Network Journal, “The international community recognizes bees as one of the safest, most economical, and environmentally sensitive pollinators of fruit trees. Bees help pollinate agricultural crops, a variety of grasses, wildflowers, fruit-bearing shrubs, fuel wood, and timber trees, all of which play a vital role in agriculture and forestry” (Jump, 2003). Bees are particularly beneficial as pollinators in those areas where natural insects are lacking or are insufficient to pollinate large areas devoted to a single crop. Moldovan crop/tree forage sources include squash, pumpkin, cucumber, apples, cherry, pear, melons, watermelon, peaches, blackberries, strawberries, sunflowers, soybeans, alfalfa, acacia, and silk oak. These forage sources are found on home-plots, in orchards and forests, and the rest are located in the remaining areas consisting of monoculture cropping systems. Bee pollination has a great impact on peoples diets and on environmental stability of a village ecosystem. Bees pollinate weeds, providing greater forage for wild birds and mammals, meanwhile promoting increased soil stability in watersheds and wilderness areas.

An additional topic associated with the discussion of the agro-forestry/apiculture relationship is in wood, a vital input of expanded apicultural activity through new beehive construction. Sources available for woodenware construction include oak, hornbeam, linden, maple, beech, and various fruit trees. An expanded discussion could also lead to common property usage agreements and a heightened awareness of the harmful effects to an ecosystem via resource exploitation.
2.10.5 Promoting Environmental Stewardship/Conservation

Natural factors affect the environment, and sometimes people can alter the suitability of a region for beekeeping by their land use patterns or agricultural practices. For example, cutting down large areas of suitable bee forage and devoting these areas to monoculture can destroy a potential apicultural area if the introduced crop is a poor forage resource for bees. Conversely, the bee pasture of an area can be improved if marginal melliferous plants are replaced with good nectar/pollen producing plants. It is seldom economically feasible to make large plantings solely for improving bee pasture, though the bee pasture of an area can be improved by selecting good melliferous plants for other primary purposes such as reforestation, windbreaks, cover crops, firewood crops or forage crops for livestock.

Insect sensitivity to particular inputs endemic to large-scale monoculture makes their use of benefit when raising awareness of over-reliance on harmful chemicals. Also, people involved in forestry projects are often interested in beekeeping. It is an income yielding undertaking partially based on the use on forest resources, yet it is not destructive to it. Someone who is earning an income from beekeeping quickly becomes an advocate for preserving forest resources.

2.10.6 Ensuring Sustainability

Sustainability has become a buzz word in development circles in recent times. Essentially, sustainability is about living, working, and ordering society in ways which encourage pollution reduction, reuse of resources, promotion of biodiversity, and does not degrade the environment. The core idea is for current generations to meet their needs without compromising the ability of future generations to meet its needs. Sustainability, also associated with promoting social justice and a fairer society; applies to many disciplines, including economic development, environment, food production, energy, and lifestyle. Basically, sustainability refers to doing something in a long-term mindset. Today's decisions are made
with a consideration of sustaining the activity into the future. Sustainability is essential to the core of this research, as without thoughts to the ends of profitability and labor savings of a given technology, players would be in a perpetual state of confusion in regard to making a decision of one technology over another. Thus, the importance of appropriate technology to development efforts must be that the hardware earns a profit without destroying the local environment.

2.11 SUMMARY

Through background discussion, the general state of affairs in contemporary Moldova has been highlighted. This was enhanced first by a discussion of the bee-human relationship. These thoughts are then applied to a historical summation of apicultural developments relevant to Moldovan apiculture development initiatives. Chapter 2 renders the current conditions of apicultural technology, education components, and institutions relevant to the analysis in the next chapter. Also important from Chapter 2 was a background discussion focusing on the resource base necessary to sustain apicultural activity. Information on current consumption, production, and trade, as well as that of the economic and resource base, led to identification of prominent development issues.
CHAPTER 3

COMPARATIVE ANALYSIS OF COMPETING HIVE TECHNOLOGIES

3.1 INTRODUCTION

The economic and technical reality found in most developing countries makes direct-transfer of complex apicultural technology unviable. Moldovan producers will build their own hives if none are readily available at a low cost; thus they would be effectively forced to practice a subsistence level of beekeeping. Moldova is a country with tradition in commercial beekeeping enterprises and any appropriate development effort should be solidly based on a foundation of that technical experience. The appropriate technology, education component, and institutional infrastructure are displayed through analysis and consideration in that order throughout the rest of this chapter. But first, these are preceded by discussion of movable-frame hive systems’ fundamental components.

3.2 MOVABLE-FRAME HIVE COMPONENTS

Bees usually build their nests in a cavity, attaching the combs to the upper part of it. The hives of feral (wild, not managed) colonies are often very inaccessible. Even if accessibility is not an issue, necessity dictates the destruction of both cavity and combs in gathering bee products. To reiterate, beekeeping implies management of the honey bee colony. Management of the hive itself is based on comb manipulation to inspect the condition or to adjust the space needs of the colony. Therefore, a practical system, movable-frames, allows for easy removal and replacement of combs without destroying them, is a prerequisite for apicultural development projects.
Movable-frame hives are used in all modern beekeeping enterprises. In these hives, bees construct comb in frames which contain an embossed sheet of beeswax foundation. The foundation serves as a pattern, ensuring straight, centered combs in the frames. These hives are constructed so that there is a “bee space” between the frames themselves and between the frames and the box holding them. Bee space (approximately 3/8\text{th} of an inch or 1 cm) is simply the crawl space needed by a bee to pass easily between two structures. If the space between any two surfaces in the hive is too small for a bee to pass through easily, the bees will seal it with propolis (bee glue). If the space is larger than the bee requires, the bees construct comb (wax) until the space is properly maintained. When the space between two surfaces in the hive is the right size, the bees will leave it free as a crawl space. Thus, if the bee space is respected throughout the process of hive construction, it will ultimately allow for easy comb removal and replacement of frames. Two types of movable-frame hive systems, “traditional” (Russian) and “Langstroth” (American), will be displayed in a comparative analysis later in this chapter.

3.2.1 Inputs

Inputs are defined here as the inventory used in supplementing the natural dynamics of a bee colony. All of these components work together in forming a basic production unit of any apicultural enterprise, the hive.

3.2.1.1 Nectar and Pollen

Nectar is a sweet, watery liquid secreted by plants. Bees collect nectar and make it into honey. Some plant species secrete very little nectar, while others secrete plentiful amounts. The quality, or sugar content, of nectar also varies among species. Pollen is the powdery substance that is the male reproductive cells of a flower. Bees collect pollen as a source of protein for the brood. Bees access these excess (free) resources, found in orchards and crops, by foraging far beyond the small amount of land on which the hives are located.
3.2.1.2 Sugar

Sugar is used in the individual beekeeper’s arsenal of knowledge as a temporary alternative food source for supplementing a hives food source during the dearth periods of spring and autumn, and while administering medications. Sugar is combined with water to form “sugar syrup” which is subsequently used by the beekeeper:

The early spring feeding stimulates activity in the hive and gets the colony up and running fast. It may also save lives if the bees’ winter stores of honey have dropped dangerously low. The colony will store the autumn sugar syrup feeding for use during the cold winter months. In either case, feeding syrup is also a convenient way to administer some important medications (Blackiston, p. 91, 2002).

For the analytical purposes of this research, sugar costs $4.00 (US) per hive per year (appendix 2.8).

3.2.1.3 Labor

Beekeeping is labor intensive, and thus labor is the backbone of any apicultural enterprise. For the analytical purposes of this research, as derived from The Hive and the Honey Bee, 10 visits per year, at 10 minutes per visit, multiplied by a wage of $2.08 (US) per hour equals $3.50 per colony per year (Sanford and Hoopingartner, p.743, 1992). In reality, the opportunity cost to labor in Moldova may be closer to zero, but as producers inherently wish to increase output and efficiency, the rate of $2.08 will be used to represent the cost of their toil. Also, the intricate construction demands of the woodenwares necessary for movable-frame hive systems require labor in the form of carpentry. Labor is included in cost of production per hive and will be supplied when necessary throughout the analysis.
3.2.1.4 Medication

Bees, like any other living organism, are susceptible to particular diseases. Without the help of the beekeeper, the colony will eventually get sick and likely perish for lack of administration of proper medications. An annual medication regime and careful hive inspection methodology can hedge the risk of infection. For the analytical purposes of this research, medication (Varoatoz and Ascoferoz) costs $1.00 (US) per hive per year. Appendix 2.8 displays a cost of $4.00 (US) per hive per year, but empirical data provides for the former price to be more applicable to the analysis.

3.2.1.5 Transportation

Transportation is a secondary cost, one that is necessary in delivering hives to sources of forage, selling honey, and buying supplies. As many Moldovan producers keep hives located on or near home-plots throughout the year, this is a minimal cost. For the analytical purposes of this research, derived from The Hive and the Honey Bee, transportation costs total approximately $.50 per colony per year (Sanford and Hoopingartner, p.732, 1992).

3.2.1.6 Queens

The queen, a mature, mated female bee, with fully developed ovaries, produces male and female offspring located in the brood. The queen is the prime-mover of a honey-bee colony: her needs dictate actions by all of the other members of a hive. The rest of the colony cannot survive without the queen. A good queen (only one per colony) means a strong and productive hive. Her two primary purposes are to produce chemical scents that help regulate the unity of the colony and to lay eggs:

She…is capable of producing more than 1,500 eggs a day at 30-second intervals.

The queen can live for two or more years, but replacing your queen after a couple of seasons ensures maximum productivity. As, a queen ages, her egg-laying
capability slows down, which results in less brood...a smaller colony...and a lackluster harvest (Blackiston, *Beekeeping for Dummies*, p. 24, 2002).

For the analytical purposes of this research, queens are replaced in every colony every third year, at a cost of $7.50 (US) (appendix 2.8).

3.2.1.7 Bee Colonies

Quality bees are of first and foremost importance to any beekeeping operation; regardless of the hive technology’s qualities, low-quality bees make for an unsustainable operation. A colony is defined here as a collection of bees (workers, drones, and a queen) living together as a single social unit. The workers are the immature female bees which constitute the majority of the colony’s population. Worker bees do most of the chores for the colony. Drones are male bees whose main job is in queen fertilization. During summer months, about 60,000 or more bees reside in a healthy hive. A 3-pound package of quality purchased colony consists of a single queen and about 11,000 bees. A unit (the size of a shoe box) also includes a small screened queen cage and a tin cup can of sugar syrup that serves to feed the colony during their trip. For analytical purposes of this research, packaged bees purchased in Moldova cost approximately $30.00 (US).

3.2.1.8 Woodenwares

Woodenware refers to the various components that collectively form the movable-frame beehive. The majority of these components are made of wood, except the beeswax foundation found embossed in wire connected at various points on the inside of each frame. Because technology is the main focus of the research, woodenwares will be detailed further in later portions of this analysis, with necessary variations discussed for each model. In the analyses, as derived from *The Hive and the Honey Bee*, depreciation is factored as “hive/comb repair”, at 10 percent (Sanford and Hoopingartner, p.732, 1992) of the initial cost of the hive, introduced at the beginning of each year, for the 20 year life of each unit.
3.2.2 Major Outputs

Outputs are defined here as the value that comes out from a process. The major output components from moveable frame hive systems mentioned here are honey and wax. Other products, resulting from more advanced beekeeping, are pollen, bee brood, queens, colonies, propolis, and royal jelly.

3.2.2.1 Honey

Honey is the primary hive product. It is basically nectar from which the bees have evaporated most of the water content. In converting the nectar to honey, the bees also add enzymes which serve mainly to break complex sugar molecules down into more simple ones. The characteristic tastes and properties of honey depend upon the floral sources of the nectar. Thus, honey from different regions and periods throughout the nectar flow is different in taste and physical properties.

Absence of foreign material is the main criterion of quality in honey. Bits of wax or propolis, pollen, brood, or dead bees can contaminate honey during extraction or processing. Honey is also graded by color: from the lightest (water white) to the darkest (dark amber). Generally, honey with a darker transparency has a stronger taste, and is actually preferred in many parts of the world, particularly Europe. Quality honey has a high cash value relative to its weight and bulk. Properly stored, it is essentially a non-perishable product. It is also economical and easy to transport. These characteristics make honey an attractive crop for small-scale and often isolated producers.

3.2.2.2 Beeswax

Beeswax is a substance secreted by glands in the abdomen of a worker bee, used by them to build comb within the hive. It is an easily-stored and generally non-perishable product. All old combs and pieces of excess beeswax can be rendered into blocks for easy storage and value-added processing later. Beeswax processing is used to make products as diverse as embossed
foundation for hive frames, candles, soap, hoof-treatment for horses, and lip balm. Darker combs contain propolis and cocoons and are considered of lower quality than rendered beeswax. But, many of the value-added products not to be used again in a hive can help develop markets for old, potentially disease contaminated beeswax.

3.3 COMPARATIVE ANALYSIS OF COMPETING HIVE TECHNOLOGIES

The Rev. Lorenzo Langstroth of Philadelphia was the first person to make use of the bee space principle in hive construction in 1851, using movable frames (figure 3.1) to contain the comb within a hive. The Langstroth system is presented here as the introduced hive technology; whereas, the other, referred to as the traditional hive technology, is utilized throughout areas with historical Russian influence. But, both of these advanced systems, as closely-related movable-frame technologies, have general advantages and disadvantages, which need discussion.

FIGURE 3.1: Movable-frame with embossed comb used in both Langstroth and traditional hive systems.


Movable-frame systems’ greatest advantages derive from a comb placement which can be easily removed, inspected, and interchanged, having been built solidly into the frame structure. Combs containing honey can be removed, and the product centrifuged from them; once empty, they are returned to the colony for refilling, over and over again. This process
enhances honey production as the bees do not have to construct new comb. Furthermore, as the comb is securely attached to the frame, less care is needed when removing and inspecting them, and the colonies can be moved to forage sources with little comb breakage. Lastly, these systems can be adapted to easily produce pollen for the mass rearing of queens.

Major disadvantages of movable-frame systems are generally uncovered when compared to the use of a simpler “beekeeping” hives and methodologies (Kenya Top Bar Hive (KTBH), hollow logs, wicker baskets, feral hunting). Movable-frame hives, with woodenware as chief input, require expertise in carpentry to build. They also require much practical and theoretical knowledge of beekeeping for attaining optimum yield. Lastly, for their greatest return, they require access to a honey extractor (figure 3.2), sometimes hard to build or purchase.

FIGURE 3.2: Internal view of a honey extractor loaded with frames.

3.3.1 Traditional Hives

Most Moldovan beekeepers use traditional hives (figure 3.3). This is a Russian hive, and it was utilized exclusively by Moldavian Soviet state-apiaries. Traditional hives typically use one long box or “super” (of variable sizes) with up to a maximum of twenty full-depth frames containing honeycomb.

FIGURE 3.3: Front view of a traditional hive (w/ pollen basket).


The following tables display the net present worth of two competing scenarios for would-be beekeepers. The first two sets of tables (3.1.1:3.2.3) represent competing project scenarios under the budget constraints listed appendix 2.8; the first, where one would-be part-time beekeeper utilizes a traditional 20-frame hive; the second, uses a competing Langstroth hive.
**TABLE 3.1.1:** Value of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing traditional technology over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Item</th>
<th>Production Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Number of Hives</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Incremental Value of Honey Production</strong></td>
<td></td>
</tr>
<tr>
<td>Yield (kg/hive)</td>
<td>15</td>
</tr>
<tr>
<td>Price ($/kg)</td>
<td>$1.07</td>
</tr>
<tr>
<td>Income (Gross Value of Production)</td>
<td>$32.10</td>
</tr>
<tr>
<td><strong>Incremental Variable Costs</strong></td>
<td></td>
</tr>
<tr>
<td>Sugar ($4/hive)</td>
<td>$8.00</td>
</tr>
<tr>
<td>Labor ($3.50/hive)</td>
<td>$7.00</td>
</tr>
<tr>
<td>Transport ($0.50/hive)</td>
<td>$1.00</td>
</tr>
<tr>
<td>Medication ($1.00/hive)</td>
<td>$2.00</td>
</tr>
<tr>
<td>Queens ($7.50/hive) (triennially)</td>
<td>$0.00</td>
</tr>
<tr>
<td>Hive &amp; Comb Repair (10% of new colony cost x # of hives &gt; 1 year old)</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total Incremental Variable Costs</strong></td>
<td>$18.00</td>
</tr>
<tr>
<td><strong>Incremental Fixed Costs</strong></td>
<td></td>
</tr>
<tr>
<td>Bees ($30/hive)</td>
<td>$60.00</td>
</tr>
<tr>
<td>Woodenware, Wax, Bee Wire ($36.01/hive)</td>
<td>$72.02</td>
</tr>
<tr>
<td><strong>Total Incremental Fixed Costs</strong></td>
<td>$132.02</td>
</tr>
<tr>
<td><strong>Net Income (Loss)</strong></td>
<td>($117.92)</td>
</tr>
</tbody>
</table>

**SOURCE:** Pfitzer, C. 2004.

**3.3.1.1 Assumptions**

This is a part-time beekeeper employing traditional hive technology. The total number of hives listed for this analysis are ordered as increasing incrementally from years 1 to 5 (2,4,6,8,16,20), then stabilizing at a total of 20 from years 6 thru 20.

**3.3.1.2 Incremental Income**

Honey yield is assumed at 15 kg per hive as a standard upper-limit for traditional hive technology under current conditions. Traditional hives in Moldova rarely produce more than 15 kg of honey per year. Price is listed at $1.07 per kg, or wholesale minimum (appendix 3.4). Assumed sales prices at the wholesale minimum level are due to relatively poor product quality
endemic to use of traditional hives. Incremental income (gross value of production) is derived from price times yield, listed in US dollars per kg per year.

3.3.1.3 Intangible Benefits

All the benefits of any moveable-frame hive system are present in the traditional hive, as summarized in section 3.2. The largest benefit of traditional technology is low initial input cost in the short-term.

3.3.1.4 Incremental Variable Costs

Incremental variable costs are the sum of sugar, labor, transportation, queens, and hive/comb repair in section 3.2.

3.3.1.5 Incremental Fixed Costs

Incremental fixed costs are the sum of bees and woodenwares. Packaged bee colonies cost $30 (US) per new colony (appendix 2.8). Total woodenware costs for a traditional hive equals $36.01 (table 3.1.2).

**TABLE 3.1.2:** Woodenware requirements for one traditional hive.

<table>
<thead>
<tr>
<th>Parts</th>
<th>Dimension</th>
<th>Quantity</th>
<th>Approximate Board Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>2 x 32 x 21 ½</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Traditional Box (empty)</td>
<td>9 5/8 x 13 ¾ x 19 7/8</td>
<td>1</td>
<td>8.5</td>
</tr>
<tr>
<td>Bottom</td>
<td>2 x 32 ½ x 19 7/8</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Top Bars</td>
<td>¾ x 1 1/16 x 19</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Bottom Bars</td>
<td>3/8 x ¾ x 17 5/8</td>
<td>20</td>
<td>1.5</td>
</tr>
<tr>
<td>Deep Sides</td>
<td>3/8 x 1 3/8 x 9 1/8</td>
<td>38</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total** 27

**Total Cost**

<table>
<thead>
<tr>
<th>Material</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>$17.01</td>
</tr>
<tr>
<td>Beeswax</td>
<td>$16.80</td>
</tr>
<tr>
<td>Bee Wire</td>
<td>$2.20</td>
</tr>
</tbody>
</table>

**Total Cost** $36.01


Wood and associated production costs are calculated in price per board feet (BF). A board foot is the unit of measure for logs and lumber, where one unit is equivalent to a piece of wood 1 inch thick, 12 inches wide, and 12 inches long (ft²=BF). 150m² of wood is purchased at $3/m² (US); thus, $3/10.76 ft²/1m² equals $.28/ BF. Labor equals $2.08/hour; 6 hives can be
constructed by 1 worker/hour; thus, $2.08/6 hives equals $.35. The sum of $.28/BF and $.35/BF equals $.63/BF. $.63/BF multiplied by 27BF equals $17.01 for the total wood cost of one traditional hive.

Beeswax and associated costs are calculated by considering that traditional hives require 20 full-depth (8 ½” X 16 ¾”) beeswax forms/colony. As listed on the Betterbee website (<http://www.betterbee.com.html>), 175 full-depth unwired brood sheets, purchased in bulk, at $129 makes the unit cost $.74/beeswax form. Labor costs are calculated with 20 full-depth frames being constructed by 1 worker/hour (3 minutes/frame) where $2.08/20 frames equals $.10/frame. The sum of $.74 and $.10 equals $.84 per beeswax form. $.84/form multiplied by 20 forms equals a total beeswax cost of $16.80 per traditional hive.

Bee wire and associated costs, also listed on the Betterbee website, are calculated by considering that bee’s wire costs $.01 per foot. One full-depth frame hive requires 5 feet of bee’s wire. Labor costs are calculated at $.10/full-depth frame. The sum of $.01 and $.10 equals $.11/full-depth frame. $.11 times 20 full-depth frames in a traditional hive equals a total bee’s wire cost of $2.20/hive.

3.3.1.6 Intangible Costs

Critical intangible costs associated with the use of traditional hives are due to both increased bee kill numbers during weather extremes and unnecessary swarming. Weather extremes affect bees like any living organism; the comfort of the queen is highly regulated, by bees either fanning the hive entrance during heat spells, or retaining heat as a balled mass through the winter. On the other hand, swarming occurs when a colony outgrows its hive. Whole colonies will abandon cramped hives; and bees, at $30 per colony, are expensive and constitute anywhere from half to one-third of the cost of a starter colony. A similar cost is the inability of a colony to expand past the twenty frames of a traditional hive, resulting in overcrowding and ultimately swarming. Since bees have a tendency to swarm from the use of
traditional hives, the need for additional labor is a cost endemic to the use of traditional hives. Also, traditional hives do not come apart and can weigh near 400 kg when fully capped (ready for harvest). Individual, fully capped deep-frames weigh near 20 kg, taxing both the beekeepers tending the hive and their ability to realistically service a large number of hives in one setting.

Lack of standardization relates to a real cost when applied to the inability of a producer to attain greater expansion over the long-term and to collect more honey due to lack of adequate bee space and queen exclusion. Hive standardization relates to assembly line economics, honey production costs, interchangeability, economies of scale, colony division, more efficient use of bee space, resale, and lower replacement and repair costs. Mixed honey and brood comb throughout the hive renders extraction unprofitable due to the low honey quality.

### TABLE 3.1.3: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing traditional technology over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental Income (Total Value of Honey Production)</th>
<th>Incremental Costs</th>
<th>Net Income (Loss)</th>
<th>Discounted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incremental Variable Costs</td>
<td>Incremental Fixed Costs</td>
<td>Total Incremental Costs</td>
<td>Discount Factor 12%</td>
</tr>
<tr>
<td>1</td>
<td>$32.10</td>
<td>$18.00</td>
<td>$132.02</td>
<td>$(117.92)</td>
</tr>
<tr>
<td>2</td>
<td>$64.20</td>
<td>$43.20</td>
<td>$132.02</td>
<td>$(111.02)</td>
</tr>
<tr>
<td>3</td>
<td>$128.40</td>
<td>$79.20</td>
<td>$264.04</td>
<td>$(343.24)</td>
</tr>
<tr>
<td>4</td>
<td>$256.80</td>
<td>$173.00</td>
<td>$528.08</td>
<td>$(701.08)</td>
</tr>
<tr>
<td>5</td>
<td>$321.00</td>
<td>$223.80</td>
<td>$528.08</td>
<td>$(487.84)</td>
</tr>
<tr>
<td>6-20</td>
<td>$321.00a</td>
<td>$374.98a</td>
<td>$0.00a</td>
<td>$374.98a</td>
</tr>
<tr>
<td>Total</td>
<td>$5,617.50</td>
<td>$6,161.90</td>
<td>$1,320.20</td>
<td>$(7,482.10)</td>
</tr>
</tbody>
</table>

Net present worth at 12 percent = $(934.98)

**SOURCE:** Derived from Gittinger, J. Economic Analysis of Agricultural Projects; 1982: 319.

**Note:** a: annual amount for years 5 through 20 inclusive; b: present worth of an annuity factor for years 5 through 20 inclusive; present worth rounded to nearest dollar.
TABLE 3.1.4: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), from one traditional hive over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental Income (Total Value of Honey Production)</th>
<th>Incremental Costs</th>
<th>Net Income (Loss)</th>
<th>Discounted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incremental Variable Costs</td>
<td>Incremental Fixed Cost</td>
<td>Total Incremental Costs</td>
<td>Discount Factor 12%</td>
</tr>
<tr>
<td>1</td>
<td>$16.05</td>
<td>$9.00</td>
<td>$66.01</td>
<td>$75.10</td>
</tr>
<tr>
<td>2</td>
<td>$16.05</td>
<td>$12.60</td>
<td>$0.00</td>
<td>$12.60</td>
</tr>
<tr>
<td>3</td>
<td>$16.05</td>
<td>$12.60</td>
<td>$0.00</td>
<td>$12.60</td>
</tr>
<tr>
<td>4</td>
<td>$16.05</td>
<td>$20.10</td>
<td>$0.00</td>
<td>$20.10</td>
</tr>
<tr>
<td>5</td>
<td>$16.05</td>
<td>$12.60</td>
<td>$0.00</td>
<td>$12.60</td>
</tr>
<tr>
<td>6-20</td>
<td>$16.05a</td>
<td>$15.10a</td>
<td>$0.00a</td>
<td>$15.10a</td>
</tr>
<tr>
<td>Total</td>
<td>$321.00</td>
<td>$293.40</td>
<td>$66.01</td>
<td>$359.50</td>
</tr>
</tbody>
</table>

Net present worth at 12 percent = ($44.43)


Note: a: annual amount for years 5 through 20 inclusive; b: present worth of an annuity factor for years 5 through 20 inclusive; present worth rounded to nearest dollar.

3.3.1.7 Risk

Risk is defined here as an exposure to a chance of loss or damage. The risks of investment loss using traditional hive technology are increased by the horizontal hive construction. The largest risk factor is incurred with swarming and literally having a high investment in a bee colony fly away due to lack of space to expand within the hive. Also, the opportunity cost to other profitable, or in this case break-even, ventures is substantial. Future income is compromised due to lack of hive capacity associated with traditional technology and the subsequent lack of critical mass (low bee populations) to effectively render, for a given apiary, the ability to perform pollination services. Opportunity cost exists with regard to society’s loss of greater agro-economic yield potential where pollination services are available.

3.3.1.8 Aggregate Benefits and Costs

Total incremental costs are derived from the sum of incremental variable costs and incremental fixed costs (table 3.1.1.). Net income, or loss, is the product of income minus total incremental costs (table 3.1.1.). The use of traditional hives is unprofitable in both the short and long term looking at the net present worth of -$44.43 (table 3.1.4). No payback period exists as
producer employing traditional hive technology never actually makes a profit. All benefits and costs considered, traditional hives are a money losing technology, unless the beekeeper is willing to devote an excessive amount of time in building new hives, purchasing queens, and dividing colonies, at a continual and unusually rapid pace.

3.3.2 Langstroth Hives

FIGURE 3.4: Front view of Langstroth hives.


Langstroth hives, invented in America and used throughout the world in production apiculture, are the introduced technology in this analysis. The Langstroth system utilizes “supers” (hollow boxes with 9 or 10 moveable frames) above the “brood chamber” (identical to a super, but named as such to distinguish the nucleus of a colony from honey storage), by restricting the movements of the queen, and capturing excess honey stored by the workers. Since bee space exists between the tops of the frames and between the brood and supers, bees (except the queen) are to pass freely between them. The construction of both brood and supers are of complementary design, and the Langstroth system allows movable-frames to be interchanged not only within the brood on a short horizontal-plane (as with traditional hives), but also on the long vertical-plane, with the addition of multiple supers. This enhances the natural tendency of the
bees to expand in an upward direction. The different names come from their relative position on the hive and thus their function. Think of the Langstroth hive as virtual multi-storied apartment complex for a bee colony, where every interior corridor allows uniform space for comfortable passage, and cubby-holed walled rooms allow for large deposits of food storage, or in the case of the queen (limited to two larger supers at the bottom) where she deposits her eggs (figure 3.5).

**FIGURE 3.5:** Integral Components of the Langstroth Hive.

![Diagram of Langstroth Hive Components](image)

**SOURCE:** Mississippi State University, <http://www.msstate.edu/Entomology/Beekeeping/Beekeeping004.html> 1996.
These levels work in unison and provide a highly efficient house for bees and “surplus” honey for the beekeeper. Successful beekeeping with the Langstroth system entails manipulation of the moveable-frames in an efficient manner, to produce honey in excess to the needs of the colony in rearing their replacements. This quality honey is the valuable commodity that is removed, processed, and marketed. In a natural setting, a crowded hive would swarm, but the Langstroth system allows for manipulation of the hive cavity. This system ultimately provides the necessary capacity for colony survival, and through manipulation, bee populations are optimized for the production of honey (table 3-2).

**TABLE 3.2:** Honey Production by Various Sizes of Colonies

<table>
<thead>
<tr>
<th>Bees</th>
<th>Brood</th>
<th>Brood/Bee Ratio (%)</th>
<th>Honey (KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,000</td>
<td>11,850</td>
<td>79</td>
<td>11.34</td>
</tr>
<tr>
<td>30,000</td>
<td>18,300</td>
<td>61</td>
<td>30.84</td>
</tr>
<tr>
<td>60,000</td>
<td>15,000</td>
<td>25</td>
<td>69.85</td>
</tr>
</tbody>
</table>


**FIGURE 3.6:** Uncapping of honey comb (in a movable-frame) from a Langstroth hive.

**SOURCE:** Pfitzer, C. 2002.
### TABLE 3.3.1: Value of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing Langstroth technology over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Item</th>
<th>Production Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Total Number of Hives</td>
<td>2</td>
</tr>
<tr>
<td>Incremental Value of Honey Production</td>
<td></td>
</tr>
<tr>
<td>Yield (kg/hive)</td>
<td>30</td>
</tr>
<tr>
<td>Price ($/kg)</td>
<td>$2.15</td>
</tr>
<tr>
<td>Income (Gross Value of Production) (yield x $/kg x # of hives)</td>
<td>$129.00</td>
</tr>
<tr>
<td>Incremental Variable Costs</td>
<td></td>
</tr>
<tr>
<td>Sugar ($/hive)</td>
<td>$8.00</td>
</tr>
<tr>
<td>Labor ($/hive)</td>
<td>$7.00</td>
</tr>
<tr>
<td>Transport ($/hive)</td>
<td>$1.00</td>
</tr>
<tr>
<td>Medication ($/hive)</td>
<td>$2.00</td>
</tr>
<tr>
<td>Queens ($/hive)(triennially)</td>
<td>$0.00</td>
</tr>
<tr>
<td>Hive &amp; Comb Repair (10% of new colony cost x # of hives &gt; 1 year old)</td>
<td>$0.00</td>
</tr>
<tr>
<td>Incremental Variable Costs</td>
<td>$18.00</td>
</tr>
<tr>
<td>Incremental Fixed Costs</td>
<td></td>
</tr>
<tr>
<td>Bees ($30/hive)</td>
<td>$60.00</td>
</tr>
<tr>
<td>Woodenware, Wax, Bee Wire ($/hive)</td>
<td>$121.38</td>
</tr>
<tr>
<td>Incremental Fixed Costs</td>
<td>$127.38</td>
</tr>
<tr>
<td>Total Incremental Costs</td>
<td>$145.38</td>
</tr>
<tr>
<td>Net Income (Loss)</td>
<td>($16.38)</td>
</tr>
</tbody>
</table>

**SOURCE:** Pfitzer, C. 2004.

#### 3.3.2.1 Assumptions

This is a part-time beekeeper employing Langstroth hive technology. The total number of hives listed for this analysis are ordered as increasing incrementally from years 1 to 5 (2,4,6,8,16,20), then stabilizing at a total of 20 from years 6 thru 20.

#### 3.3.2.2 Incremental Income

Honey yield is assumed at 30 kg per hive as a standard lower-limit for Langstroth hive technology under current conditions. Langstroth hives typically produce at least 30 kg of honey per year. It is assumed that a part-time beekeeper would not have the resources to maximize the potential of the technology. The price is listed at $2.15 per kg, or wholesale maximum (appendix 3.4). Assumed sales prices at the wholesale maximum level are due to relatively good
product quality endemic to use of Langstroth hives. Incremental income (gross value of production) is derived from price times yield, listed in US dollars per kg per year.

3.3.2.3 Intangible Benefits

All the benefits of any movable-frame hive system are present in the Langstroth hive, as summarized in section 3.2. Many intangible benefits are associated with the Langstroth hive, the most critical being swarm prevention, reduced bee kill, and increased output potential.

The ability of the colony to expand when necessary into additional supers is crucial. Beekeepers who desire maximum productivity from their hives cannot afford to allow bees to fly away. According to Beekeeping in California, “Swarming is generally related to colony congestion. Congestion can be relieved by: reversing boxes, adding boxes, dividing colonies, and using young queens” (Mussen, p.18, 1987). A great bonus is in the labor savings associated with super manipulation over fewer hive visits/disturbances. Increased colony survival rates are attributable to the vertical construction of Langstroth hives. These are all benefits endemic to use of the Langstroth system.

Langstroth hives come apart and can weigh much less than a traditional hive when fully capped. Standardization of equipment quickly becomes a major benefit when contrasted to the inability of a producer to attain greater expansion over the long-term and collect more honey due to lack of adequate bee space and queen exclusion. Separation of honey supers from the brood makes extraction a much more likely proposition. Langstroth hives can produce more than three times the amount of honey per year with proper manipulation, and as only honey combs are removed and extracted, better product quality is insured, thus receiving a higher market price.

Standardization is initially more expensive, but allows for much improved management techniques, resulting in drastic improvements in both quantitative and qualitative aspects of apiary productive health and cost effectiveness. According to The Hive and the Honey Bee, “The construction…offers complete control of the combs which are the heart of beekeeping. It is
also sufficiently large to reduce crowding, minimize swarming, accommodate a prolific queen and her brood, and store two foods - pollen and honey” (Dadant, p.541, 1988). Beekeepers should be particularly concerned with standardization and interchangeability of hive components, so that both brood and supering areas will consist of nothing but hive body depth, with a uniform amount of bee space throughout the hive. A “queen excluder” (perforated metal screen) located mid-hive, prevents the queen from venturing throughout the entire hive to lay eggs, allowing only worker bees to access the entire hive, thus packing away excess honey in the upper combs.

Surplus frames located above the brood in mid-depth supers, containing pure comb honey are removed from the hive once filled. Wax cappings on the aggregation of comb cells are cut off with a heated “uncapping” knife (figure 3.6), and the honey is centrifuged out of the comb in an extractor. The empty frames are then returned to the colony with comb intact to be refilled and recapped by the colony.

This enhances honey production as the bees do not have to construct new comb. The combs are securely attached to wooden frames and less care is needed when removing and inspecting comb, and the colonies can be transported with relatively little disturbance. In the long-term, this permits migratory beekeeping, with the moving of colonies, to take advantage of nectar flows in different geographic locations and seasons. Space in the hive can be increased in a vertical plane by adding supers; where in contrast, a traditional hive has a maximum of 20 deep frames on a horizontal plane. The natural tendency of the bees to expand in an upward direction, particularly in the presence of heavy pollen flows, is enhanced by Langstroth technology. Furthermore, Langstroth hives can be easily used to produce pollen or for the mass rearing of queens.

In areas of the world where the beekeeping industry is well developed and utilizing high technology methodology, markets for products such as propolis, pollen, queens, and bee venom,
develop. While these are products derived from an apicultural enterprise, they are not generally associated with part-time beekeeping. A beginning project in its early stages does not produce in sufficient quantity to merit seeking an international market (for which no official world commodity exchange exists). Ready international markets exist for highly specified apicultural products, but any development effort should focus on local markets first. Developing a local apicultural economy insulates local producers from fluctuating world prices and provides an accessible market for entry-level producers.

Another marketing product associated with this system is in bee colonies themselves. Once a village-level apicultural economy becomes established, a market for qualities with particular genetic qualities quickly develops. More experienced producers can supply colonies and queens to new beekeepers, creating a cyclical dynamic for apicultural inputs, access to high technology, information, and education.

Future income is more secure due to excess hive capacity and the subsequent bee numbers to effectively render pollination services. Opportunity cost exists with regard to greater agro-economic yield potential where pollination services and output are connected. Unfortunately, the economies of scale from a part-time beekeeping operation do not lend feasibility to large pollination services. Regardless of scale, Langstroth technology is a prerequisite for hopes of increasing pollination on either the home-plot or macro-village economy.

Efficiencies gained from more intensive management practices in accounting and record-keeping endemic of the Langstroth hive are a substantial long-term intangible benefit. Another benefit is the ability of part-time beekeepers to expand as they wish, constructing or purchasing hives at their leisure. Ultimately, an opportunity cost lies in the inability of the producer to actively engage a large producer cooperative as a part-time beekeeper.
3.3.2.4 Incremental Variable Costs

Incremental variable costs are the sum of sugar, labor, transportation, queens, and hive/comb repair in section 3.2.

3.3.2.5 Incremental Fixed Costs

Incremental fixed costs are the sum of bees and woodenwares. Packaged bee colonies cost $30 (US) per new colony (appendix 2.8). Total woodenware costs for one Langstroth starter hive equals $60.96 (table 3.3.2).

**TABLE 3.3.2:** Woodenware requirements for one Langstroth starter hive.

<table>
<thead>
<tr>
<th>Parts</th>
<th>Dimension</th>
<th>Quantity</th>
<th>Approximate Board Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-depth super (9 frames)</td>
<td>appendix 3.5</td>
<td>2</td>
<td>28.18</td>
</tr>
<tr>
<td>Shallow-depth super (9 frames)</td>
<td>appendix 3.5</td>
<td>2</td>
<td>17.42</td>
</tr>
<tr>
<td>Bottom board</td>
<td>2 x 16 ¼ x 19 7/8</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Inner cover</td>
<td>¾ x 16 ¼ x 19 7/8</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>51.1</strong></td>
</tr>
</tbody>
</table>

**Total Cost**

- Wood $32.19
- Beeswax $25.20
- Bee Wire $3.30
- **Total Cost** $60.69

**SOURCE:** Sieling, Bee Hive Construction, 1999: 4.

Wood and associated production costs are calculated in price per board feet (BF). A board foot is the unit of measure for logs and lumber, where one unit is equivalent to a piece of wood 1 inch thick, 12 inches wide, and 12 inches long (ft²=BF). 150m² of wood is purchased at $3/m²; thus, $3/10.76 ft²/1m² equals $.28/BF. Labor equals $2.08/hour; 6 hives can be constructed by 1 worker/hour; thus, $2.08/6 hives equals $.35. The sum of $.28/BF and $.35/BF equals $.63/BF. $.63/BF multiplied by 51.1BF equals $32.19 for the total wood cost of one Langstroth hive.

Beeswax and associated costs are calculated by considering that traditional hives require 20 full-depth (8 ½” X 16 ¾”) beeswax forms/colony. As listed on the Betterbee website, 175 full-depth unwired brood sheets at $129 makes the unit cost $.74/beeswax form. Labor costs are calculated with 20 full-depth frames being constructed by 1 worker/hour (3 minutes/frame)
where $2.08/20$ frames equals $.10/frame. The sum of $.74$ and $.10$ equals $.84$ per beeswax form. $.84$/form multiplied by 30 forms equals a total beeswax cost of $25.20$ per traditional hive.

Bee wire and associated costs, also listed on the Betterbee website, are calculated by considering that bee’s wire costs $.01$ per foot. One full-depth frame hive requires 5 feet of bee’s wire. Labor costs are calculated at $.10$/full-depth frame. The sum of $.01$ and $.10$ equals $.11$/full-depth frame. $.11$ times 30 full-depth frames in a traditional hive equals a total bee’s wire cost of $3.30$/hive.

Higher initial costs exist with the implementation of Langstroth hive technology. Higher initial costs and the subsequent risk involved with the protection of assets exist; but the payback period for investment in one hive lies somewhere near the beginning of the second season’s initial honey flow production. Langstroth hive technology is not only beneficial in financial terms, as seen from the previous tables, but appears to be even more so when intangible benefits are considered.

3.3.2.6 Intangible Costs

However, there are disadvantages associated with this type of movable-frame technology system. The Langstroth system requires standardization of woodenwares, thus expertise in carpentry is necessary to build the hives. For their optimum return, they require the use of comb foundation and a honey extractor, both relatively expensive items. The system’s optimal utilization depends heavily on access to inputs, technical information, and experience level of the beekeeper performing the hive manipulation.

Beekeeping projects on all scales can be started with Langstroth hives. Thus, these types of projects require follow-up inputs and technical assistance. Without these dynamics in play, a situation can result where a relatively high investment made in equipment allows for a greater return, but inefficiencies in educational mechanisms keep producers from realizing the system’s
true potential. The silver-lining lies in the beekeeper’s ability to incrementally acquire pertinent technical information and the system’s flexibility to counter those efforts in kind with increased productivity.

However, less-expensive, traditional technology systems might prove more efficient in the short-term than a direct transfer of high technology due to lack of available inputs and market structures outside the village economy. In essence, this is the utilization of appropriate technology for subsistence beekeeping. Such an alternative generally does not allow for long-term growth. But this is a mute point if village producers do not have concurrent access to appropriate hive, apiary, business, and organizational management techniques.

Employment of Langstroth hive technology offers an inexpensive leap for those who wish to make the transition from subsistence to production apiculture. This system provides for the economic and technical shortcomings of a small-scale development site, while still allowing the users to employ the most current beekeeping knowledge gained from an extension education program. “Advanced” technology is a relative term, when movable-frame hardware components of production apiculture are contrasted with the technological innovations endemic to the green revolution: the largely mechanized, petroleum-dependent advances which transformed both traditional agriculture and rural society. To reiterate, all the physical inputs needed for movable-frame hive technologies can be produced in carpentry, tailoring, and metal-smithing shops at the local level. Most inputs are found in the local forests or produced by the colony. According to Bee Hive Construction, “The bees don’t care what kind of lumber you use for the hive. I consider the following in choosing wood: cheap, easy to nail, stable, light weight and if possible, rot resistant” (Sieling, p. 7, 1999).
TABLE 3.3.3: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), for one would-be part-time project participant employing Langstroth technology over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental Income</th>
<th>Incremental Costs</th>
<th>Net Income (Loss)</th>
<th>Discounted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Total Value of Honey Production)</td>
<td>Incremental Variable Costs</td>
<td>Incremental Fixed Costs</td>
<td>Total Incremental Costs</td>
</tr>
<tr>
<td>1</td>
<td>$129.00</td>
<td>$18.00</td>
<td>$127.38</td>
<td>$145.38</td>
</tr>
<tr>
<td>2</td>
<td>$258.00</td>
<td>$48.14</td>
<td>$127.38</td>
<td>$175.52</td>
</tr>
<tr>
<td>3</td>
<td>$516.00</td>
<td>$96.28</td>
<td>$362.78</td>
<td>$459.06</td>
</tr>
<tr>
<td>4</td>
<td>$1,032.00</td>
<td>$207.55</td>
<td>$725.52</td>
<td>$960.07</td>
</tr>
<tr>
<td>5</td>
<td>$1,290.00</td>
<td>$292.10</td>
<td>$362.76</td>
<td>$654.86</td>
</tr>
<tr>
<td>6-20</td>
<td>$1,290.00a</td>
<td>$426.38a</td>
<td>$0.00a</td>
<td>$426.38a</td>
</tr>
<tr>
<td>Total</td>
<td>$22,575.00</td>
<td>$7,057.77</td>
<td>$1,705.82</td>
<td>$8,790.59</td>
</tr>
</tbody>
</table>

Net present worth at 12 percent = $3,874.28


Note: a: annual amount for years 5 through 20 inclusive; b: present worth of an annuity factor for years 5 through 20 inclusive; present worth rounded to nearest dollar.

TABLE 3.3.4: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), from one Langstroth hive over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental Income</th>
<th>Incremental Costs</th>
<th>Net Income (Loss)</th>
<th>Discounted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Total Value of Honey Production)</td>
<td>Incremental Variable Costs</td>
<td>Incremental Fixed Cost</td>
<td>Total Incremental Costs</td>
</tr>
<tr>
<td>1</td>
<td>$64.50</td>
<td>$9.00</td>
<td>$90.69</td>
<td>$99.96</td>
</tr>
<tr>
<td>2</td>
<td>$64.50</td>
<td>$15.07</td>
<td>$0.00</td>
<td>$15.07</td>
</tr>
<tr>
<td>3</td>
<td>$64.50</td>
<td>$15.07</td>
<td>$0.00</td>
<td>$15.07</td>
</tr>
<tr>
<td>4</td>
<td>$64.50</td>
<td>$22.57</td>
<td>$0.00</td>
<td>$22.57</td>
</tr>
<tr>
<td>5</td>
<td>$64.50</td>
<td>$15.07</td>
<td>$0.00</td>
<td>$15.07</td>
</tr>
<tr>
<td>6-20</td>
<td>$64.50a</td>
<td>$17.57a</td>
<td>$0.00a</td>
<td>$17.57a</td>
</tr>
<tr>
<td>Total</td>
<td>$1,290.00</td>
<td>$340.33</td>
<td>$90.69</td>
<td>$431.29</td>
</tr>
</tbody>
</table>

Net present worth at 12 percent = $275.12


Note: a: annual amount for years 5 through 20 inclusive; b: present worth of an annuity factor for years 5 through 20 inclusive; present worth rounded to nearest dollar.

3.3.2.7 Risk

Risk is effectively neutralized with the implementation of the Langstroth hive technology. The largest risk factor is in the initial investment in woodenwares, at start-up almost twice the price of a traditional hive. Also, swarming is only hedged to the extent that the beekeeper adds supers when overcrowding in the hive is evident.
3.3.2.8 Aggregate Benefits and Costs

The use of Langstroth hives turns a profit sometime in the second year of production. The net present worth of one hive with a 20-year productive life is approximately $275 (table 3.3.4). All benefits and costs considered, Langstroth technology is a profitable venture for part-time Moldovan apicultural producers.

3.3.3 Sources of Data Used in the Research

The Peace Corps project “Apiculture for Rural Development” grant proposal (appendix 2.8) was used primarily to supply estimates for input and product pricing in the analysis; whereas the literature sources provided the appropriate models and calculations for the research.

3.3.3.1 Grant Proposal for Peace Corps Project “Apiculture for Rural Development”

Appendix 2.8 is the budget portion of a grant proposal for the project “Apiculture for Rural Development”, to the Peace Corps Moldova, Small Project Assistance (SPA) grant committee, and the Peace Corps Partnership Project (appendices 1.2 and 1.3). It was used in these analyses, price information of the cost components to be consistent with current values.

3.3.3.2 Literature

Three sources provided invaluable information for conducting this research, and also that found later in regard to project expansion and scale. Other citings are placed throughout the research as supporting documents for individual points; but, the sources emphasized here are the sources used to compile and formulate necessary data in performing the study.

3.3.3.2.1 *The Hive and the Honey Bee*

This Dadant & Sons (Hamilton, IL) book is one of, if not the best, reference book on honey bees and beekeeping. It has been revised many times and translated into numerous languages. It has 22 chapters, written by 33 world-famous authors, and includes a comprehensive history and description of the industry, hundreds of photos, drawings, charts, and diagrams. Special features in the most recent revision (1988) include a 52-page section on U.S.
and Canadian forage sources, updated Africanized honey bee information, parasite management, business practices, marketing, hive products, bee behavior, and pesticides.

“Langstroth on the Hive and the Honey-Bee, a Beekeeper’s Manual, was the title of the original book by the Reverend L.L. Langstroth in 1853. This practical treatise made available to the world his fundamental discovery of the bee space and his invention of the top-opening, moveable-frame hive which made modern beekeeping possible. More than a century [and a half] has passed since Langstroth’s discovery, but [the western] system of beekeeping still is based on his hive and methods.” (Graham, The Hive and the Honey Bee, p. v, 1988)

The book is cited extensively through the entirety of this research. For the particular purposes of this comparative analysis, page 732, with a “Sample budget for Beekeeping Operations of 3000 colonies” was utilized extensively. Not all the variables depicted in this example were appropriate for this research, and thus they were altered where necessary.

3.3.3.2.2 Economic Analysis of Agricultural Projects

This James Gittinger book, published by John Hopkins University Press (Baltimore, MD), for the Economic Development Institute of the World Bank, “was written to provide those responsible for agricultural investments in developing countries with sound analytical tools they can apply to estimate the income-generating potential of proposed projects.” (Gittinger, Economic Analysis of Agricultural Projects, p. v, 1982) It was used considerably in the analysis through its discussion of section 1.4.2, “Net Present Worth of Competing Technologies”, and in finding appropriate values for discount measures of project worth. Tables 9-9 and 9-10 (pages 326 and 328) were used as models for displaying computation of net present worth for this analysis.
3.3.3.2 Bee Hive Construction

This 1999, Garreson Publishing Company (Bath, NY), 23 page booklet written by Peter Sieling, describes how to make bee hives with only a table saw and dado blades. It thoroughly covers the various components necessary for construction of a Langstroth hive; bottom boards, shallow, medium and deep supers, inner covers, telescoping outer covers, and frames. Plans are included for a simple finger jointing jig. Also, the cost comparison on page 4 shows that making bee hives is a very effective way to save money. In this comparison, he breaks down the components of a Langstroth hive into board feet requirements. Also, deduced from this assessment is the board feet requirement for a traditional hive, component by component. According to a book review in Bee Culture, “This modest book has the perfect detail needed to easily construct equipment with exquisitely detailed drawings. Lots of woodworking hints and tips, and even some beekeeping advice.” (Bee Culture, October 2003)

3.3.4 Performance Criteria

Net present worth is used to display the disparity in profitability, or lack thereof, between traditional and Langstroth movable-frame hive systems, over a 20-year time period. Also taken into consideration is the payback period of the technology, meaning the timeframe for payback and the initial start-up cost. Opportunity cost to capital and labor are also considerations in determining if hives should be built, traditional or Langstroth. The positive number found in the tables 3.3 series will be used for a scale analysis later in this sub-chapter 3.6, “Additional Considerations”.

51
3.4 SUMMARY

Movable-frame hive systems are relatively complicated. Many advantages exist over subsistence “beekeeping” enterprises. The major disadvantages of movable-frame systems are made obvious when subsequent education components are misapplied, even to an appropriate technology. Movable-frame hive systems, with woodenware as chief input, require expertise in carpentry to build, as well as a combination of theoretical knowledge and practical experience to attaining optimum yields. A fine-tuned education component is vital to the success of a project utilizing technology-transfer. Thus, section 3.4 considers constraints to the educational component, specific to development initiatives in Moldova.
CHAPTER 4
CONSIDERATION OF REQUIRED SUPPORT MECHANISMS

4.1 EDUCATIONAL COMPONENT CONSIDERATIONS

When matched with the information from Chapter 2, Moldova has an appropriate environment for use of Cooperative Extension methodology as an educational component for this type of project, in a highly literate workforce with previous experience in utilization of advanced technology, particularly with movable-frame hive systems in Soviet state apiaries. Two fundamental doctrines of Cooperative Extension work have been supported through the years. First, the mission is to "make science useful". Cooperative Extension believes in the potential value of science and research to improve peoples' lives. Second, Cooperative Extension is based on the needs of people in communities and counties. Cooperative extension brings people together in local communities to solve local problems. One of the great stories in American education is the story of the development of Cooperative Extension at land-grant colleges and universities. The Smith-Lever Act provided individual states with federal funds to carry on Cooperative Extension work as agreed upon by their respective colleges and Universities and the federal government. Since its nationalization under this act, Cooperative Extension work has engaged faculty, students and community members throughout the country in educational activities aimed at developing peoples’ ability to contribute to the political, economic, and cultural lives of their communities.

Ideally, appropriate technology and Extension programming are employed in conjunction with each other in order to better maximize the productivity of village resources. A common limiting factor in beekeeping enterprises is typically the inability of producers to profitably utilize relatively expensive equipment. But, traditional Cooperative Extension programs can help in this matter. As stated by First Monday Newsletter: ADRA Network Journal,
“Cooperative extension has a long history of working well in these types of situations. [Beekeeping] is not difficult to learn and well suited to the basic components of traditional agricultural extension” (Jump, 2003). Necessity dictates examination of possible constraints to Extension activities in Moldova, as compared to those found in other area of the world. As displayed in Education through Cooperative Extension, some of the following 10 constraints are shared by extension the world over, while others are endemic to areas generally identified in the “third world” (Severs, Education through Cooperative Extension, p. 217, 1997).

4.1.1 Poorly trained, poorly paid personnel who lack transportation.

Since beekeeping is not difficult to learn, as long as the change-agent has access to correct and pertinent information applicable to Moldovan producers, the impartation of knowledge does not face any enormous constraints in regard to training. As displayed in Chapter 2, Moldova producers have a history of working with movable-frame production apiculture. Furthermore, many of the former apiary laborers, who have since gravitated away from beekeeping due to financial restraints or lack of inputs, still retain knowledge of the trade, and could be reintroduced to apiculture with the help of an appropriate training structure.

Poor pay is a different matter entirely. Poverty breeds corruption, and Moldova, as the poorest country in Europe, is not exempt from this phenomenon. Moldova generally operates under a barter economy. Moldovans are used to bribing others to get what they need out of necessity, typically in cash. Bribing is an old tradition; a vestige of the Soviet era, it has become second nature. Yet, a well compensated director/employee, who realizes the benefits of a constant paycheck (say $30.00/month), and recognizes the virtue in their labor, will remain overzealously “loyal” to the ideals of the project, barring the corruption endemic to poorly planned organizational structure in support of the educational component
Transportation issues are not a constraint to the educational component at the village level, as Moldova was once part of the Soviet Union and a relatively modern infrastructure still exists. Where cars and transports are not available, horse-carts and bicycles pick up the slack. Moldova has the highest population density of all the former Soviet Republics, and a person is rarely 15 km from a village. Most of the beehives are to be placed on home-plots, near the beekeepers’ homes, thus decreasing need for an automobile and its related expenses.

4.1.2 Regulatory and input-dispensing duties that impinge on time spent on educational programming.

As only a few administrators are afforded in a small project scenario, duties other than those directly associated with an educational component, such as regulatory and input-dispensing duties may be a fact of life. As beekeeping is an inherently labor intensive undertaking, efficient utilization of both the hardware and labor (management) go hand-in-hand. A cyclical pattern exists, where as colonies grow, so does the need for inputs and pertinent information. Thus, a project director (as change agent) would wear many hats, and yet not necessarily disrupting the effectiveness of the educational component. Time spent dispensing inputs or regulating supporting structures is complementary to recommending proper utilization of an introduced technology, and vital to the overall education component. Beekeeping entails the use of such simple technology that producers can quickly adapt their knowledge base with newly acquired information, creating a learn-learn environment between themselves and the change agent, constantly striving to improve productivity and efficiency of both individual apiaries and the overall educational component.

4.1.3 Advice is poorly timed.

Poor timing is very subjective and site-specific depending on the experience of the extension agent and producer. Due to the small-scale of the project, ill-timed advice will not sink the entire project. Mistakes are part of human nature, and much of the experiential learning
process entails overcoming one's own limitations. Thus, if the action put in place by poor and/or ill-timed advice is not fatal to the entire apiary, in all likelihood the colony will still be able to recover and still produce at an adequate level. It is simply a matter of optimization of output where the determination of “poor timing” is relevant. Attention to bee cycles throughout a season is critical to productivity; hence, effective timing of advice needs the highest level of consideration.

4.1.4 Illiterate clientele.

As previously stated in Chapter 2, Moldova has a 99 percent literacy rate. During the Soviet era, the highest priority was placed on education, and all citizens were required to go to school. Most Moldovans speak at least two languages (Romanian and Russian; maybe French, English or German), and both Romania and Russia have beekeeping publications with relevant information to the region’s apicultural setting. As previously stated, Moldovan producers are generally very adaptive to movable-frame hive technology from their time spent working in state apiaries. Complex diagrams, charts, graphs, statistics, reading materials, for transfer of abstract programming content should not prove problematic. Thus, illiteracy is not a major constraint to an educational component.

4.1.5 Counter-productive government policies, wars, drought, civil unrest, and need for land reform.

Moldova does not have many laws that apply to apiculture. Beekeeping is in essence an unregulated enterprise. Simple regulations in regard to health or production standards have not been implemented to any degree. Furthermore, the nature of the barter economy makes taxation an unlikely proposition anytime in the near future. This actually hurts Moldovan producers on a larger scale as few incentives exist for producers develop products that compete with the value-added goods found in neighboring countries. Thus, Moldovan producers generally produce for the bulk market; selling in bulk to international sellers, where the “crude” products are sold in
bulk, to be refined abroad. But for small-scale projects, this is generally a mute point as most products are produced for the barter economy in-country: thus it is not a major constraint to an educational component.

Since independence, the government has been quite explicit about market reforms in most sectors of the economy. Land is not a major requirement for a successful apicultural development project; therefore land reform would only be relevant if it came to an issue of what crops to produce in trying to establish new forage for bees in privatized land. Again, government regulations are not a problem for the educational component.

Like all agricultural enterprises, the weather does play a part in the effectiveness of extension. Irrigation is very uncommon in Moldova, and drought can be problematic for available forage. This hinders the educational component when viewed from a broad scope of overall project productivity, but the Langstroth system and other technological advances will still prove superior even in adverse climactic conditions, just as the weather would affect any agricultural enterprise. Weather is not an explicit concern in regard to the educational component.

In 1992, Moldova fought a short, post-independence civil war with the now autonomous, self-proclaimed Soviet Socialist Republic of Transnistria. The belligerent region gained autonomy after "peace-keepers" from the Russian 14th Army were redeployed there. This region, lying outside of historic Bessarabia, holds most of Moldova’s industrial capacity, and therefore hinders agricultural development to a broad degree: in controlling the capacity to add value to raw foodstuffs produced in the rest of the Republic. This conflict is still a contentious issue for the west, and access to Transnistria is generally off limits to Americans, hindering any international development projects via funding from outside sources other than those derived from CIS (Commonwealth of Independent States) countries. But the Transnistria problem is one
endemic to larger national concerns, and not those viewed from the standpoint of the educational component for apicultural projects.

4.1.6 Social and cultural factors that make female audiences difficult to reach.

Beekeeping is generally a male trade in the former USSR, but that has not stopped women from trying. The Soviet Union did not enforce a division of labor. Men and women are encouraged to participate equally in many trades that are not traditionally available to both genders in the west. Social and cultural factors involving women are not a constraining to an education component.

4.1.7 Lack of monitoring and evaluation.

These are huge constraints. Moldovans are very suspect of any type of “monitoring”. They still negatively stigmatize paperwork, surveys, inquiries, etc. as something from the Soviet era. They do not understand that much of this is as or more necessary to the success of the enterprise as the act of beekeeping itself. Extension agents will find it very hard to find accurate information on production and marketing, until it is made entirely obvious to everyone, that this is for their own benefit.

4.1.8 Poor selection of local leadership.

Poor selection of local leadership is not so much a constraint attributable to an educational component, as it is directly to the structural integrity of the supporting institution’s infrastructure. Supporting infrastructure needs to be structured quite differently from those of the past; monitoring controls used in the structure of cooperatives would provide the transparency needed to increase leadership’s accountability to the ideals of their respective organizations. Organizations should not be formed around the needs of one producer, but instead, for those all who use its services. Some Moldovan organizations exist quite randomly, without the necessary checks and balances to ensure equitable distribution of goods and services to all their members. The cost of poor leadership is sometimes necessary, effectively
forcing/teaching the members exercise their organizational voting power, and gravitating towards those with enough integrity for the position. The catch exists in the initial structuring of the organization to allow for the existence of democratic mechanisms. Without adequate infrastructural mechanisms, leadership will ultimately fail, as will the educational component of the associated group. Selection of local leadership, if poor, will surely stifle development initiatives in the short-term.

Moldova is a small country, with a very close knit NGO/funding community, where expatriates and nationals alike share information, and discuss the credibility of given individuals, even in the remotest of villages. Ideally, long-term competition at the national-level, between trustworthy organizations, will not only draw, but dictate credible leadership. As time passes, cooperative extension’s role as an educational component would only strengthen these initiatives, forcing organizations to effectively sink or swim on their credibility, in regards to their ability to access services from both the national-level and abroad.

4.1.9 Advice that is not research based.

A deficiency in access to affordable materials, lack of standardization, out of date information, and a shortage of colonies and queens are the largest problems identified by Moldovan beekeepers. Sound advice, based on research in country and abroad, would help alleviate many of these problem areas. This speaks to the necessity of both a sound educational component and complementary supporting institutional infrastructure. An educational component would not be hindered by, but instead supplant unsound advice. Poor advice would ultimately undermine project profitability; thus, dynamics within the educational component would need to identify unsound research and address it. Moldovan producers are use to a downward flow of information: a vestige of the Soviet era. A combination of good local leadership and research based advice would be critical to project success. As many local
beekeepers already posses some knowledge of movable-frame hives, it is of great advantage to
the education component to be promoting a similar system.

4.1.10 Environmental concerns.

Environmental concern is virtually synonymous with the stereotype of all former Soviet
Republics. Past over-application of agro-chemicals and fertilizers at state and collective farms
had large effects on apicultural enterprises due to synonymous bee kill; but agricultural inputs
are relatively expensive, and no longer used by most producers, thus no longer a constraint to
apicultural activities or their associated education components.

4.2 INSTITUTIONAL INFRASTRUCTURE CONSIDERATIONS

Section 2:10:1 displays the traits of the two organizations used in this consideration of
institutional infrastructure: producer cooperatives and associations. The following two sections
(3.5.1 and 3.5.2) display examples of current technology-transfer development initiatives found
in Moldova. The first is displayed in the organizational structure of a producer cooperative,
using introduced technology in a hive manufacturing program; the second, an association using
construction of traditional hive technology as a component in a rural development project. Both
have educational components drawing from traditional Cooperative Extension methodology. A
brief comparative analysis, displaying the disparity between producer cooperatives and
associations, follows the next two sections.

4.2.1 Mindria Albinii Beekeepers Cooperative

The following is a summary of organizational structure and projects initiated by the
organization.

4.2.1.1 Organization Information

Mindria Albinii Beekeepers Cooperative (MABC) was founded in 1999 as a limited
liability company; and later, in 2002, as a business cooperative (appendix 2.1), with the help of
an American NGO, Citizens Network for Foreign Affairs (CNFA). CNFA has a program that works with small-scale farmers to establish member-owned cooperatives that pool resources, provide know-how, and increase market access to producers (appendix 2.4). This example is displayed utilizing relatively large-scale beekeepers, with considerable experience and knowledge based on traditional apicultural practices:

The cooperative recruits beekeepers that own at least 40 bee-families and are interested in [the] cooperative’s services. The applicant has to agree with paying the membership fee of [$35 (US)]. Another important requirement considered by the board is personal openness and willingness to participate in cooperatives ventures (Brinza, MABC Beekeepers Cooperative Information, p.1, 2003).

4.2.1.2 Site History

The small city of Caușeni, a former state apiary site, has a population of approximately 20,000 and is located 120 km southeast of Chișinău (figure 2.2). A few years ago the members of the current cooperative were storing honey for months at a time, until they could find an adequate market outlet. At that time, there was no mechanism in place to guarantee producers against unfair treatment. As a result of collaboration with CNFA volunteers, MABC products are now sold on a regular basis throughout the country and abroad, bringing a stable and reliable income to the cooperative members.

4.2.1.3 Objectives

Five objectives are stated as follows: “[to] create favorable conditions for the beekeeping business; source new honey marketing opportunities; reduce the risk and cost of selling honey for cash on domestic and international markets; maintain a quality product; and protect the image of the MABC label” (Brinza, MABC Beekeepers Cooperative Information, p.1, 2003).
4.2.1.4 Deliverables

Deliverables are defined here as the tangible items or products that the member can expect the organization to provide. Short-term deliverables refer generally to the services a producer can realistically expect from the organization upon recognition of full membership. Long-term deliverables refer to what services are planned for the future as the organization expands.

4.2.1.4.1 Short-term

Consultation, training, exchange of information for members; render marketing services (filtering, packaging, selling), represent members’ interests before local government officials, acquire quality affordable inputs, and help members gain access to updated hive technology and credit.

4.2.1.4.2 Long-term

Expand into new markets, increase in sales, establish a domestic distribution network resulting in higher sales volumes, launching of marketing initiatives, establish a good and reliable suppliers for packaging materials (jars, lids, etc.), purchase an advanced bottling line, and run at full-capacity the hive manufacturing program. MABC attained sales activity in 2001 (first-year) in excess of $9,000; 2002 sales doubled in excess of $18,000; and $23,000 in 2003 (Brinza, MABC Beekeepers Cooperative Information, p.1, 2003).

4.2.1.5 Project Introduction

MABC developed a manufacturing and sales program, utilizing a direct transfer approach, of a new hive technology to cooperative members. Realizing that the traditional beekeeping practices used by most Moldovan beekeepers are not likely to satisfy the long-term demand of the market, MABC decided to manufacture Langstroth hives and sell them to the members. By helping members gradually replace old and inefficient Soviet equipment, the cooperative is increased the likelihood of more production and the opportunity to fill larger
supply contracts. MABC members raised the capital and financed the new enterprise out of their own funds.

Volunteer Cesar Flores, a Colorado beekeeper, worked with MABC on the details of the “Hive Manufacturing Program” and recommended the Board consider organizing member production training to complement new production technologies. The cooperative acted quickly and in February 2003 set up a demonstrational bee farm, where anyone interested in beekeeping could monitor the performance of the new technologies up close and first hand:

Langstroth hives are proving very popular...the cooperative generated Lei 8,868 ($610 (US)) in hive sales and has several large orders placed for the coming months. New bee farm management practices...were put to the test in the winter of 2002-2003. The effects of the cold weather were compounded with the old equipment and outdated management practices, and many Moldovan beekeepers lost their entire hives. In contrast to the rest of the country, MABC members’ bees survival rate was 98% (Brinza, MABC Beekeepers Cooperative Information, p.1, 2003).

4.2.1.6 Beneficiaries

Beneficiaries or stakeholders are defined here as individuals, groups or organisations who, in their own view and whether targeted or not, benefit directly or indirectly from the development intervention. Direct beneficiaries are listed as 30 member beekeepers of the MABC cooperative and 54 non-member independent honey suppliers (CNFA, 2003). Also, at the community-level are those who benefit from the micro-enterprise associated with the production of inputs. Indirect beneficiaries are area producers who gain from increased pollination of orchards and crops, family members of households with active cooperative membership, those to be affected by organization expansion programs in the future.
4.2.2 Beekeepers’ Association of the Republic of Moldova

4.2.2.1 Organization Information

The Beekeepers Association of the Republic of Moldova was founded in 1998 under the direction of current director Petru Arhip. The purpose of this Association is to propagate and popularize knowledge and expertise in modern beekeeping and to contribute to the development and promotion of beekeeping as a science through the application of modern technology and members’ collective experience. It is an NGO, founded through the initiative of several Moldovan beekeepers and dedicated to revitalizing enterprises throughout the country (appendix 2.9).

In accordance to Moldovan law, the Beekeepers’ Association management body consists of an assembly, a nine-person board, and a five-person union presidium (appendix 2.9). Association membership is comprised of 60 people. Most members have 12-20 years experience in beekeeping and each owns 70-160 bee families. In autumn 1999, four members of the association participated in a 4-week long internship at beekeeping associations and organizations in Romania, Bulgaria and Hungary. This internship was organized and financed by, Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance (ACDI/VOCA) (appendix 2.3), and represented a useful exchange of professional experience among private individuals and associations. Furthermore, during the summer of 1997, the association director, was involved in a 4-month long training course held in St. Charles, Michigan. Past Association activities include: seminars and workshops, implementation of a project to build a storehouse for storing and packing with support of ACDI/VOCA, and annual cooperation with scholars and interns from the State Beekeeping School.
4.2.2.2 Site History

The village of Sadova, located near a former Soviet state apiary site, has a population of 5,500, and is located approximately 50 kilometers northwest of Chișinău (figure 2.2). According to the village mayor’s office, in 1989-1992 the community hosted between 2,300 and 2,500 bee colonies, which pollinated the area’s orchards and cropland (appendix 2.6). After the collapse of the Soviet Union, Sadova saw a dramatic decline in bee populations of almost 80 percent dropping to 500 colonies.

A project first conceptualized in 1998 as a cooperative effort between the Beekeepers’ Association and ACDI/VOCA was implemented to Cooperative Extension services specific to beekeepers, and established both a product collection point and woodenwares workshop. The emphasis was on introducing villagers to beekeeping information and technology. Fire devastated that project in April 2002 and the catastrophe ended ACDI/VOCA’s involvement in the project.

Peace Corps accepted the site in May 2002 and placed a volunteer with the Beekeepers’ Association. A needs assessment survey was administered to association members and the results deemed favorable for the project, as the community contributions to the project were also adequate (appendix 2.8). The Beekeepers’ Association accumulated a list of potential participants to attended seminars beginning in February 2003; and contracted active participation from the State Beekeeping School to provide pseudo-extension style services and establish some infrastructure in facilitating information exchange between seminar participants, students and faculty, and member beekeepers (appendix 2.7).

Needs assessment surveys emphasized the desire of both the Beekeepers’ Association and community members in the host-village of Sadova, to create a project providing infrastructure theoretical knowledge and practical skills for new beekeepers. The association decided to focus on implementation of a pilot-project as a template for village-level expansion
and subsequently a mechanism to increase national membership. The village sought the creation of a viable marketplace for the exchange apicultural information, honey, wax, and hives, and thus expanded agro-economic activity. The project “Apiculture for Rural Development” was initiated to mesh these needs by utilizing resources from the village, a national organization, and the NGO sector. With Peace Corps guidance and the utilization of traditional cooperative extension methodology, an attempt was made to cultivate new beekeepers within the community and establish a sustainable beekeeping economy (appendix 1.1).

After the needs assessment information was compiled, the association looked toward funding from Peace Corps administered sources in establishment of an appropriately-scaled program emphasizing the efficient employment of traditional beekeeping technology and extension programs for the project education component. At the time, scarce attention was paid to the type of technology which was to be employed.

Two funding sources were utilized: first, the SPA Program (appendices 1.2 and 1.4), which gives grants to a maximum of $5,000 from an in-country committee made up of fellow volunteers; and secondly, the Partnership Program (appendix 1.3), matching donations from America to needy volunteer projects worldwide via the official Peace Corps website (figure 3.7). SPA funds could be used for any expenses related to the project, except those administered outside of Moldova, which Partnership funds could cover. With financial assistance from these sources the project commenced in February 2003 with a total budget of $9733 (appendix 2.8).
4.2.2.3 Objectives

Five objectives are stated by the association: to consider new problems; represent and support the interests of members at the legislative level; regularly inform members about the most applicable and useful achievements in apiculture; offer members a wide variety of qualified apiary products; and establish connections with similar organizations domestically and abroad.

4.2.2.4 Deliverables

The definition of deliverables is defined here the same as in the previous example of an institutional structure.
4.2.2.4.1 Short-term

Develop villagers’ theoretical knowledge of apiculture and practical skills in beekeeping. Train association members in organizing seminars for promotion of project expansion. Engage students from the State Beekeeping School through internships. Increase both the number of part-time beekeepers and association members in the village. Complete construction of a structure for training purposes, product collection, and formation of a woodenware shop.

4.2.2.4.2 Long-term

A more active beekeeping community in Sadova will deliver greater economies of scale for the product collection point. Selling in bulk, particularly to markets in Chisinau, will provide improved market access for Sadova’s beekeepers. In turn, this activity will increase association buying power for beekeeping supplies such as wax forms, wood, wire, and medications. The product collection point will become an effective medium of information exchange, primarily through dispersal of technical knowledge and market prices.

4.2.2.5 Project Information

Providing the village with a training location, product collection point, and woodenware shop was explicit. Beekeeping seminars and literature provided the participants with theoretical knowledge. Complete hives and starter kits were distributed among project participants and placed at their residence. During seminars, trainees had full support of the association in monitoring the productivity of their colonies. The establishment of the woodenware shop provided the production of traditional hives and frames. The ability of the association to provide hives to the community was of utmost importance. The product collection point was established and provided a market for honey and wax, and a means for information exchange.
4.2.2.6 Beneficiaries

The term beneficiaries is used here the same as in the previous example. Direct beneficiaries are listed as 60 association members and the area’s non-member honey suppliers, 20 seminar participants, 25 students from the State Beekeeping School who perform internships, and those within the community who will benefit from micro-enterprise associated with the production of inputs. Indirect beneficiaries are area producers who gain from increased pollination of orchards and crops, family members of household with an active association or seminar participant, and those affected by project expansion in the future.

4.2.3 Comparative Analysis

MABC and the Beekeepers’ Association of the Republic of Moldova are two similar organizations which promote the development of apicultural enterprise in Moldova; but there are many differences in their basic structure, and thus how they function. MABC has a much more developed, transparent organizational structure: actively engaged with the outside assistance of CNFA and a program which deals specifically with new enterprise development. Conversely, the Beekeepers’ Association utilized ACDI/VOCA for initial guidance, but did not continue to nurture the linkage with outside organizations and/or developing appropriate governing mechanisms within its organizational structure. Now, the future direction of the Beekeepers’ Association, at least technically speaking, is at the discretion of the director without much argument. MABC is engaged with its members in many profitable, equitable undertakings. The current situation at the Beekeepers’ Association is neither equitable for the members nor healthy for any further project development. Much of the discrepancy between the structure of an association and a cooperative comes from the legislative requirements of the national government in forming these organizations.
MABC promotes Langstroth technology as the template for its hive manufacturing program; whereas, The Beekeeper’s Association uses the unprofitable traditional hive for its rural development project. Without use of a profitable hive system in any venture, membership retention will be next to impossible as beekeepers continually struggle to find an incentive to participate in a money losing venture. As the Beekeepers’ Association is not sustainable, the resources used in project implementation would have been better spent elsewhere. The Beekeepers’ Association’s opaque structure fails its members by not allowing them a voice in organizational decision making. The Beekeepers’ Association’s leadership based the project “Apiculture for Rural Development” on unsustainable hive technology.

4.3 ADDITIONAL CONSIDERATIONS

The question of greater expansion, profitability, and vertical integration all transcend the discussion of one particular area of analysis or consideration.

4.3.1 Expansion

Economies of scale are present in apiculture enterprises effectively utilizing movable-frame hive systems; fixed costs in the brood and initial movable-frames become more efficient as more hives are added to an apiary. Interchangeable hive bodies and movable frames make more advanced management schemes possible, increasing the efficiency of the resources in a given apiary. Surrounding vegetation (crops and trees) benefit from increased pollination from the larger bee populations associated with larger apiaries. Large honey producers in the United States can tend and process hundreds of hives annually by employing transportation and mechanization of frame and honey processing, and management practices; but more importantly, the ability to tend an ever increasing number of hives per apiary visit. Basic beekeeping methodology is generally the same regardless of the number of hives in an apiary. Once new knowledge is internalized, over time the individual producer finds where their opportunity cost to
labor lies in relation to expansion or devoting more time to an additional number of hives. A conceptual saturation point exists, where one producer’s ability to effectively tend hives is overcome by one additional hive, reducing the efficiency of all other hives. The following analysis does not attempt to find the saturation point; but instead, displays some of the characteristics of a more expansive apicultural operation. The analysis is performed with the explicit goal of observing the budgetary changes which take place in a more intense expansive production timeframe.

**TABLE 4.3.1:** Value of incremental income from honey production, and incremental costs (fixed and variable), for one would be full-time project participant employing Langstroth technology over a 20-year period (US$)

<table>
<thead>
<tr>
<th>Item</th>
<th>Production Years</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Hives</td>
<td></td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Incremental Value of Honey Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield (kg/hive)</td>
<td></td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Price ($/kg)</td>
<td></td>
<td>$2.15</td>
<td>$2.15</td>
<td>$2.15</td>
<td>$2.15</td>
<td>$2.15</td>
<td>$2.15</td>
</tr>
<tr>
<td>Income (Gross Value of Production)</td>
<td></td>
<td>$430.00</td>
<td>$860.00</td>
<td>$1,720.00</td>
<td>$2,580.00</td>
<td>$3,440.00</td>
<td>$3,440.00</td>
</tr>
</tbody>
</table>

| Incremental Variable Costs               |                  |     |     |     |     |     |      |
| Sugar ($4/hive)                           |                  | $20.00 | $40.00 | $80.00 | $120.00 | $160.00 | $160.00 |
| Labor ($3.50/hive)                        |                  | $17.50 | $35.00 | $70.00 | $105.00 | $140.00 | $140.00 |
| Transport ($0.50/hive)                    |                  | $2.50 | $5.00 | $10.00 | $15.00 | $20.00 | $20.00 |
| Medication ($1.00/hive)                   |                  | $5.00 | $10.00 | $20.00 | $30.00 | $40.00 | $40.00 |
| Queens ($7.50/hive)(triennially)          |                  | $0.00 | $0.00 | $0.00 | $37.50 | $37.50 | $105.00 |
| Hive & Comb Repair (10% of new colony cost x # of hives > 1 year old) | | $0.00 | $49.31 | $98.61 | $197.22 | $295.83 | $394.44 |
| Incremental Variable Costs               |                  | $45.00 | $139.31 | $278.61 | $504.72 | $693.33 | $859.44 |

| Incremental Fixed Costs                  |                  |     |     |     |     |     |      |
| Bees ($30/hive)                           |                  | $150.00 | $150.00 | $300.00 | $300.00 | $300.00 | $0.00 |
| Woodenware, Wax, Bee Wire ($98.61/hive)   |                  | $493.05 | $493.05 | $986.10 | $986.10 | $986.10 | $0.00 |
| Incremental Fixed Costs                  |                  | $643.05 | $643.05 | $1,286.10 | $1,286.10 | $1,286.10 | $0.00 |

| Total Incremental Costs                   |                  | $688.05 | $782.36 | $1,564.71 | $1,790.82 | $1,979.43 | $859.44 |

| Net Income (Loss)                         |                  | ($258.05) | $77.64 | $155.29 | $789.18 | $1,460.57 | $2,580.56 |

4.3.1.1 Assumptions

This is a full-time beekeeper employing Langstroth hive technology on a more expansive scale. The total number of hives listed for this analysis are ordered as increasing incrementally from years 1 to 5 (5, 10, 20, 30, 40), then stabilizing at a total of 40 from years 6 thru 20.

4.3.1.2 Incremental Income

Honey yield is assumed at 40 kg per hive as a mid-production level for Langstroth technology. The Langstroth system typically produces more than 30 kg of honey per year due to the expanded capacity in this scenario. It is assumed that a full-time beekeeper would have the resources to better maximize the potential of the technology. The price is listed at $2.15 per kg, or wholesale maximum (appendix 3.4). Assumed sales prices at the wholesale maximum level are due to relatively good product quality endemic to use of Langstroth hives. Incremental income (gross value of production) is derived from price times yield listed in US dollars per kg per year.

4.3.1.3 Intangible Benefits

All the benefits of any movable-frame hive system are present in the Langstroth hive, as summarized in section 3.2. At this greatly increased scale of beekeeping, rendering pollination services is a realistic necessity, for increased access to the cascade of nectar sources through the year. However, increased crop and orchard pollination would relate directly to project profitability only if it was a catalyst for growth within the community, and measured with the most optimistic values of net present worth. This suggestion can only be seriously considered with a large number of mobile hives under management directed as part of a cooperative structure or other large enterprise. Expanded activity implies access to good transportation infrastructure for increased access to forage sources throughout the area, subsequently rendering
further efficiencies to labor productivity, and a more intimate knowledge of bee and pollen calendars.

4.3.1.4 Incremental Variable Costs

Incremental variable costs are the sum of sugar, labor, transportation, queens, and hive/comb repair in section 3.2.

4.3.1.5 Incremental Fixed Costs

Incremental fixed costs are the sum of bees and woodenwares (appendix 2.8). Total woodenware costs for a Langstroth hive on this expanded scale equals $98.61 (US). This analysis displays the cost of a starter Langstroth hive at $60.69 (table 3.3.2), and an additional four shallow supers at $9.48 each; $9.48 multiplied by 4 equals $37.92; the sum of $37.92 and $60.69 equals $98.61.

4.3.1.6 Intangible Cost

Section 3.3.2.6 displays the general intangible costs associated with the use of Langstroth hive technology. There is additional expense (and profit) at this scale of operation, but most of the intangible costs resulting from the requirements of better management practices necessary associated with such a fast expansion program. Moldovan producers do not have a background in management, marketing, accounting, etc; and this could prove extremely problematic if not recognized early. The education component becomes even more critical at this advanced stage, and the likelihood of failure is subsequently increased.
TABLE 4.3.2: Net present worth of incremental income from honey production, and incremental costs (fixed and variable), for one would-be full-time project participant employing Langstroth technology over a 20-year period (US $)

<table>
<thead>
<tr>
<th>Year</th>
<th>Incremental Income (Total Value of Honey Production)</th>
<th>Incremental Costs</th>
<th>Net Income (Loss)</th>
<th>Discounted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incremental Variable Costs</td>
<td>Incremental Fixed Costs</td>
<td>Total Incremental Costs</td>
<td>Discount Factor 12%</td>
</tr>
<tr>
<td>1</td>
<td>$430.00</td>
<td>$45.00</td>
<td>$643.05</td>
<td>$688.05</td>
</tr>
<tr>
<td>2</td>
<td>$860.00</td>
<td>$139.31</td>
<td>$643.05</td>
<td>$782.36</td>
</tr>
<tr>
<td>3</td>
<td>$1,720.00</td>
<td>$278.61</td>
<td>$1,286.10</td>
<td>$1,564.71</td>
</tr>
<tr>
<td>4</td>
<td>$2,580.00</td>
<td>$504.72</td>
<td>$1,286.10</td>
<td>$1,790.82</td>
</tr>
<tr>
<td>5</td>
<td>$3,440.00</td>
<td>$693.33</td>
<td>$1,286.10</td>
<td>$1,979.43</td>
</tr>
<tr>
<td>6-20</td>
<td>$3,440.00a</td>
<td>$859.44a</td>
<td>$0.00a</td>
<td>$859.44a</td>
</tr>
<tr>
<td>Total</td>
<td>$60,630.00</td>
<td>$14,552.57</td>
<td>$5,144.40</td>
<td>$19,696.97</td>
</tr>
</tbody>
</table>

Net present worth at 12 percent = $11,361.66

**SOURCE:** Derived from Gittinger, J. *Economic Analysis of Agricultural Projects*; 1982: 319.

**Note:** a: annual amount for years 5 through 20 inclusive; b: present worth of an annuity factor for years 5 through 20 inclusive; present worth rounded to nearest dollar.

4.3.1.7 Risk

Risk is much greater at this level of production with much capital devoted to hive construction. Until the producer engages the cooperative at the full-time production level, they assume a large risk in the purchase of 40 Langstroth hives. Infrastructure outside the village level is necessary for this scenario to work properly. Credit is probably a requirement for such an enterprise. On this scale, much more industry activity is needed on a national level, creating a cost in time and energy to spend engaging organizations outside of the village. For example, transportation costs, and labor necessary to move hives, are costs associated with full-time beekeeping.

4.3.1.8 Aggregate Benefits and Costs

The expanded use of Langstroth hives turns a profit sometime in the second year of production. The net present worth of this type of project, in a 20-year productive life is approximately $11,360 (table 3.4.2), as opposed to $3,874.287 (table 3.3.2) in the previous analysis, where a part-time beekeeper produced and expanded on a more normal scale. All
benefits and costs considered, Langstroth technology is a highly profitable venture for full-time Moldovan apicultural producers.

4.3.2 Profitability

Profitability in beekeeping can be immediate irregardless of scale. But in both the short and long term, profitability depends primarily upon the hive technology employed by the activity. Financial constraints exist in every project, therefore limiting expenditures to those which more effectively utilize a given amount of resources. Both funders and producers need information in order to discriminate against projects will not potentially optimize profitability.

Moldovan beekeepers producing quality honey for the domestic market, at a relatively low-cost, is a realistic scenario. The greatest domestic market potential for commercial apiaries is sustained by the disparity between the cost of living in the few urban areas and that in the countryside. The cost of living is quite low for rural Moldovans. Retail honey sells at The Green Hills Supermaket in Chișinău for $3.50 (US)/kg (appendix 3.4). Many in the city, mostly Russian speakers, have disposable income, and they are eager to buy quality honey. Retail sales requires bottling equipment, filters, organizational structure, standards, and contracts; many potential problem area on the periferey to village-level beekeeping. Even as the retail markets bode problematic, wholesale markets for good quality honey flourish in outdoor markets and roadside stands. In such a situation, even the most conservative sales estimates from wholesale honey markets seem to hold positive profitable potential for rural producers.

Moldovan beekeepers producing honey for export markets encounter similar obstructions as those in the domestic retail market. According to The Hive and the Honey Bee, “Honey, the major product of a beekeeper, is a world commodity. There is no formalized futures market for honey, and prices do not always conform to what is expected in a free market.” (Sanford and Hoopingarner, p. 723, 1988) But, if these obstacles can be overcome, much export potential exists. For example, MABC has contracted with Axeronix Ltd., a local holding company of a
German honey buyer, for selling wholesale honey to Western Europe. Germany has the largest consumption of honey per capita in the world. Moldova’s general proximity to Germany, Russia, and Romania (outsider for EU member in 2007) gives hope to Moldovan honey producers for increased access to these potentially huge markets.

Commercial honey production in America averages approximately 40 kg (about 80 lb) of honey per colony; subsequently, 9 to 18 kg (20 to 40 lb) of beeswax is produced for every kg of honey harvested. This provides a relative measure of productivity for Moldova’s high technology based development projects. This is not entirely impractical as the same basic technology is in use in both developed enterprises and those developing in Moldova. But, infrastructure lacking, productivity levels cannot be expected to be sustainable with the same intensity in both locations. Nonetheless, as beekeeping is a low input, high price output business venture, Moldovan beekeepers using the Langstroth system ensures greater sustainability.

4.3.3 Vertical Integration

Examples of incentives for vertical integration in Moldovan apicultural enterprises are acquisition of inputs, developing markets, networking, and making linkages to educational enterprises and government programs. As seen in section 3.6.1, expansion can prove very profitable. Conversely, the costs and risks associated with such a venture are also increased substantially. Thus, an efficient institutional structure is necessary for organizing a growth model for the industry as cooperation can help streamline purchases and increase the economies of scale associated with such activity. More specifically, forward vertical integration, where village enterprises (producer cooperatives or associations) organize structures to distribute or market products to members/customers, or to use these products in value-added processes. Processing facilities for bulk honey, operated by large producer cooperatives in a geographically central location, could help develop markets domestically and internationally, achieving greater economies of scale, and gain more economic and political security.
Some village-level producers can be expected to undertake expansive activities, while others will sell their hives and move away from beekeeping. Aggressive producers will find personal abilities the largest limiting factor in their capability in handling and increasing number of hives. Vertical integration at the village-level will only occur on a large scale if the appropriate structures are present.

4.4 SUMMARY

Moldova is a country with tradition in commercial beekeeping enterprise development, but in recognition of the past any appropriate efforts should be solidly based on a foundation of Langstroth hive technology, as proven in the comparative analysis in section 3.3. The economic and technical reality found in country makes direct-transfer of complex, moveable-frame hive technology, not only a viable proposition, but a highly profitable one to boot. Two examples of institutional infrastructure in support of the educational component were contemplated in section 3.4. Also, for apicultural projects to function efficiently and profitably, funders and project directors must contemplate the constraints displayed in section 3.5: constraints hindering educational initiatives organized around Cooperative Extension methodology. Lastly, additional considerations displayed benefits and costs pertinent to expansive activities and scale, profitability, and incentives for vertical integration. Chapter 4 assists in constructing recommendations for change in government policies, building institutional infrastructure, and developing future project focus: by drawing conclusions from the previous analyses and considerations.
CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapter 4 summarizes the research by extrapolating significant information from the previous chapters. This last chapter develops conclusions, and makes subsequent recommendations, on behalf of the major issues presented in section 1.4.

5.2 CONCLUSIONS

Conclusions are defined here as positions, opinions, or judgment reached after consideration of a proposition, and arrived at by logical reasoning. The initial problem statement declared that apicultural development initiatives in the Republic of Moldova are marginalized due to a reliance on outdated hive technology. Thus, the consideration in question is in regard to appropriate hive technology for apicultural project development in the Republic of Moldova. The logic used in the research is analysis and contemplation of major issues in the preceding chapters.

5.2.1 Compatibility of Apicultural Development Initiatives to Contemporary Moldova

The optimum areas of the world in terms of potential honey flows are the areas of deciduous forest in the wet/dry tropics. Such areas have long dry season which allows bee colonies to build up their strength to peak population to take advantage of the maximum nectar flow. The flora of these areas is also rich in melliferous plants. The dry, sunny period after the rainy season promotes a good nectar flow and provides good foraging weather. Areas with continuous cool and cloudy or rainy conditions are poorly suited for beekeeping, due to poor quality nectar and limited time that bees can forage. However, assessment of Moldova’s compatibility to beekeeping activity should not put too much emphasis on bee flora. Melliferous flora varies widely within any major climactic zone.
Fortunately for Moldova, beekeeping can be carried on profitably under a wide range of nectar and honey flow conditions. These conditions figure more in determining the size and type of a beekeeping operation rather than determining the profitability per se. There are many areas that are not practical for large-scale beekeeping ventures, but are highly suited for small-scale projects. This is generally the case for Moldova, for many reasons.

Moldova’s geographic location (proximity to potential European markets), climate, natural resource base, and development needs, taken as an aggregate, far exceed most other locations for potential in sustaining profitable apicultural projects. In particular, Moldova, with its economy tied closely to agriculture, needs bees to pollinate crops to increase productivity in that sector of the economy. Finally, Moldova has an acute need for controlled development; it does not need a supplementary supply of honey as much as more citizens engaged in some level of economic activity.

Moldova has an adequate setting towards implementing and sustaining successful apicultural development projects. It has a long history with apiculture development, as Moldovan producers have a history of utilizing movable-frame hive systems from the time of the Soviet state apiaries. According to “The World Fact book”, Moldova is a country with a 99.1 percent literacy rate, and a workforce of 2.2 million people (CIA, 2002). A highly literate workforce, large population density, availability of low-cost natural resources and labor, and good market potential: all these facts bode well for potential apicultural development projects.

Initial financial support aside, what Moldovan beekeepers need most is the ability to maintain sustainable organizations. This requires the necessary time, patience, and skill, to procure assistance in current discipline-oriented and business related problem areas in regard to: observation, experimentation, research, monitoring, relationship building, and general training. These sustainability issues can be addressed with the educational component: one based on
proven Cooperative Extension methodology, and an appropriate supporting institutional infrastructure.

5.2.2 Net Present Worth

Since the net present worth turned out to be negative for traditional hive technology at the assumed discount rate of 12 percent, the present worth of the benefit stream is less than the present worth of the cost stream and is thus insufficient to recover investment. Therefore, investment in the Langstroth hive technology, with a positive net present worth at various scales, is a better investment decision; or, technically speaking, to accept all independent projects with a zero or greater net present worth when discounted at the opportunity cost of capital.

5.2.1.1 Competing Technologies

The Langstroth hive is a profitable movable-frame system, where the traditional hive, a vestige from the Soviet era, is not. Lack of an effective management and accounting system, particularly at the Soviet state and collective farms (apiaries), may have given extended life to, and eventually institutionalized, use of the unprofitable traditional hive. Neither a system of leadership accountability or fiscal responsibility existed for years, under a communist government and use of the ruble as “currency”. Most Moldovan producers still build and use the traditional hive, without regard to returns on capital and labor. Profitability is of critical importance to apicultural development projects; teaching producers to lose money based on outdated technology is not an appropriate development effort.

5.2.1.2 Competing Scales

Expanding the number of colonies in an apiary turns a greater profit faster. The expansion analysis showed that beekeeping can be increasingly profitable with additional hives. The limitations lie with the abilities of the individual producer’s ability to effectively service the hives. Thus, larger educational efforts and more ornate organizational structures are necessary for long-term sustainability and growth. Expansion may be hindered by the relatively high initial
start-up cost associated with it. Hence, development efforts may affect more people, by first becoming vested at the household-level. One unique, positive trait of the Langstroth hive is the system’s ability to profitably accommodate producers on all scales.

5.2.3 Implications for Apicultural Development Initiatives

Acceptance of Langstroth hive technology would be greatly complemented by the use of Cooperative Extension methodology as a model for the development of an educational component. This can only happen when institutional infrastructure supplements these efforts by providing the necessary structures for sustainable growth.

5.2.3.1 Appropriate Technology

Langstroth hive technology is profitable on various scales, and no other wide-spread technological innovations are more currently applicable for apicultural development initiatives in Moldova. As hive management principles at work are generally the same for all movable-frame hive systems, producers can draw from most of their previous apicultural experience. The major difference between the competing systems is in the ability to manipulate the size of the colony and accommodating the growth of the hive population past the point of critical mass in finding a return on the capital investment made to the hive. Due primarily to swarming and the low quality of honey produced from them, traditional hives never show a return, unless opportunity cost to labor is not a consideration. It seems inconceivable that Moldovan producers have not taken to this system previously, but being hindered by the conventions of the Soviet Union have left the legacy that Russian technology is better technology. In this instance, that wisdom is flawed.
5.2.3.2 Educational Components

Lack of education, in the construction and use of the Langstroth hive, prohibits the economic use of this system in many small-scale development project situations; therefore, the educational component, so vital to technology-transfer project implementation, must never be underestimated.

The lack of appropriate technical information relating to almost every facet of beekeeping is staggering. Beekeepers need access to current research. Technical assistance is needed in regard to discipline-oriented education initiatives. Producers have been isolated from improvements in bee disease control, genetic improvements, and hive management techniques since the fall of the Soviet Union. This fact is acutely displayed in Moldova by the use of antiquated traditional hives. Also, education on the management of bee diseases, particularly emphasizing those of natural origin, is of critical importance colony health. Additionally, queen rearing and replacement techniques, such as selecting for disease resistance, honey production, and other desirable traits, are additional areas where the utilization of specific knowledge would greatly increase productivity.

Vocational and agricultural training centers and rural teacher training institutes make good sites to mount beekeeping extension programs. The trainees can have a multiplier effect in introducing beekeeping at the village level and the centers themselves serve as excellent demonstration sites. Technical assistance, for integration of the Langstroth system, derived initially from international extension education initiatives, can help to address the acute problems endemic with introduction of a new technology. Extension is needed where geographic and economic isolation has slowed the development of mechanisms for efficient information exchange.
While working under the Soviet market structure, Moldovan beekeepers “sold” outputs into a centrally planned market; therefore, they possess much knowledge of beekeeping for home consumption and barter, but lack the ability to add value to, and effectively market their goods. Moldova needs concerted educational efforts directed at problems relating to product marketing.

5.2.3.3 Institutional Infrastructure

The most successful efforts have provided for continued availability of necessary inputs for long-term growth. These have often been associated with the concurrent establishment of producer cooperatives to better insure continued sustainability, growth, new product development, and membership expansion. Producer cooperatives allow for a greater purchasing power for procuring inputs, more member control in processing and marketing outputs. Also, producer cooperatives encourage the establishment of micro-credit programs, dispense relevant and updated information, and allow access to expertise and financial resources. Producer cooperatives also help in the process of researching problems, promoting membership participation and village-level democracy, and electing organizational leaders. Prior to reaping economic benefits from apicultural development, there must be a critical mass of active players, to form an efficient, transparent, profitable, and sustainable organization. The establishment of a village cooperative in organizing producers is a natural target for medium to large scale beekeeping development organization.

The example of MABC, in section 3.5.1, is a testament to the use of cooperative structures for implementing effective hive technology-transfer efforts in Moldova. Changes, promoted by CNFA extension volunteers, led to adoption of Langstroth hive technology and a selective approach to genetics. These changes resulted in bee families being more resistant to temperature changes. Less preparatory time was needed and better resources were available in preparing hives for cold weather. Many American advisors were brought to Moldova to provide technical assistance while the cooperative grew out of infancy. By rendering this assistance,
members gradually replaced unproductive Soviet equipment. The organization is increasing the likelihood of expanded production, thus providing the opportunity to fill larger contracts in the future. MABC provides a good example of technical assistance to a cooperative, but what is appropriate extension programming for beginning beekeepers is somewhat different. Opportunity costs associated with more intensive and efficient management practices endemic to the use of Langstroth technology, in regard to accounting and record-keeping, is substantial, and volunteers were also brought to teach Moldovan beekeepers about the business side of apiculture.

The Beekeepers Association of the Republic of Moldova project “Apiculture for Rural Development” was originally implemented to provide both localized apicultural extension services and establish village level infrastructure. These goals were not adequately accomplished, but they did mark a starting point for developing strategies for emergent apicultural project development in the village of Sadova. Unfortunately, the use of traditional hive technology in the project greatly hinders potential profitability and growth.

Moldovan apiculture will survive in the long-term only to the extent that beekeepers are willing, in the short-term, to improve those practices most likely to lead to sustainable beekeeping. Sustainability is closely related to productivity, and thus, maximized production. Maximized production depends on the utilization of appropriate technology and knowledge to effectively utilize it. First and foremost, apicultural projects must be based on the implementation of Langstroth hive technology.

5.3 RECOMMENDATIONS

The thoughts entailed in this subchapter are based on conclusions from the analytical research and contemplated associated components.
5.3.1 Government Policies

Government is in the unique position of being able to promote initiatives on a national and international-scale, level the playing field and benefit producers by dictating the direction of controlled development, and to a great degree, hinder or supplement any development initiative. Government institutions must tread lightly and precisely around development initiatives, in order to supplement and not stifle, their effectiveness.

5.3.1.1 Moldovan

The Moldovan government needs to support the formation of autonomous, transparent, democratic organizational development initiatives, by actively engaging the NGO community, monitoring organizational advancement, and combating corruption by political officials. Also, the Moldovan government needs to promote community, grass-roots involvement, commitment of local resources, leadership, education initiatives, transparency, accountability, and attention to the economic and political atmosphere.

Great initiative is needed to create, and ultimately operate, sustainable organizations. Not all communities are ready to engage the process; thus, many potential beekeepers throughout Moldova are inadvertently excluded from these activities as it takes some level of interest in a specific locality to develop a project. Cultivating producers in new communities should be an important goal on the national level. Projects require leaders, and national projects should focus on transferring in knowledge of new technologies to interested parties from new communities. For opening the benefits of beekeeping projects to those who would otherwise go unaffected by its activities, organizations should promote additional programs similar in structure to “Apiculture for Rural Development”, but combined with better information, updated technology, and more equitable organizational structure.
Government support, for the formation and implementation of a consolidation or convergence model on a national level would be an ideal implementation strategy for attaining the greater economies of scale for overall industry growth and profitability. A consolidation model entails individual beekeepers supplying outputs to a village-level organization; subsequently, after some value-added processing (uncapping comb and consolidating bulk honey to tanks for transport) at a village collection point, a regional or national organization would market the bulk honey and/or beeswax to either a national processor or international distribution network. This would help develop a market structure and ensure a greater level of productivity, if appropriate consideration is given to the structure of the supporting institutions. Ideally, the larger organizations would be cooperatively owned enterprises, benefiting all producers on a regional or national scale.

A government sponsored, industry-wide initiative toward the development of grades and standards for apicultural goods would greatly enhance development efforts at the national level. Also, a national quality assurance/brand identification program could be helpful at building consumer confidence and promoting both the purchase and production of Moldovan honey.

5.3.1.2 American

Peace Corps looks for sites with potential and, ideally, ones with a working program template with a specific role for the volunteer to fill. Peace Corps agricultural development programs are relatively scarce, and beekeeping volunteers almost non-existent. Thus, a realistic deduction is that a Peace Corps apiculture program, addressing these project needs will not emerge anytime soon, unless explicitly developed and vigorously. For recruitment, some previous beekeeping experience would be a plus, but ultimately, would not prove vital as a component of project success: international extension volunteers could fill the role of master beekeeper specialists on a temporary basis. Nonetheless, an effort to procure and train a number
of highly specialized beekeeping volunteers would prove advantageous for projects explicitly centered on apicultural development.

Peace Corps needs more appropriate agricultural site and volunteer development curriculum. Apiculture could be another highly effective focal point for these efforts, but only if adequate institutional infrastructural development efforts coalesce. Development of a PCMI (Peace Corps Masters’ International) (appendix 1.5) program, with a masters specialization in international apicultural development, for providing the necessary training to volunteers; requires much inter-institutional cooperation between Peace Corps, applicable universities, and the NGO community.

PCMI students can earn their master’s degree by completing approximately one year of intensive on-campus study, then serve for two years in the Peace Corps in an assignment related to their course of study. Many U.S. colleges and universities have graduate programs that are particularly relevant to the challenges that Peace Corps volunteers face overseas. In cooperation with the Peace Corps, more than 40 institutions now offer an opportunity to simultaneously earn an advanced degree and gain international experience. After completion of Peace Corps service, students complete theses, professional papers, practicum requirements, progress reports, and/or other degree requirements designated by the university. Upon graduation, students enjoy the credibility of both a graduate-level education and two years of substantive, professional field experience in an international setting. The PCMI program is flexible and can accommodate varying academic requirements at each university. Generally, a volunteer’s greatest direct contribution to project success is in procuring help from the NGO community, providing up-to-date technical assistance, and in offering a measure of short-term stability as an effective monitoring and evaluation force. PCMI has combined applicable service and appropriate graduate study, forming a highly effective model for volunteer development. Since the first PCMI program at Rutgers University in 1987, numerous programs have been initiated.
nationwide, in response to foreign governments’ need for highly skilled volunteers for particular development efforts. Unfortunately, no PCMI program exists to specifically support apicultural development efforts.

Cooperative Extension as a focal point for an appropriate education component is a natural match with the PCMI program, as Peace Corps has a long and successful history in working with this proven methodology. Furthermore, land-grant based universities in the United States have supported institutionalized Cooperative Extension efforts, both at home and abroad, for almost a century with great effectiveness. Education, research, and extension have all been utilized in conjunction to address societal and economic problems such as increasing productivity, accessing credit, community development, etc. The coupling federal, state, and local resources, to combat problems facing ordinary citizens (particularly in rural areas), has been a highly recognized story of government success. Apiculture has not been exempt from these activities. Universities such as Cornell, North Carolina State, and Georgia all maintain Master Beekeeper Extension education programs, through their respective departments of entomology. They would provide excellent resources and structural support for addressing the needs of international apicultural development efforts, via a model coupling a PCMI program with proven Cooperative Extension methodology.

5.3.2 Building Institutional Infrastructure

Cooperative Extension and research are both vital to building institutional capacity. Each component complements and strengthens the role of the other. Contemplation of Cooperative Extension and research are meant to reinforce the overall effectiveness educational component and broaden the outcome of apicultural development initiatives locally, regionally, nationally, and internationally.
5.3.2.1 Cooperative Extension

Training and visit (T&V) is a natural model for implementation of Cooperative Extension education programs in Moldova. A project director, more experienced local beekeepers, Peace Corps volunteers, and temporary NGO volunteers, could be used as change-agents for diffusing valuable information to local producers. An integrated, participatory system would be ideal, if utilized to gather research, and establish linkages between individual beekeepers, producer cooperatives, the NGO community, institutes of higher learning and scholars, and Peace Corps volunteers. An international beekeeper exchange program administered by the NGO community, where apicultural volunteers come for weeks or months at a time, engaging in Cooperative Extension type educational initiatives; and Moldova project directors travel to America with CNFA or ACDI/VOCA, or to Canada with the Canadian Executive Service Organization (CESO) (appendix 2.2), to gain invaluable experience working with Langstroth hive technology, in western, production-oriented apiaries.

Foreign technical assistance is acutely needed at the household, village, and organizational levels; for educational efforts teaching fundamental lessons in economics, finance, accounting, recordkeeping, management, and marketing. Those in leadership positions need specific skills for effectively monitoring their business activities. Cooperative Extension initiatives are specifically needed in regard to the subject of marketing. Moldovan producers have unrealistic price expectations for their honey and hives due to isolation from global markets and an antiquated internal price structure. Beekeepers need assistance in determining returns to capital and labor, as well as developing realistic pricing and profit margins for domestic markets. Under current conditions, a two-tiered marketing approach should be used to alleviate some of the problems relating to marketing; serving the traditional local market through a barter scheme in trade for vital inputs, and when possible, selling bulk and value-added products for cash. This could help insure local sustainability, and help hedge some of the risk associated with larger
development initiatives. Efforts should focus on the areas of honey processing, packaging, and labeling techniques for promotion of bulk and direct consumer sales at the organizational level. Lastly, to better coordinate the various aspects of project management throughout the village, integrated Cooperative Extension initiatives are needed to coordinate and educate those individuals indirectly related to apicultural development projects, yet vital to their success. Specifically, raising awareness for micro-enterprise project support of village sawmills, forest/farm enterprises; with environmental/conservation initiatives, establishment of micro-credit mechanisms, and enforcement of standards and regulations: all to support the institutionalization of Langstroth hive technology in apicultural enterprises.

5.3.2.2 Research

Lack of domestic research for apicultural enterprises is a large problem as stated in section 3.4.9. American research can be a stop-gap measure in the short-term, as Langstroth hive technology and manipulation is highly applicable to Moldova; but studies conducted and demonstrated in country would be of great benefit to both domestic beekeepers and actively-engaged research institutions abroad. No structure link to research and Cooperative Extension exists for Moldovan apicultural development projects. Interaction between universities abroad and rural Moldovan apicultural organizations would benefit both institutions, by establishing an exchange of relevant research information in both directions. In particular, American universities have much to gain by interacting with Moldovan apicultural development initiatives. Research topics could be explored by students and scholars interested in subjects pertinent to international development, while acquiring information in site-specific, idiographic setting, so vital in truly understanding the needs of Moldovan apicultural producers, foresters, carpenters, and entrepreneurs. Students and scholars could render immediate assistance by applying updated research data from abroad, to current problems in development projects. For example, many of the environmental factors present in Moldova also exist in various regions of the United States.
South Dakota is one of the largest beekeeping states in the country. The similarities in northern latitude, steppe soils, limited water resources, climate with potential for drought, and struggling agricultural economies, makes apicultural research conducted from that area quite relevant to some of the problems found in Moldova.

5.4 SUMMARY

These conclusions and recommendations are posited for the international NGO community, universities, the Moldovan and American national governmental organizations, and others in positions of interest, to try and make structural changes to allow greater utilization of beekeeping in development initiatives. The recommendations, based on conclusions drawn from both analytical research and contemplation of associated issues, will require forward looking development efforts to be effectively initiated. As development efforts are not easily implemented, devotion to the cause of sustainability is of utmost importance. Langstroth hive technology employed in development projects, coupled with education component based on the fundamentals of tested Cooperative Extension methodology, working in an effective institutional infrastructure such as a producer cooperative, will render the best combination of outcomes for apicultural projects in The Republic of Moldova.
APPENDIX 1.1:

PEACE CORPS AGRICULTURE/AGRIBUSINESS DEVELOPMENT (AAD)
PROJECT INFORMATION

This project is part of Peace Corps Moldova’s Economic and Organizational Development (EOD) portfolio. Volunteers work locally with individual farmers and community groups, to facilitate the transition from the collective farming of the former Soviet Union to private agribusiness in a market economy. Assisting rural farmers to connect with regional information centers and other farmers groups will be a critical part of improving linkages for long-term information sharing. An integral part of [the] job is to include one or more Moldovan partners in all aspects of [the] activity. These partners, along with farmers groups, can continue the work after [the volunteer] has left the country. (Peace Corps, 2003)

The following are the three project goals explicitly stated by the Peace Corps Moldova AAD project director in 2002:

1. **Support the development of sustainable local farmer associations or producers cooperatives** by providing technical assistance in such areas as human resources and cash management, marketing, feasibility analysis of new projects, business planning, and completing loan applications. Volunteers also provide advice to local groups in developing associations, and locating customers in other markets and provide assistance to farmers’ associations in organizational development and planning, cooperative management, budgeting, preparing applications for credit, financial analysis and strategic planning.

2. **Provide technical assistance to local farmers** through individual consultations and by organizing information and training programs. Access, develop and/or distribute guides, directories, and newsletters to promote the region, sector, specific issues, or organization in which [they] work. Volunteers serve as a source of information between development organizations and beneficiaries; help establish libraries and resource centers; develop data bases that track clients, economic indicators or agricultural activity; and assist local farmers to market agricultural products by researching prices, preparing information for the local and regional markets, and by developing business plans, crop budgets, and cost/benefit or profitability analyses.

3. **Strengthen the capacity of community members in rural areas** to participate in community economic development by organizing seminars on topics such as business start-up, marketing, writing business plans and forming farmers’ associations or cooperatives. Additionally, many volunteers work with youth groups to encourage their participation in developing good farming and business skills.

**SOURCE:** Peace Corps, 2003.
APPENDIX 1.2:

PEACE CORPS SPA INFORMATION

Volunteers and their counterparts who have been involved in the community development process report time and time again that solutions which come from the community and activities that rely on local resources are the most effective and sustainable. They also point out that some solutions will require technical assistance and financial support from outside the community. When this is the case, the SPA program may be able to help.

The SPA program makes small grants available to communities through an agreement between the Peace Corps and the United States Agency for International Development (USAID). These funds are designed to provide small amounts of capital that are combined with local contributions to support community-initiated activities. SPA grants are intended to improve the community’s ability to organize, plan, make group decisions, and collaborate to improve their lives. In fact, the broad goal of the SPA program is:

To enhance communities’ capabilities to conduct low-cost, grass-roots, sustainable development activities.

Capacity building, then, is the hallmark of the SPA program. Based on the specific needs you and your community identify, capacity building can take many forms and is directly related to the work you do in your primary sector assignment. Working with a health Volunteer, the advisory committee of a clinic may request badly needed training for area health workers. Working with an environment or agriculture Volunteer, farmers may request assistance from an extension agent in planting nitrogen-fixing or fruit-bearing trees. Community women may request training to set up a school garden or dried vegetable small enterprise. Working with an education Volunteer, the staff and students of a school may request help establishing a vocational training program or a new library. Working with a business Volunteer, a cooperative may request help to identify prospective markets or an NGO to meet its clients’ needs. Activities such as these in a primary sector assignment build the capacity of the community.
SPA grants may be used in many ways to support the activities mentioned above, including: to purchase instructional materials to provide training for community health workers; to finance the purchase of seeds and tools needed to establish the school vegetable garden; to partially defray the costs of building the school library or other community infrastructure; to cover a portion of the start-up costs of a new women-owned business; or to purchase ledgers and implement accounting, marketing, and business planning classes for members of a cooperative.

While SPA grants may support community-based activities in any sector, it should be noted that when Volunteers and their communities work together to implement grant activities that are part of the Volunteers’ primary-project activities, the opportunity for achieving more lasting change and impact are enhanced. This occurs because the Volunteer has more time to work on the activities and the activities are more likely to respond to the community’s felt need. The Volunteer is available to play the role of “troubleshooter” or to provide additional assistance to better ensure that the community will be able to continue the activity following the Volunteer’s close of service date.

APPENDIX 1.3:

PEACE CORPS PARTNERSHIP PROGRAM INFORMATION

Peace Corps' Partnership Program provides funding for community-initiated projects being overseen by our volunteers serving around the world. Since its inception in 1964, the Partnership Program has assisted thousands of Peace Corps Volunteers, in every Peace Corps country, in order to benefit the health and well-being of their host communities.

Our Mission Statement

*Our mission is to build enduring financial alliances with the private sector that connect donors with community-based projects where our volunteers serve.*

How You Can Help


We are not asking for a handout to the communities we serve. This is a true partnership. In order to receive funding through Partnership Program, a community must make a 25% contribution to the total project cost and outline success indicators for the individual projects. This helps ensure community buy-in, a greater chance of long-term sustainability, and, ultimately, success.

**Note:** 100% of your contribution goes to the community being served and all donations are tax deductible.

APPENDIX 1.4:

SPA APPROVAL FROM PEACE CORPS MOLDOVA

December 2, 2002

Chad Pfister
Beekeepers’ Association
Sadova

Dear Chad:

Thank you for recently submitting a proposal to the Small Project Assistance (SPA) Project Review Committee. I am pleased to inform you that your proposal for “Apiculture for Rural Development” was approved.

The SPA Review Committee cited several reasons in their decision to fund your project. The action plan and topics for each seminar are well thought out and the project will do much to strengthen existing organizations and broaden the outreach of Beekeepers’ Association. Additionally, they were very impressed with the level of enthusiasm and the local expertise to be tapped by the project. The project, as presented, is an excellent example of the use of local resources to transfer knowledge and increase project sustainability.

Funding for your project will be dispersed to your community pending on availability of the funds transferred to Peace Corps Moldova SPA Program. So far we would suggest you to work on the following items:

- Separate account in the Banca de Economii for managing SPA funds.
- Completion of the Activity Agreements and Consent and Liability with appropriate signatures.

Please remember that you must use your judgment in justifying and researching for alternatives for some of the parts of the project, such as trip to Russia and origin of the bee families to be donated to training participants.

Congratulations and best of luck with your project! If you have questions, please don’t hesitate to contact any member of the SPA Review Committee.

Sincerely,

David Reside
Program and Training Officer
APPENDIX 1.5:

PEACE CORPS MASTER’S INTERNATIONAL INFORMATION

Master’s International (MI) has made the truly unique opportunity of completing a master’s degree with overseas service available in a variety of fields at over 40 academic institutions nationwide. Establishment in 1987, Master’s International addresses the third goal of Peace Corps: to help the people of interested countries in meeting their need for trained men and women. Master’s International students serve in over 70 different countries and participate in every aspect of life overseas.

As a prospective student, you will apply simultaneously to both the Peace Corps and the participating graduate school(s) of your choice. After being accepted by both, you will complete a year to two years of graduate course work at your respective university while continuing to prepare for work overseas. Each MI Program is autonomous. Your academic institution will have its own requirements and will award credit for Peace Corps service accordingly.

After completing your initial course work and receiving your Peace Corps placement, you will travel to your respective site and begin training. Once overseas, you are given and assignment according to the needs and requests of your host country. Participating faculty recognize that while overseas, your primary responsibility is the project and community to which you have been assigned. Rather than determining a research topic in advance, you will allow your volunteer assignment to shape your academic requirement.

Depending on the institution, that assignment may be a thesis, professional paper, or culminating project, under the direction of your faculty and with the approval of Peace Corps overseas staff. You must be flexible and, in some cases, creative when transforming your volunteer service into your graduate work. Other possibilities offered are graduate credits for Peace Corps service and tuition or fee waivers.

After completing your Peace Corps service, you will return to their finish your graduate coursework or begin your career. Now, you have the advantage of actually having implemented some of your ideas and applied theory to a practice, while living overseas. You will have returned with a world view and the skills and education to change that world.

APPENDIX 2.1:

MABC BEEKEEPERS COOPERATIVE INFORMATION (SUPPLEMENTAL)

<table>
<thead>
<tr>
<th>Date of Submission:</th>
<th>April 17, 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Project Began:</td>
<td>February 15, 2000</td>
</tr>
<tr>
<td>Host Organization:</td>
<td>Mindria Albini Beekeepers’ Cooperative (MABC)</td>
</tr>
<tr>
<td>Project Location:</td>
<td>Causeni, Tighina region (southeastern Moldova)</td>
</tr>
<tr>
<td>PIA Prepared By:</td>
<td>Oleg Brinza</td>
</tr>
</tbody>
</table>

**Volunteer Assignments:**

<table>
<thead>
<tr>
<th>Date of Assignments</th>
<th>Volunteer</th>
<th>Affiliation</th>
<th>Home State</th>
<th>Name of Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/14-8/31/00</td>
<td>Ann Harman</td>
<td>Commercial Beekeeper</td>
<td>VA</td>
<td>MABC Organizational Development</td>
</tr>
<tr>
<td>8/14-8/31/00</td>
<td>Bob Cole</td>
<td>Commercial Beekeeper</td>
<td>NC</td>
<td>Honey Production Development</td>
</tr>
<tr>
<td>9/26-10/12/00</td>
<td>Cesar Flores</td>
<td>Commercial Beekeeper</td>
<td>CO</td>
<td>Honey Marketing Development</td>
</tr>
<tr>
<td>3/5-3/26/01</td>
<td>Cesar Flores</td>
<td>Commercial Beekeeper</td>
<td>CO</td>
<td>Honey Production Development</td>
</tr>
<tr>
<td>5/13-5/31/01</td>
<td>John Caldeira</td>
<td>Financial Planning Manager/Part-time Beekeeper</td>
<td>TX</td>
<td>Advanced Honey Production Technologies</td>
</tr>
<tr>
<td>9/26-10/12/01</td>
<td>Cesar Flores</td>
<td>Commercial Beekeeper</td>
<td>CO</td>
<td>Marketing Team Development</td>
</tr>
<tr>
<td>1/16-2/04/02</td>
<td>Cesar Flores</td>
<td>Commercial Beekeeper</td>
<td>CO</td>
<td>Cooperative Business Management</td>
</tr>
<tr>
<td>2/4-2/25/02</td>
<td>Fred Boeshans</td>
<td>Business Service Manager</td>
<td>ND</td>
<td>Organizational Development</td>
</tr>
<tr>
<td>3/24-4/6/02</td>
<td>Cesar Flores</td>
<td>Commercial Beekeeper</td>
<td>CO</td>
<td>Export Marketing</td>
</tr>
<tr>
<td>5/12-5/30/02</td>
<td>Judy Eggleston</td>
<td>President and CEO</td>
<td>VA</td>
<td>Business Development</td>
</tr>
<tr>
<td>6/2-6/19/02</td>
<td>John Tobin</td>
<td>Instructor</td>
<td>MN</td>
<td>Business Management</td>
</tr>
</tbody>
</table>

**Number of People Whose Lives Were Improved This Year:**

<table>
<thead>
<tr>
<th>Estimated Number of People Whose Lives CNFA Aims to Improve Through This Project*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly Improved</td>
<td>35</td>
</tr>
<tr>
<td>Indirectly Improved</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35</strong></td>
</tr>
<tr>
<td><strong>TOTAL including family members</strong></td>
<td><strong>105</strong></td>
</tr>
</tbody>
</table>

*Number of people who will experience Level III impact(s) described in the Desired Impacts table above.
While still growing, MABC has emerged in stages from reorganization, first into a true cooperative with a small core membership, and currently into an economically viable organization with expanding business and membership activity. This development, due in a large part to implementation of volunteer recommendations, has resulted in a cooperative that provides income and opportunity to an increasing number of members. While operating in a challenging economic environment, MABC continues to demonstrate its sustainability through growth, new product development, and membership expansion.

Mindria Albinei (MABC) continued its impressive development trend into 2002, achieving its greatest financial results ever! From tripling its number of members to a double increase in income, the cooperative has shown many achievements in 2002. MABC is a good example of how U.S. beekeeping and cooperative practices can be adapted and assimilated to Moldova’s market realities. In summary, a total of 35 people benefited directly from cooperative’s activity. Thirty members increased their income from selling hive products through Mindria Albini, gained access to various inputs, such as new efficient hives, while 5 employees enjoy a stable income and annual salary increases (HP, section III, question C “Staff”).

One of the most important achievements registered by MABC is the volume of sales. Thanks to Volunteer Fred Boeshans’ training in inventory management, MABC was able to track and regulate its internal levels of production to ensure a constant supply to local groceries. This, along with business planning skills acquired through Boeshans’ training, secured MABC’s honey stocks throughout the whole year. Not only did MABC maintain sales on the domestic market, but they also registered a twofold increase of export sales (HP, section II, question G “Sales, bulk and retail”). According to MABC Manager Alexandru Gogu, this became possible thanks to Cesar Flores’ help uncovering new export marketing opportunities. Having identified that direct export activities are not the best option for MABC beekeepers, Flores recommended that MABC export honey in bulk through local exporting dealers, thus spreading the risk and the financial burden of the cooperative. In the summer of 2002, after developing a member supply database, the cooperative was able to negotiate favorable contractual terms with Axeronix Ltd., a local holding company of a German honey buyer (HP, section II, question G4 “Major customers/markets”). The database, which includes all producer-related information, developed after Judy Eggleston’s assignment allows MABC’s Manager to reply promptly to any buyer’s inquiry and to be the first in line of honey suppliers (HP, section II, question A “Does the organization have a beekeepers' database”). One week after the development of the database, MABC collected and delivered 14.4 metric tons of honey to Axeronix Ltd. The promptness of the manager resulted in Lei 207,584 ($14,287) worth of income for the beekeepers and established a new relationship with a buyer (HP, section II, question G “Sales, bulk and retail”).

Realizing that the traditional beekeeping practices used by most Moldovan beekeepers are not likely to satisfy the long-term demand of the market, MABC decided to manufacture Langstroth hives and sell them to the members. By helping members gradually replace old and inefficient Soviet equipment the cooperative is increasing the likelihood of more production and the opportunity to fill larger supply contracts (HP, section II, question G8 “Has the production technologies/practices changed through time?”) MABC members raised the capital and financed the new enterprise out of their own funds. Their readiness to work together and combine resources once again proves that MABC has successfully graduated as a start-up organization and has cemented the trust and the confidence of the members.
Volunteer Cesar Flores, a Colorado beekeeper, helped MABC work out the details of the “Hive Manufacturing Program” and recommended the Board consider organizing member production training to complement new production technologies. The cooperative acted quickly and in February 2003 set up a demonstrational bee farm, where anyone interested in beekeeping can monitor the performance of the new technologies up close and first hand (HP, section V, question H “Member services”). Langstroth hives are proving very popular with non-members too and in just a little over one month, the cooperative has generated Lei 8,868 ($610) in hive sales and has several large orders placed for the coming months (HP, section IV, question F1 “Total Income”).

New bee farm management practices acquired through volunteer training were put to test in the winter of 2002-2003. The unusually severe and long winter was fatal to over 30% of the bee population of Moldova, according to official statistics published by the Ministry of Agriculture. The effects of the cold weather were compounded with old equipment and outdated management practices, and many Moldovan beekeepers lost their entire hives. In contrast to the rest of the country, MABC members’ bees survival rate was 98%. MABC’s manager explained that the recent innovations introduced by CNFA volunteers in the last two and a half years, namely the change to a vertical-type Langstroth hive and selective approach to genetics, resulted in bee families more resistant to temperature change and less preparatory time and resources preparing hives for cold weather (HP, section II, question G8 “Has the production technologies/practices changed through time?”). Most MABC members’ bees were ready for winter by the time of the first early frost in November, while non-MABC beekeepers left their bees without enough food and insulation for the heavy winter. As of today, MABC members’ now manage 1,490 bee families, or a 100% increase over last year (HP, section II, question F1 “Total number owned by members of association”).

The increase in membership is another significant achievement directly linked to the enhanced performance of the cooperative thanks to CNFA training. It also shows that the systems set within the cooperative comply with democratic and member-oriented principles. Transparency in operations, clear division of responsibilities, regular internal controls, fair treatment of members and, most importantly, marketing and input-supply services motivated beekeepers to join MABC. Today, MABC has 30 members from different geographical areas that are looking forward to new opportunities that the cooperative opens for them (HP, section II, question B1 “Total number of members”). The increase in membership was largely due to the market access provided by MABC, along with important support services, such as the hive-manufacturing program. New possibilities and the ability to serve a larger number of beekeepers allowed the Board to approve new members, although cooperative directors continue to apply a selective approach to applicants. The cooperative recruits beekeepers that own at least 40 bee-families and are interested in cooperative’s services. The applicant has to agree with paying the membership fee of Lei 500 ($35). Another important requirement considered by the Board is personal openness and willingness to participate in cooperative’s ventures. The other important aspect of the admission process remains to be cooperative’s ability to serve an increased membership. Thus far, Mindria Albinii’s policy is to match the cooperative’s service capacity with approval of new members. Even though this appears to be a limiting factor, the Board did not have any problems in expanding membership in 2002 and the cooperative registered a triple increase in members versus the planned twofold expansion.
Discussion, Conclusions and Lessons Learned:

MABC’s growing confidence and favorable market trends for 2003 allow the management to make optimistic projections. Mindria Albinii plans to enroll another 15 new members and increase its staff to 7 people in the coming year. Even if the sales of honey would not turn out to be as ambitious as planned, the management is certain that the “Hive Manufacturing Program” and all the related proceedings will become a strong alternative profit center to the honey marketing service. The cooperative expects that in two to three years, all members will be equipped with Langstroth hives and apply uniform rules of production. These, in turn, will open new marketing opportunities for the cooperative and its members.

Having sent 12 volunteers to MABC, CNFA has greatly contributed to the establishment of a viable business organization functioning in accordance with modern-day democratic cooperative principles. The most recent results prove that MABC has reached a sustainable level of development and does not require any further immediate assistance. The most recent CNFA volunteers also recommend that MABC be left to operate independently and without additional volunteer training, although some assistance from the CNFA field office staff may be appropriate as needed. Furthermore, MABC management and members look forward to working on their own and applying the acquired skills in their daily operations. Lastly, USAID Chisinau also looks forward to seeing CNFA volunteer training spread to other needy Moldovan farmers.

The example of the beekeepers’ cooperative from Causeni has been widely published in the local farmers’ media lately. MABC manager reports that he has received many enquiries from farming groups around Moldova willing to replicate MABC practices. A standing proof of the growing interest and trust from farmers around Moldova is the geographical representation of the cooperative. MABC now consists of beekeepers from 6 different regions, as opposed to only 3 locations earlier (HP, section I, question L “Geographic regions covered?”). The physical distance does not stop beekeepers from cooperating and solving their production and marketing problems as a group.

APPENDIX 2.2:

CESO INFORMATION

CESO stands for the Canadian Executive Service Organization and we pronounce it as KESSO.

Founded in 1967, CESO is a not-for-profit, volunteer-based organization providing economic development expertise to Canadian Aboriginal Peoples, non-Aboriginal Canadians, developing nations and the new market economies of Central and Eastern Europe.

<table>
<thead>
<tr>
<th><strong>Our mission</strong></th>
<th><strong>Core values</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>To promote and extend the economic growth of the Aboriginal and Non-Aboriginal peoples in Canada, the peoples of the developing nations and emerging market economies.</td>
<td>1. Volunteerism;</td>
</tr>
<tr>
<td></td>
<td>2. Accountability;</td>
</tr>
<tr>
<td></td>
<td>3. Transferring skills to people in need; and</td>
</tr>
<tr>
<td></td>
<td>4. Respect.</td>
</tr>
</tbody>
</table>

The backbone of CESO is our distinguished talent bank of approximately 3,500 Volunteer Advisers (VAs). Our VAs are highly experienced in their professions or careers and serve as mentors, advisers and trainers to our client-partners at home and abroad.

We operate in 22 countries in Africa, Asia, the Caribbean, Central and South America as well as in 16 new market economies in Central Eastern Europe, all with funding support from the Canadian International Development Agency (CIDA).

APPENDIX 2.3:

ACDI/VOCA INFORMATION

About ACDI/VOCA

ACDI/VOCA is a private, nonprofit organization that promotes broad-based economic growth and the development of civil society in emerging democracies and developing countries. Offering a comprehensive range of technical assistance services, ACDI/VOCA addresses the most pressing and intractable development problems.

Driven by the goal of adding value to local enterprise, ACDI/VOCA helps build:

- businesses,
- agricultural systems,
- financial systems and
- grassroots organizations

that underlie prosperous free markets and stable democracies.

The ACDI/VOCA Difference

ACDI/VOCA has a proven record of development successes dating back almost 40 years. This experience coupled with strong technical expertise means that clients and partners can always expect high standards of quality from ACDI/VOCA.

ACDI/VOCA is also distinguished by its:

- private sector orientation
- emphasis on local action
- legacy of lasting institutions
- grant management capacity
- food/fiber system approach
- approach to transitioning from relief aid to economic development
- innovative commodity management and food monetization programs
- experience working regionally (across borders)
- high-value, short-term volunteer consultants
- sophisticated monitoring and evaluation systems
- strong partners
- direct connection to the U.S. agricultural sector
- field offices in over 38 nations

APPENDIX 2.4:

CNFA INFORMATION

The Citizens Network for Foreign Affairs (CNFA) is a non-profit, nonpartisan organization dedicated to stimulating international economic growth in developing and emerging world markets. CNFA builds partnerships between the public and private sectors to foster sustainable development and create market-oriented, economically viable enterprises where none or few existed before.

CNFA currently is working in the food and agriculture sector of the New Independent States of the former Soviet Union - Ukraine, Russia, Moldova and Belarus; and in southern Africa - Zimbabwe, Mozambique and Zambia. CNFA is expanding its model of public-private partnerships into different economic sectors and disciplines, and into other developing areas of the globe.

APPENDIX 2.5:

STATUTE: THE BEEKEEPERS' ASSOCIATION OF THE REPUBLIC OF MOLDOVA

Aprobat
la Adunarea de constituire
da Asociației Apicultorilor din
Republica Moldova
“APIS MELLIFERA”

Înregistrat
de Ministerul Justiției
al Republicii Moldova
nr. 18/99
Ăl. Popescu

STATUTUL
Asociației Apicultorilor
din Republica Moldova
“APIS MELLIFERA”

mun. Chișinău
APPENDIX 2.6:

LETTER FROM THE SADOVA PRIMARIA

Primăria comunei Sadova, județul Chișinău

Câtre: Corpul Păcii al SUA
în Republica Moldova

Scrioare de Referință


La moment apicultura a degradat și au mai rămas doar 500 familii de albine pe teritorul comunei, ceea ce a dus la sporirea numărului de șomeri.


Primăria Sadova va acorda tot sprijinul pentru implementarea reușită a proiectului „Apicultură pentru Dezvoltarea Rurală” cu participarea voluntarului Corpului Păcii.

Primarul s. Sadova, Savin Anatolii Ion
APPENDIX 2.7:

CONTRACT BETWEEN THE BEEKEEPERS’ ASSOCIATION OF THE REPUBLIC OF MOLDOVA AND THE STATE BEEKEEPING SCHOOL

Contract de Colaborare

Între Asociația Apicultorilor din Republica Moldova, “Apis Mellifera” și școala de meserii s. Dănceni

Chișinău, 14 noembrie 2002

Asociația Apicultorilor, “Apis Mellifera” și școala de meserii din s. Dănceni își exprima interesul de a colabora în vederea pregătirii mai eficiente a grupului de apicultori, și convinse la următoarele etape:

1) Asociația „Apis Mellifera” va contribui la desfășurarea seminarelor demonstrative – practice cu iesire la prisacă.

2) Asociația va contribui la îmbunătățirea bazei didactice a școlii cu diferite modele de stupi, inventar și echipament apicol demonstrativ, reviste de specialitate și manuale.

3) Asociația va informa regulat grupul de apicultori a școlii despre cele mai eficiente metode de combatere a bolilor și dăunătorilor albinelor.

4) Asociația își asumă răspunderea de a implica studenții grupei de apicultori la prisacile Asociației, pentru a desfășura practica de diplomă.

5) Școala de meserii va pune la dispoziția Asociației sălile de clasă și va asigura prezentarea studenților la seminarele demonstrative.

6) Școala va promova în rândurile studenților interesul față de apicultură și colaborarea cu Asociația „Apis Mellifera”.

Asociația Apicultorilor din Republica Moldova „Apis Mellifera”
Președintele

Petru Arhip

Directorul școlii de meserii din s. Dănceni
Condea

Grigore Mihai
APPENDIX 2.8:

APICULTURE FOR RURAL DEVELOPMENT: CONTRIBUTIONS AND BUDGET

NOTE: All figures listed in US dollars.

SPA funds requested: $5000 (51% of total budget)
Cash Contribution: $2401 (25% of total budget)
In Kind Contribution: $726 (7% of total budget)
Peace Corps Partnership: $792 (8% of total budget)
Not Funded: $814 (9% of total budget)

Total budget: $9733

SPA CONTRIBUTION:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>180.00</td>
</tr>
<tr>
<td>Direct Costs</td>
<td>724.00</td>
</tr>
<tr>
<td>Seminar materials*</td>
<td>2743.00</td>
</tr>
<tr>
<td>Product Collection Point Materials</td>
<td>797.00</td>
</tr>
<tr>
<td>Video Materials</td>
<td>330.00</td>
</tr>
<tr>
<td>Workshop Materials</td>
<td>1040.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5814.00</td>
</tr>
</tbody>
</table>

TOTAL REQUESTED: $5000.00

*NOTE: Some requested seminar materials will be purchased outside of Moldova with contributions through Peace Corps Partnership (see Seminar Materials for a listing).

PEACE CORPS PARTNERSHIP CONTRIBUTION:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia Trip</td>
<td>435.00</td>
</tr>
<tr>
<td>Seminar materials*</td>
<td>357.00</td>
</tr>
</tbody>
</table>

TOTAL REQUESTED: 792.00

*NOTE: Some requested seminar materials will be purchased inside of Moldova with SPA funds (see Seminar Materials for a listing).
**CASH CONTRIBUTION:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant Entry Fee</td>
<td>5.00</td>
<td>20</td>
<td>100.00</td>
</tr>
<tr>
<td>Electric Table Saw</td>
<td>120.00</td>
<td>1</td>
<td>120.00</td>
</tr>
<tr>
<td>Video Cassettes</td>
<td>4.15</td>
<td>6</td>
<td>25.00</td>
</tr>
<tr>
<td>Apiculture Literature</td>
<td>7.50</td>
<td>20</td>
<td>150.00</td>
</tr>
<tr>
<td>Plastic</td>
<td>3.00/m2</td>
<td>16m2</td>
<td>48.00</td>
</tr>
<tr>
<td>Cement</td>
<td>2.50/sac</td>
<td>18</td>
<td>45.00</td>
</tr>
<tr>
<td>Nails</td>
<td>0.50/kg</td>
<td>14 kg</td>
<td>7.00</td>
</tr>
<tr>
<td>Wood</td>
<td>105/m3</td>
<td>3.5m3</td>
<td>368.00</td>
</tr>
<tr>
<td>Roofing</td>
<td>2.60/leaf</td>
<td>70</td>
<td>182.00</td>
</tr>
<tr>
<td>Lut</td>
<td>15.00/truck</td>
<td>3</td>
<td>45.00</td>
</tr>
<tr>
<td>Sand</td>
<td>17/truck</td>
<td>2</td>
<td>34.00</td>
</tr>
<tr>
<td>Sobas</td>
<td>40.00</td>
<td>2</td>
<td>80.00</td>
</tr>
<tr>
<td>Transports</td>
<td>-</td>
<td>-</td>
<td>210.00</td>
</tr>
<tr>
<td>Guttering</td>
<td>6.60/leaf</td>
<td>8 leaves</td>
<td>53.00</td>
</tr>
<tr>
<td>Food</td>
<td>-</td>
<td>-</td>
<td>283.00</td>
</tr>
<tr>
<td>Electrical Supplies</td>
<td>-</td>
<td>-</td>
<td>64.00</td>
</tr>
<tr>
<td>Gas</td>
<td>10/tank</td>
<td>3</td>
<td>30.00</td>
</tr>
<tr>
<td>Plywood</td>
<td>8.6/piece</td>
<td>8 pieces</td>
<td>69.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>2401.00</strong></td>
</tr>
</tbody>
</table>

*Line Explanation:*

Participant Entry Fee: $5/person (payable by last seminar)

Electric Table Saw: purchased by Petru Arhip in August 2002 for the workshop


Apiculture Literature: donated by the Association

Plastic: built into the product collection point for the border under the roof overhang

Cement: poured into the floor at the product collection point

Nails: built into the product collection point and workshop
Wood: built into the product collection point and workshop
Roofing: built onto the product collection point
Lut: built into the product collection point and workshop
Sand: built into the product collection point and workshop
Sobas: built into the product collection point and workshop
Transports: used in transporting all materials from Chișinău
Guttering: built onto the product collection point
Food: in lieu of payment for services performed
Electrical Supplies: built into the product collection point and workshop
Gas: used for cooking during construction
Plywood: used during construction of the ceiling

IN KIND CONTRIBUTION:

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hives</td>
<td>36.25</td>
<td>4</td>
<td>145.00</td>
</tr>
<tr>
<td>Honey Extractor</td>
<td>79.00</td>
<td>1</td>
<td>79.00</td>
</tr>
<tr>
<td>Wax Extractor</td>
<td>86.00</td>
<td>1</td>
<td>86.00</td>
</tr>
<tr>
<td>Solar Wax Extractor</td>
<td>38.00</td>
<td>1</td>
<td>38.00</td>
</tr>
<tr>
<td>Bee Vail</td>
<td>2.50</td>
<td>1</td>
<td>3.00</td>
</tr>
<tr>
<td>Coveralls</td>
<td>5.00</td>
<td>1</td>
<td>5.00</td>
</tr>
<tr>
<td>Smoker</td>
<td>3.10</td>
<td>1</td>
<td>3.00</td>
</tr>
<tr>
<td>Hive Tool</td>
<td>2.30</td>
<td>1</td>
<td>2.00</td>
</tr>
<tr>
<td>Queen Cages</td>
<td>5.00</td>
<td>3</td>
<td>15.00</td>
</tr>
<tr>
<td>Labor</td>
<td>2.08/hr</td>
<td>11/15.3 hrs</td>
<td>350.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>726.00</strong></td>
</tr>
</tbody>
</table>
**Line Explanation:**

Hives: Traditional and Langstroth hives donated by the Association

Honey Extractor: 3-frame extractor donated by the Association for the product collection point and seminar demonstrations

Wax Extractor: donated by the Association for the product collection point and seminar demonstrations

Solar Wax Extractor: donated by the Association for the product collection point and seminar demonstrations

Bee Vail: donated by the Association for seminar demonstrations

Coveralls: donated by the Association for seminar demonstrations

Smoker: donated by the Association for seminar demonstrations

Hive Tool: donated by the Association for seminar demonstrations

Queen Cages: donated by the Association for seminar demonstrations

Labor: used in building the product collection point and workshop by hired labor and specialists

**PROJECT BUDGET**

<table>
<thead>
<tr>
<th>N</th>
<th>Budget category</th>
<th>%</th>
<th>SPA</th>
<th>Cash</th>
<th>In Kind</th>
<th>Partnership</th>
<th>Total for Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Personnel</td>
<td>5</td>
<td>180.00</td>
<td>0.00</td>
<td>350.00</td>
<td>0.00</td>
<td>530.00</td>
</tr>
<tr>
<td>II</td>
<td>Direct costs</td>
<td>8</td>
<td>724.00</td>
<td>100.00</td>
<td>0.00</td>
<td>0.00</td>
<td>824.00</td>
</tr>
<tr>
<td>III</td>
<td>Russia Trip</td>
<td>4</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>435.00</td>
</tr>
<tr>
<td>III</td>
<td>Seminar Materials</td>
<td>38</td>
<td>2743.00</td>
<td>175.00</td>
<td>376.00</td>
<td>357.00</td>
<td>3651.00</td>
</tr>
<tr>
<td>IV</td>
<td>Product Collection Point Materials</td>
<td>29</td>
<td>797.00</td>
<td>2006.00</td>
<td>0.00</td>
<td>0.00</td>
<td>2803.00</td>
</tr>
<tr>
<td>V</td>
<td>Video Materials</td>
<td>3</td>
<td>330.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>330.00</td>
</tr>
<tr>
<td>VI</td>
<td>Workshop Materials</td>
<td>13</td>
<td>1040.00</td>
<td>120.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1160.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>100</td>
<td>5814.00</td>
<td>2401.00</td>
<td>726.00</td>
<td>792.00</td>
<td>9733.00</td>
</tr>
</tbody>
</table>
I. Personnel

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>30.00</td>
<td>4 months</td>
<td>120.00</td>
</tr>
<tr>
<td>Local Consultant</td>
<td>15.00</td>
<td>4</td>
<td>60.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>180.00</strong></td>
</tr>
</tbody>
</table>

_Budget Justification for SPA:_

Manager: to Petru Arhip for time during project

Local Consultants: to specialists during the seminars

II. Direct Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone</td>
<td>12.50</td>
<td>4 months</td>
<td>50.00</td>
</tr>
<tr>
<td>Transportation*</td>
<td>-</td>
<td>-</td>
<td>380.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>7.50</td>
<td>4 months</td>
<td>30.00</td>
</tr>
<tr>
<td>Mail*</td>
<td>-</td>
<td>-</td>
<td>29.00</td>
</tr>
<tr>
<td>Heater</td>
<td>135.00</td>
<td>1</td>
<td>135.00</td>
</tr>
<tr>
<td>Translation</td>
<td>$5/page</td>
<td>20</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>724.00</strong></td>
</tr>
</tbody>
</table>

_Budget Justification for SPA:_

Telephone: for costs of organizing project

Transportation: to finish construction work, move hives and colonies, and for travel to the State Beekeeping School

Electricity: for costs during seminars for heat and light

Mail: to send official documents and find funding through Peace Corps Partnership Program

Heater: for to provide heat throughout the seminars

Translation: English to Romanian
III. Russia Trip

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airline Tickets</td>
<td>225.00</td>
<td>1</td>
<td>225.00</td>
</tr>
<tr>
<td>Food</td>
<td>60.00</td>
<td>1</td>
<td>60.00</td>
</tr>
<tr>
<td>Hotel</td>
<td>150.00</td>
<td>1</td>
<td>150.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>435.00</strong></td>
</tr>
</tbody>
</table>

**Budget Justification for the Peace Corps Partnership:**

Airline Tickets: Air Moldova, mid-March, Chișinău – Moscow (round trip). Necessary for travel to the “Bee and Man” Apiculture Convention to purchase equipment and books for practical training.

Food: Based on an assumption of $20.00 per day

Hotel: Based on an assumption of $50.00 per day
### IV. Seminar Materials

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smokers (Russia)</td>
<td>3.10</td>
<td>30</td>
<td>93.00</td>
</tr>
<tr>
<td>Beekeeping Hats (Russia)</td>
<td>2.50</td>
<td>30</td>
<td>75.00</td>
</tr>
<tr>
<td>Beekeeping Tools (Russia)</td>
<td>2.30</td>
<td>30</td>
<td>69.00</td>
</tr>
<tr>
<td>Books (Russia)</td>
<td>4.00</td>
<td>30</td>
<td>120.00</td>
</tr>
<tr>
<td><strong>Total funds requested from Peace Corps Partnership</strong></td>
<td></td>
<td></td>
<td><strong>357.00</strong></td>
</tr>
<tr>
<td>Plastic Moulds (USA)</td>
<td>23.00</td>
<td>6</td>
<td>150.00</td>
</tr>
<tr>
<td>Presentation Paper</td>
<td>8/packet</td>
<td>4</td>
<td>32.00</td>
</tr>
<tr>
<td>Notebooks</td>
<td>1.00</td>
<td>20</td>
<td>20.00</td>
</tr>
<tr>
<td>Jenter Combs</td>
<td>5.00</td>
<td>65</td>
<td>325.00</td>
</tr>
<tr>
<td>Bee Science Journal</td>
<td>16.00</td>
<td>10</td>
<td>160.00</td>
</tr>
<tr>
<td>Romanian Apicultural Journal</td>
<td>11.00</td>
<td>10</td>
<td>111.00</td>
</tr>
<tr>
<td>Pollen Collector</td>
<td>3.20</td>
<td>25</td>
<td>80.00</td>
</tr>
<tr>
<td>Ready-to-use Hives</td>
<td>33.00</td>
<td>25</td>
<td>825.00</td>
</tr>
<tr>
<td>Bee Families</td>
<td>30.00</td>
<td>25</td>
<td>750.00</td>
</tr>
<tr>
<td>Varoatoz (medicine)</td>
<td>4.00</td>
<td>25</td>
<td>100.00</td>
</tr>
<tr>
<td>Ascoferoz (medicine)</td>
<td>4.60</td>
<td>25</td>
<td>115.00</td>
</tr>
<tr>
<td>Queens</td>
<td>7.50</td>
<td>10</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>Total funds requested from SPA</strong></td>
<td></td>
<td></td>
<td><strong>2743.00</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>3100.00</strong></td>
</tr>
</tbody>
</table>

**Budget Justification for the Peace Corps Partnership:**

- **Smokers:** to be purchased in Russia to complete practical application portion of seminars
- **Beekeeping Hats:** to be purchased in Russia to complete practical application portion of seminars
- **Beekeeping Tools:** to be purchased in Russia to complete practical application portion of seminars
- **Books:** to be purchased in Russia to complete practical application portion of seminars
**Budget Justification for SPA:**

Plastic moulds: to be purchased in the United States for production of wax candles

Presentation Paper: for visual aid throughout seminar presentations

Notebooks: for participant note-taking and record-keeping

Jenter combs: for use by participants for breeding queens at residence

Bee Science Journal: written information for participants

Romanian Apicultural Journal: written information for participants

Pollen Collector: for use by participants at residence

Ready-to-use Hives: traditional woodenware (including 20 deep-frames) for use by participants at residence

Bee Families: for use by 15 seminar participants at residence (1 queen and colony)

Varoatoz: viral bee medication for use by participants at residence

Ascoferoz: bacterial bee medication for use by participants at residence

Queens: for replacement if necessary at project participants’ residences

**V. Product Collection Point Materials**

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate</td>
<td>145.00</td>
<td>1</td>
<td>145.00</td>
</tr>
<tr>
<td>Doors</td>
<td>65.00</td>
<td>2</td>
<td>130.00</td>
</tr>
<tr>
<td>Glass</td>
<td>3.75/m</td>
<td>8.9/m2</td>
<td>33.00</td>
</tr>
<tr>
<td>Linoleum</td>
<td>5.50</td>
<td>40/m2</td>
<td>222.00</td>
</tr>
<tr>
<td>Sub-Floor</td>
<td>19.50</td>
<td>4/m3</td>
<td>78.00</td>
</tr>
<tr>
<td>Paint</td>
<td>3.75</td>
<td>15</td>
<td>56.00</td>
</tr>
<tr>
<td>Brushes</td>
<td>2.00</td>
<td>2</td>
<td>4.00</td>
</tr>
<tr>
<td>Cement</td>
<td>2.60</td>
<td>11</td>
<td>29.00</td>
</tr>
<tr>
<td>Labor</td>
<td>2.08/hr</td>
<td>48 hrs/6 people</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>797.00</strong></td>
</tr>
</tbody>
</table>

x
Budget Justification for SPA:

Gate: one metal gate used as a service entrance and automobile access

Doors: two wooden doors necessary for access to the building and security purposes

Glass: for windows

Linoleum: for floor covering

Sub-Floor: for use with linoleum

Paint: for application on building

Brushes: for application of paint

Cement: to finish the floor

Labor: for install of linoleum by a specialist

VI. Video Materials

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television</td>
<td>225.00</td>
<td>1</td>
<td>225.00</td>
</tr>
<tr>
<td>VCR</td>
<td>100.00</td>
<td>1</td>
<td>100.00</td>
</tr>
<tr>
<td>Coaxial Cable</td>
<td>5.00</td>
<td>1</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>330.00</strong></td>
</tr>
</tbody>
</table>

Budget Justification for SPA:

Television: 21 inch JVC television purchased at XENON on Stephan Cel Mare Blvd. in Chișinău, necessary for visual aids during seminars and clinics

VCR: purchased at “The Underground” on Stephan Cel Mare Blvd. in Chișinău, necessary for visual aids during seminars and clinics

Coaxial Cable: purchased at XENON on Sephan Cel Mare Blvd. in Chișinău, necessary for visual aids during seminars and clinics
### VII. Workshop Materials

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill Press</td>
<td>65.00</td>
<td>1</td>
<td>65.00</td>
</tr>
<tr>
<td>Motor</td>
<td>27.40</td>
<td>1</td>
<td>27.00</td>
</tr>
<tr>
<td>Belt</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>Reductor</td>
<td>13.00</td>
<td>1</td>
<td>13.00</td>
</tr>
<tr>
<td>Base</td>
<td>16.60</td>
<td>1</td>
<td>17.00</td>
</tr>
<tr>
<td>Pulleys</td>
<td>10.80</td>
<td>2</td>
<td>22.00</td>
</tr>
<tr>
<td>Ventilator</td>
<td>34.30</td>
<td>1</td>
<td>34.00</td>
</tr>
<tr>
<td>Ventilator ducts</td>
<td>5.90/piece</td>
<td>6</td>
<td>36.00</td>
</tr>
<tr>
<td>Woodworking tools package</td>
<td>350.00</td>
<td>1</td>
<td>350.00</td>
</tr>
<tr>
<td>Wood</td>
<td>3.00</td>
<td>150/m3</td>
<td>450.00</td>
</tr>
<tr>
<td>Labor</td>
<td>2.08/hr</td>
<td>1 @ 12 hrs</td>
<td>25.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>1040.00</strong></td>
</tr>
</tbody>
</table>

**Budget Justification for SPA:**

- **Drill Press**: for hives and frames
- **Motor**: for use in an electric wire spool
- **Belt**: for use in an electric wire spool
- **Reductor**: for use in an electric wire spool
- **Base**: for use in an electric wire spool
- **Pulleys**: for use in an electric wire spool
- **Ventilator**: for removal of dust
- **Ventilator ducts**: for removal of dust
- **Woodworking tools package**: for hives and frames
- **Wood**: for frames and hives
- **Labor**: for ventilator installation by specialist
APPENDIX 2.9:

MOLDOVAN ASSOCIATION LEGAL FRAMEWORK AND TAXATION INFORMATION

1. Right of association or foundation guaranteed by law?

The right of association is not specifically provided in the Constitution of the Republic of Moldova (there is only a reference to political parties and trade unions (Clause 41 and 42)), but since Moldova ratified both UN Human Rights Declaration and the Council of Europe Convention on Human Rights, these documents have become a part of national legislation.


2. Basic definition

A definition of public associations is provided in Article 1 Paragraph (1) of the Law on PA "A public association is a voluntary, independent, self-governing formation, arising as a result of free and conscious will of citizens, joined together on the basis of common professional and other interests of their members for mutual realization of economic, social and cultural rights; it is not intended to produce financial gain."

The definition of foundations is provided in Article 1 of the LF "Foundation is a noncommercial organization which has no membership and established on the basis of constitutive document by one or by several physical and/or juridical persons possessing property, which is isolated and separated from the property of founders, and which is designed for accomplishing noncommercial objectives prescribed by Statute."

3. Minimum number of founders (Association only)

In compliance with Article 14 (2) "Public associations are founded on the initiative of at least three people and one or several juridical entities - public associations."
4. Main types of association (Association only)

Under Article 5 (1) of LPA, associations can be founded in one of the following organizational-legal forms:

**public movement** (association of natural and/or legal persons (public associations only) that do not have a fixed membership);

**public organization** (membership association of natural and/or legal persons (public associations only), based on a fix membership, founded for the common activity in order to achieve the objectives and goals of the Statute, as well as the protection of their common interests);

**public institution** (union of citizens without fixed membership, created to perform certain services, works in the interests of its participants and in order to achieve the Statute goals).

Another distinction is the existence of associations and foundations pursuing activities of public benefit and the ones pursuing mutual benefit. The former are issued a State Certificate by the Certification Commission acting under the auspices of Ministry of Justice.

5. Membership nationality requirements

Foreign citizens and persons without citizenship, living permanently on the territory of the Republic of Moldova can found and be members of public associations with equal rights with the citizens of the Republic of Moldova, if otherwise it is not specified by the legislation of the Republic of Moldova about separate types of public associations. Though, they may not be chairpersons of public association, nor members of control and auditing bodies.

Not less than a half of the members of a foundation council must be citizens of Moldova.

6. Legal personality, and how acquired

Legal competence of the public association as a legal entity arises from the moment of the registration of the Statute of the given association by the authorized state body. The public association that did not register its Statute does not have the legal capacity of the legal entity and represents an informal association of individuals.

From the moment of its registration a foundation acquires the status of juridical entity.
7. Legal capacity

A public association can have in its property any assets (buildings, structures, dwellings, transport, equipment, sports and health property) necessary for material provision of activity, specified by the Statute of the public association excluding structures, which according to the legislation in force or in accordance with the international agreement can be only the property of the state. A public association can have as its property enterprises, publishing houses, organizations, institutions, charitable institutions founded and acquired from the public association’s funds according to its goals specified in the Statute.

8. Statutes

The statute shall provide for the following:

a. organizational and legal form of the association;
b. name of the association;c. legal address of the association and territory, within the limits of which it executes its activity;d. goals and objectives of the associations, methods of achieving them; a period, for which the public association is to be established;e. terms and procedures of enrolment into membership of the association and leaving it (upon fixed membership);f. rights and duties of the public association members (if a fixed membership takes place);g. structure of the public association, a procedure of its founding; exact names, structures, competence and terms of powers of governing, executive and control/auditing bodies of the association, their place of location;h. procedure of statute approval and making amendments;i. sources, procedure of formation and usage of property and other assets; membership fees amount (if a fixed membership takes place); a body, competent to make decisions on procurement, distribution and disposal of property;j. procedure and terms of convocations of general meetings, conferences, congresses;k. forms of participation of the public association in affairs of society and state;l. procedure of formation, status, structure and methods of activity of primary organizations of the public associations;m. main parameters of financial report and a way of its publications;n. procedure of reorganization and termination of activity of the public association.

A statute of a public association may contain a description of the association's symbolics and other provisions relating to the association activity, which do not run counter to the law.
9. Registration requirements

National and international public associations, as well as foundations, are registered with the Ministry of Justice, whereas local public associations are registered by the local public administration bodies. In order to get registered, a public association shall submit its Statute to a registering agency. In order to register a statute of a public association, within one month term from a day of the statute approval, the following documents, a list of which may not be enlarged, shall be submitted to an appropriate government body:

a. an application, signed by all members of a managing body together with their place of residence;
b. two copies of statute;
c. two copies of a protocol of a founding convention (conference) or general meeting, which approved a statute of a public association. A protocol shall contain information on establishing a public association, on approval of its statute, on election of directing and control/auditing bodies;
d. information about founders of a public association: for natural entities - family name, first name, year of birth, place of residence, citizenship (to be attested by their signatures); for a public association - a copy of certificate of state registration of a statute of this association, an extract from a protocol of a meeting of an authorized directing body of a public association with a decision to establish a new public association, and a copy of founding agreement in case of establishing a public institution or a union (association) of public associations;
e. a statement of a citizen, or in case he is dead - a statement of his relatives on an agreement to use a personal name of the citizen in a name of a public association;
f. a decision of a supreme body of a public association on vesting a directing or executive body with right to represent the association in a process of registration;
g. a document, confirming the location of a public association;
h. a bank document, confirming a payment of a registration fee.

Changes and additions to the Statute of the public association are to be registered in the same order and in time when was registered the Statute of the public association. When registering changes and additions to the Statute no fee is paid if changes are caused by the changes of the legislation in force.

Registration of the Charter of the local department, branch of the public association is implemented by the local public administration body on the basis of the presented papers of the local department, branch of the public association, mentioned in part five of the present article, certified by the central governing body of the public association, as well as copies of the certificate about state registration of the Charter of the mentioned public association.

The capacity of the foundation, as legal entity, starts from the moment of its Statutes registration with the authorized state body. The Statutes of the republican, local and
international foundations, of their subsidiaries and representatives, are registered by the Ministry of Justice of the Republic of Moldova.

In order to have the Statutes of the foundation registered, within one month from the date of application submission on registration, the following documents need to be presented, whose list cannot be extended:

a. an application for registration, that contains information on a foundation goals, estimates of assets, necessary to achieve the goals as well as a procedure of creating the assets. The application shall be signed by all members of the foundation council with an indication of a place of residence of each member;
b. two copies of a foundation statute;
c. two copies of an act of establishing a foundation;
d. a bank document, confirming a payment of a registration fee.
e. documents confirming a transfer of property to a foundation;
f. a written agreement of relatives of a natural person in case of using a personal name of the person in a name of a foundation;
g. a document confirming location of a foundation;
h. a document, attesting that a foundation name is correct;
i. a registration paper giving to a foundation a unified identification code for organizations.

Upon registration of representatives, subsidiaries and structural subdivisions of the international foundations, the decision is made on the basis of the foundation Board application to register the subsidiary, representative, by indicating the person representing the foundation in Republic of Moldova, and the foundations statute translated in Moldovan, as well as the documents listed under letters d), g) and h) above.

10. Commercial activity

A public association can carry out its productive-economic and other entrepreneur activity exclusively for the realization of objectives and goals specified in its Statute.

A public association has the right to found enterprises and economic organizations, having the right of the legal person, as well as acquire property complexes, intended for the carrying out scientific, technical, pedagogical, cultural, sports, entrepreneur and other activity allowed by the legislation. Public associations of invalids have the right to establish specialized enterprises in order to employ the labor force of invalids in accordance with the Law on social protection of invalids.

Enterprises of the public association function according to the Law "About entrepreneur activity and enterprises" and in accordance with the Statutes of the public associations.

The income obtained from productive-economic and other entrepreneur activity of public associations cannot be redistributed between the members (participants) of these associations and are used exclusively for implementation of goals and objectives
specified by the Statute of the public association. It is allowed to use income for charitable goals, even if it is not mentioned in the Statute of the public association.

Enterprises and other economic organizations of public associations introduce payments to the budget in the order and amount specified by the legislation in force.

Public associations and their juridical representatives for productive-economical and other entrepreneur activities are obliged to get licenses for certain kind of activities that require one.

Foundations have the right to carry out economic activity directly connected with the achievement of their statutory purposes.

Any other economic activity of a foundation shall be carried out through its own enterprises which have a status of corporate body. The enterprises established by a foundation shall carry out their activities in conformity with the Law on Entrepreneurship and Enterprises, Law on Foundations and Articles of a Foundation.

The enterprises established by a foundation shall transfer payments to the budget in accordance with the procedure determined by legislation.

The enterprises set up by a foundation shall register in accordance with the established procedure. Foundation and enterprises set up by it must obtain licenses for activities to be licensed.

11. Disposal of assets on liquidation

Termination of the activity of a public association can be implemented by means of:

a. reorganization (affiliation, division, separation, transformation); or
b. liquidation.

The order of the termination of the activity of a public association is specified by the founder (founders) and is defined in the Statute of the public association.

Upon voluntary liquidation of the organization, property remained as a result of the liquidation of the public association, after satisfying the demands of creditors is directed to objectives, specified in the Statute of the public association, in the absence of the corresponding parts in the Statute of a public association - it is directed to goals, specified by the decision of the convention (conference), general meeting about the legislation of the public association, or by the decision of the court. If an issue on how to use remaining assets is not solved in the decision on liquidation issued by the congress or general assembly of the public association, these assets, after creditor requirements' satisfaction, are directed by a public associations' governing body to implement statute goals. A decision on utilization of remaining assets is published in press.
Upon dissolution of a public association based on court ruling, property of the liquidated public association can become, without return, the property of the state after satisfying the demands of creditors.

The remained property after the liquidation of the Foundation and repayment of debts shall be used in compliance with the Foundation Statute; in the event that the Statute does not include corresponding provisions, the property shall be used for the implementation of statutory objectives of the Foundation. The said property shall be used by means of its transfer to a similar organization in terms of statutory objectives foundation in accordance with the decision on liquidation. The decision concerning the use of the remained property shall be made public.

12. Indirect tax - Specific exemptions or privileged rates

Neither public associations nor foundations are entitled to VAT privileges. Exceptions are cases subject to intergovernmental agreements on technical assistance, in which case the decision to levy VAT is made by the Ministry of Finance. Other possibilities are ruled out.

As for customs duties, public associations are exempted from custom duties and other taxes while carrying out export-import operations provided the shipped goods come through intergovernmental agreements of technical assistance (this specifically refers to World Bank, TACIS, USAID).

Local public administration bodies decide on local taxes (e.g. rent fees for premises in municipal property), however, individual privileges are not allowed.

Tax for the territory arrangement is binding for non-commercial organizations and is equal 10% of the minimal salary for each employee.

13. Direct tax - general position

Only public benefit associations and foundations are entitled to exemptions from the income tax. The decision is taken by the Ministry of Finance based on the list of public benefit organizations issued by the Certification Commission under the Ministry of Justice.

Real estate tax is regulated in Title VI of the Fiscal Code and stipulate exemptions from the Real Estate Tax for some non-commercial organizations, such as societies of the blind, deaf and handicapped persons, as well as institutions founded by them to pursue bylaws goals of these societies.

There are no exemptions from other taxes for public associations.
14. Recognition of associations/foundations for tax purposes

Ministry of Finance recognize as being eligible for income tax exemptions only public benefit associations and foundations. Certification Commission of the Ministry of Justice is the body issuing State Certificates.

15. Criteria for recognition

Public benefit organizations which meet the following requirements:

a. are registered or founded in compliance with the law, and specify in their bylaws, regulation, or another document the scope of work of the non-commercial organizations and its status as a noncommercial organization, as well as interdiction to distribute the income or property among organization members, founders or private persons, including during reorganization and liquidation process of the non-commercial organization;

b. the entire income from the bylaws activity is spend to pursue bylaw goals;

c. use no part of their property or income in the interest of an organization member, founder, or private person;

d. support no political party, electoral bloc or candidate running for public office and spend no part of the income or property to finance them; are exempted from income tax. No other public associations or foundations are entitled to income tax exemption.

16. Criteria for obtaining tax concessions

The only criteria for obtaining public benefit status (and consequently getting tax concessions) is for an organization to function for at least six months and to have no arrears to the state budget, proved by a letter from the State Fiscal Inspectorate.

17. Gifts to associations/foundations

Article 36 of the Tax Code defines donations for charitable purposes as gifts and donations in favor of organizations issued public benefit certificate. Under the same article, resident donors are entitled to deduction of any donations made for charitable purposes during the current fiscal year, provided these do not exceed 7% of the taxable income. Donations for charitable purposes shall be deducted provided proper evidence is presented. A donor declares donations to the Ministry of Finance that fixes the fact in order to decrease taxation of the donor for an appropriate amount.

There are no clear provisions regarding donations to non-resident associations or foundations.

APPENDIX 3.1:

BEESARABIHN HISTORY

Bessarabia, named so in 1812 after Russian Prince Bessarab, is a historic region of southeastern Europe (between the Prut and Dniester rivers north of the Black Sea). This region generally corresponds to the present-day Republic of Moldova. In the Middle Ages Bessarabia belonged to the principality of Moldavia (culturally Romanian), generally comprising the principality’s eastern half. Moldavia was ruled by the Ottoman Empire from 1513 to 1812, until the Russo-Turkish War (1806-1812) led to annexation of the area by the Russian Empire. For a brief period (1856-1878) southern Bessarabia was returned to Moldavia, then part of a newly formed Romanian state, after 1862. In 1878 Russia re-annexed southern Bessarabia from Romania. In 1918, after the breakup of the Russian Empire, Bessarabia was reunited with Romania. In 1940, during World War II, troops of the Red Army reoccupied Bessarabia yet again. The larger part of Bessarabia was joined to the already existing Moldavian Autonomous Soviet Socialist Republic (ASSR), across the Dniester River, to form the Moldavian Soviet Socialist Republic (SSR); the northernmost area around Khotin and the coastal strip to the south along the Black Sea became part of the Ukrainian SSR.

APPENDIX 3.2:

MOLDOVAN GOVERNMENT’S OFFICIAL STATEMENT ON AGRICULTURAL DEVELOPMENT

“The [Moldovan] government gives highest priority to attract foreign investment into the following sectors: energy, agriculture, transport, social commodities, and construction and building materials” (US State Department, 1999).

“Development of agricultural and food industry is also viewed as one of the priority directions of the national strategy for the future, taking into account the specific favorable conditions of the country, i.e. natural and social/economic environment, historical traditions and experience accumulated by the rural population of Moldova. To overcome the crisis faced by this sector there is an urgent need to develop policies centered on the modernization and reorientation of this sector to be driven by efficiency and competitiveness on foreign and domestic markets. Should these key problems of the agricultural sector be left unsolved, it will become impossible to rehabilitate and achieve a general economic growth in the country” (UNDP Moldova, 2002).

“The goal related to further promotion of a sustainable growth in agricultural sphere is to create a competitive private-driven sector. This goal can be accomplished by implementing policies regulating the development of agriculture and by supporting the agrarian institutions centered on the development of a market-driven rural economy. To accomplish these objectives it is necessary to undertake concrete actions aimed at updating the previous policies, re-evaluating the current policies so that they become consistent with the global economic situation, ensuring the advancement to a package of market-oriented political instruments as well as to an appropriate system to support these actions from institutional and legal standpoint” (UNDP Moldova, 2002).

APPENDIX 3.3:

LANGSTROTH HIVE INFORMATION

Hive Stand: The hive stand, actually an optional piece of equipment, supports the floor of the hive up off the ground. In principle, this support reduces dampness in the hive, extends the life of the bottom board, and helps keep the front entrance free of grass and weeds. Colonies often are supported on concrete blocks, railroad ties, pallets or logs rather than on commercial hive stands.

Bottom Board: The bottom board serves as the floor of the colony and as a take-off and landing platform for foraging bees. Since the bottom board is open in the front, the colony should be tilted forward slightly to prevent rain water from running into the hive. Bottom boards available from many bee supply dealers are reversible, providing either a 7/8- or 3/8-inch opening in front.

Hive Bodies: The standard ten-frame hive body is available in four common depths or heights. The full-depth hive body, 9 5/8 inches high, is most often used for brood rearing. These large units provide adequate space, with minimum interruption, for large solid brood areas. They are also suitable for honey supers. However, when filled with honey, they weigh over sixty pounds and are heavy to handle.

The medium-depth super, Dadant or Illinois shallow, is 6 5/8 inches high. While this is the most convenient size for honey supers, it cannot be cut from standard lumber sizes efficiently.

The standard shallow-depth super, 5 11/16 inches high, is the lightest unit to manipulate (about 35 pounds when filled with honey). This size has the greatest cost of assembly per square inch of usable comb space.

Section comb honey production is a specialized art requiring intense management. It is not recommended for beginners. Section comb honey supers, 4 5/8 inches high, hold either basswood section boxes or plastic rings and section holders.

Different management schemes are used according to depth of hive bodies found in the brood area of the hive. One scheme is to use a single full-depth hive body, which theoretically would give the queen all the room she needs for egg laying. However, additional space is needed for food storage and maximum brood nest expansion. Normally a single full-depth brood chamber is used only to crowd the bees for comb honey production or when a package, a nucleus colony or division recently has been installed or established. Most beekeepers use either two full-depth hive bodies or a full-depth and a shallow for the brood area. Using hive bodies similar in size allows the interchange of combs between the two hive bodies. Beekeepers who wish to avoid lifting the heavy full-depth hive bodies use three shallow hive bodies for the brood nest. This approach is certainly satisfactory, but it is also the most expensive since it requires thirty frames instead of twenty.
Frames and Combs: The suspended comb is the basic structural component inside the hive. Each comb is composed of a wooden or plastic frame that supports a sheet of comb foundation. After the workers have added wax to draw out the foundation, they use the cells for storage of honey and pollen and for brood rearing. Frames come in sizes to fit the various hive-body depths. Frames are 17 5/8 inches long and either 9 1/8, 6 1/4 or 5 3/8 inches high. Each frame consists of a top bar, two end bars, and a bottom bar. Top bars may be either grooved or wedged; bottom bars are split, solid, or grooved. Top bars are suspended on ledges or rabbets in the ends of the hive body. Metal strips in the shape of an acute angle or frame spacers are often nailed on the recess for reinforcement. The shoulders on the end bars may also help hold the frames apart.

The comb foundation consists of thin sheets of beeswax imprinted on each side with patterns of worker-sized cells. There are two basic types of comb foundation, distinguished by their relative thicknesses. Thin surplus foundation is used to produce section comb honey, chunk honey, or cut-comb honey. Thick or heavy foundation should be used in the brood chamber and in frames for producing extracted honey. Thicker foundations often are reinforced with vertical wires, thin sheets of plastic, metal edges, or nylon threads. You should select a foundation according to the type of bottom bar and size of frames you have. Sheets of foundation are secured within the frame with either metal support pins, horizontal wires, and the wedge of the top bar, or with two v-shaped metal wedges. Vertically wired foundation has wire hooks on one side that fit over the wedge of the top bar. Combs may be strengthened further by embedding horizontal wires (28 or 30 gauge) into the foundation with an electric current from a small transformer or by using a spur wire embedder.

Undrawn foundations should be given to only rapidly growing colonies such as a package, swarm, or colony split or to established colonies during a major nectar flow. When foundation is given to colonies during a nectar dearth, the bees will often chew holes in the foundation. Workers build combs as they add wax to the cell base imprints on the sheet of foundation.

Wax is produced by four pairs of glands on the underside of the worker's abdomen. As wax is secreted and exposed to the air, it hardens into flat wax scales. To produce comb, the bees remove the wax scales from the underside of the abdomen with spines located on the hind leg. Then they manipulate the beeswax with their jaws until it is ready to be formed into six-sided cells.

Queen Excluder: The primary function of the queen excluder is to confine the queen, brood rearing, and pollen storage to the broodnest. It is an optional piece of equipment and is used by less than 50 percent of the beekeepers. Many beekeepers refer to queen excluders as "honey excluders," since workers are reluctant to store honey in the supers above them until all available space in the brood chambers is used up.

An excluder is constructed of a thin sheet perforated metal or plastic with openings large enough for workers to pass through. Other signs consist of welded round-wire grills supported by wooden or metal frames.
Frames of honey in the super directly above the brood chambers or comb sections act as a natural barrier to keep the queen down. Properly timing the reversal of brood chambers in the spring with supering and a surplus nectar flow will serve the same purpose as a queen excluder. For this reason queen excluders should not be left on throughout the entire foraging season.

Keeping brood combs separate from honey combs is an important consideration, since brood combs darken with use and will darken the honey. Queen excluders also are used to separate queens in a two-queen system, to raise queens in queenright colonies, and for emergency swarm prevention. An excluder also may help in finding the queen. If you place an excluder between hive bodies, after three days you will be able to tell which hive body contains the queen.

**Inner Cover:** The inner cover rests on top of the uppermost super and beneath the outer telescoping cover. It prevents the bees from gluing down the outer cover to the super with propolis and wax. It also provides an air space just under the outer cover for insulation. During summer, the inner cover protects the interior of the hive from the direct rays of the sun. During winter, it prevents moisture-laden air from directly contacting cold surfaces. The center hole in the inner cove may be fitted with a Porter bee escape to aid in removing bees from full supers of honey.

**Outer Cover:** An outer telescoping cover protects hive parts from the weather. It fits over the inner cover and the top edge of the uppermost hive body. The top is normally covered with a sheet of metal to prevent weathering and leaking. Removal of the outer cover, with the inner cover in place disturbs few bees within the hive.

APPENDIX 3.4

PRODUCT PRICE LIST

HONEY:

Wholesale maximum- 30 lei ($2.15)/kg

Wholesale minimum- 15 lei ($1.07)/kg

Retail- 50 lei ($3.59)/kg

Note: Prices dependent upon crop source from which product is derived. MDL/US$ (2003): 13.22 (end of year), 13.94 (average) (CIA, 2002). 1 kg equals 2.205 lbs, conversely, 1 lbs. equals .4536 kgs. Current domestic prices (May 2003) as observed in Chișinău (Green Hills Nistru, the central agricultural market, and wholesalers) for apicultural produce.

BEESWAX:

Maximum- 45 lei ($3.23)/kg

Minimum- 25 lei ($1.79)/kg

Note: Prices dependent upon quality and color. MDL/US$ (2003): 13.22 (end of year), 13.94 (average) (CIA, 2002). 1 kg equals 2.205 lbs, conversely, 1 lbs. equals .4536 kgs. Current domestic prices (May 2003) as observed in Chișinău (Green Hills Nistru, the central agricultural market, and wholesalers) for apicultural produce.
APPENDIX 3.5

LANGSTROTH SUPER PRICE LIST

ONE FULL-DEPTH LANGSTROTH SUPER (including 9 full-depth frames)

<table>
<thead>
<tr>
<th>Parts</th>
<th>Dimension</th>
<th>Quantity</th>
<th>Approximate Board Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-depth super</td>
<td>9 5/8 x 16 1/4 x 19 7/8</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Top Bars</td>
<td>3/4 x 1 1/16 x 19</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Bottom Bars</td>
<td>3/8 x 3/4 x 17 5/8</td>
<td>9</td>
<td>.75</td>
</tr>
<tr>
<td>Deep Sides</td>
<td>3/8 x 1 3/8 x 9 1/8</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>9.75</strong></td>
</tr>
</tbody>
</table>

**Total Cost**

| Wood           | $6.14               |
| Beeswax       | $8.40               |
| Bee Wire      | $1.10               |
| **Total Cost**| **$15.64**          |

TOTAL WOOD COST: BOARD FEET (BF); Unit of measure for logs and lumber. One board foot is equivalent to a piece of wood 1 inch thick, 12 inches wide, and 12 inches long (ft^2=BF); Parts, dimensions, and quantity: Seiling, P., *Bee Hive Construction*, 1999.; From appendix 3.4, 150m² wood purchased at $3/m²; $3/10.76 ft²/m² = $0.28/BF; Labor: $2.08/hour, 6 hives can be constructed by 1 worker per hour (10 minutes/hive), $2.08/6 hives = $0.35; TOTAL: $6.3/BF. $0.63 X 9.75BF = $6.14.

TOTAL BEESWAX COST: 10 full-depth (8 1/2” X 16 3/4”) unwired brood sheets purchased at $.74/sheet ($129/175 sheets). <http://www.betterbee.com.html>; Labor, 20 full-depth frames can be constructed by 1 worker per hour (3 minutes/frame), $2.08/20 frames = $0.10/frame; TOTAL: $0.84/frame. $0.84/form X 10 forms = $8.40.

TOTAL BEE WIRE COST: 5’ wire/full-depth frame @ $0.01/foot <http://www.betterbee.com.html>; Labor $.10/full-depth frame; TOTAL: $.11/full-depth frame. $.11 X 10 frames = $1.10.

ONE SHALLOW-DEPTH LANGSTROTH SUPER (including 9 shallow-depth frames)

<table>
<thead>
<tr>
<th>Parts</th>
<th>Dimension</th>
<th>Quantity</th>
<th>Approximate Board Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow-depth super</td>
<td>5 11/16 x 16 1/4 x 19 7/8</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Top Bars</td>
<td>3/4 x 1 1/16 x 19</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Bottom Bars</td>
<td>3/8 x 3/4 x 17 5/8</td>
<td>9</td>
<td>.75</td>
</tr>
<tr>
<td>Deep Sides</td>
<td>3/8 x 1 3/8 x 9 1/8</td>
<td>18</td>
<td>.75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>7.5</strong></td>
</tr>
</tbody>
</table>

**Total Cost**

| Wood           | $4.73               |
| Beeswax       | $4.20               |
| Bee Wire      | $.55                |
| **Total Cost**| **$9.48**           |

TOTAL WOOD COST: BOARD FEET (BF); Unit of measure for logs and lumber. One board foot is equivalent to a piece of wood 1 inch thick, 12 inches wide, and 12 inches long (ft²=BF); Parts, dimensions, and quantity: Seiling, P., *Bee Hive Construction*, 1999.; From appendix 3.4, 150m² wood purchased at $3/m²; $3/10.76 ft²/m² = $0.28/BF; Labor: $2.08/hour, 6 hives can be constructed by 1 worker per hour (10 minutes/hive), $2.08/6 hives = $0.35; TOTAL: $6.3/BF. $0.63 X 9.75BF = $6.14.

TOTAL WAX COST: 5 full-depth (8 1/2” X 16 3/4”) unwired brood sheets purchased at $.74/sheet ($129/175 sheets). <http://www.betterbee.com.html>; Labor, 20 full-depth frames can be constructed by 1 worker per hour (3 minutes/frame), $2.08/20 frames = $0.10/frame; TOTAL: $0.84/frame. $0.84/form X 5 forms = $8.40.

TOTAL BEE WIRE COST: 5’ wire/full-depth frame @ $0.01/foot <http://www.betterbee.com.html>; Labor $.10/full-depth frame; TOTAL: $.11/full-depth frame. $.11 X 5 frames = $1.10.
REFERENCES

Chapter 1:


Chapter 2:

“Severe Winter Killed 30% of Bee Populace in Moldova.” Basa-Press. 4/15/2003.
<http://www.azi.md/news?ID=23723.html>

Chapter 3:


Chapter 4: