COMMODITY SYSTEMS ASSESSMENT METHODOLOGY

for Value Chain Problem and Project Identification

A first step in food loss reduction

By Jerry La Gra

Co-authors:

Lisa Kitinoja

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Foreword

The global population is expected to reach 9 billion by the year 2050. As a result, food production will need to increase by 60 percent in order to meet future food demand. However, increasing production will not suffice if one third of the food produced for human consumption continues to be lost or wasted. The global fight against hunger must include efforts to avoid food losses (postharvest losses).

Throughout its history, the Inter-American Institute for Cooperation on Agriculture (IICA) has been committed to food and nutritional security in the Americas. One of the Institute's contributions, as stated in its 2014-2018 Medium-term Plan, is "improving institutional capacity to reduce losses of food and raw materials throughout the agricultural chains." As a result, IICA, together with Jerry La Gra (a retired IICA specialist) and Lisa Kitinoja, has created a new edition of the manual entitled "Commodity Systems Assessment Methodology for Value Chain Problem and Project Identification," which features revised and updated content.

The Commodity Systems Assessment Methodology (CSAM) seeks to identify weaknesses throughout agricultural value chains that lead to food losses (postharvest losses) and, at the same time, identify solutions and prepare proposals for improving their efficiency. Use of this methodology by different stakeholders represents the first step toward reducing food losses.

Professionals from different organizations have dedicated years of research and tests in numerous countries to the development of the methodology presented in this manual. Therefore, we proudly present this methodology for application and further development by its users.

Through this methodology, which focuses on reducing losses of food and raw materials, we hope to contribute to improving the efficiency and productivity of agricultural value chains, making them more competitive and sustainable; this, in turn, will benefit the food and nutritional security of countries.

Daniel Rodriguez Saenz
Leader Flagship Project
Competitiveness and sustainability of agricultural chains
for food security and economic development
IICA

Chapter 1

Introduction

Developmental themes and buzz-words that have influenced agricultural development

Agriculture development themes and strategies are defined by international banks and development organizations. These themes evolve over time and tend to highlight what banks and development organizations consider to be priority constraints to agriculture development at particular points in time. Most development banks and aid organizations were formed after World War II when there was a strong push for international development and poverty alleviation. In the 1960s, John F. Kennedy created the Peace Corps and the Alliance for Progress to help develop Latin America and the Caribbean. The first Peace Corps Volunteers (PCVs) were trained in community and integrated rural development and many of them worked with small farmers on micro- sized projects. Those projects that responded to the real needs and capabilities of farmers contributed to sustainable development. Failed projects frequently led to small farmers migrating to urban areas where they often became traders.

The Alliance for Progress helped put the green revolution on the fast track and progress was made in increasing production and productivity of food grains through plant breeding and farm mechanization. By the 1970s success of the green revolution was causing gluts in the agricultural value chains which focused international attention on postharvest handling, infrastructure development, and technology transfer. With a worldwide scarcity of agricultural technologists, development banks and USAID invested millions in training young professionals. Institution building was seen as the way forward and agricultural centers for training house extension officers cropped up in developing countries. Over time, agricultural support services to small farmers began to improve.

In 1973 E.F. Schumacher published the book 'Small is Beautiful' (considered by some to be one of the most influential books since the Second World War). Schumacher's work grew out of his research on village-based economies in England. He argued that the modern economy was unsustainable, that nature's resistance to pollution was limited, and that government efforts should be concentrated on **sustainable development**. He suggested that the "philosophy of materialism" should take second place to the ideals of justice, harmony and health. Like the philosopher Rene Descartes, Schumacher believed that the best way to understand reality was by breaking it down into smaller and smaller components until the problems and their causes were clearly exposed.

By the 1980s the increased production from the green revolution was triggering bottlenecks in transport, storage and processing centers, causing postharvest losses to soar and governments to define new agricultural sector policies. The demand for more and better market infrastructure grew. Governments had access to grants and soft-loans from donors and development banks but were uncertain about the best way forward. The lack of a good understanding of national value chains led to the construction of much infrastructure that proved to be unsustainable over time.

Development organizations like World Bank, Food and Agriculture Organization of the United Nations (FAO), IICA, Ministries of Agriculture, NGOs and consultants engaged young national

professionals many of whom studied abroad and participated in research and the development of innovative research methodologies (e.g. rapid rural appraisals, SWOT analysis, logical framework and problem tree analysis, participatory rural appraisal, value chain analysis and stakeholder analysis, among others.). From the early 1980s, the United States Agency for International Development (USAID), FAO and the International Fund for Agricultural Development (IFAD), among others, expressed their concern with the high levels of postharvest losses occurring in most crops and countries. In 1985 Michael Porter published Competitive Advantage and introduced the **value chain concept**.

From the 1970s and well into the 2000s poverty in farming communities continued to impel rural populations to migrate to cities. By 2007 over 50 percent of the world's population was living in urban areas. While total world population increased over three times (from 2.5 billion in 1950 to more than 7 billion in 2014) the world's urban population increased over five times (from 746 million in 1950 to 3.9 billion in 2014). To meet the growing demand of urban populations for diverse types of food, marketing and merchandising concepts multiplied, value added activities increased and links in the supply chain grew fewer in number but much larger in terms of volume of food handled. By 2011 donors and researchers were once again becoming increasingly concerned with the high levels of postharvest losses.

Over the past 50 years development themes have focused on green revolution, market infrastructure, institution building, training technical resources, market systems, postharvest loss reduction, and food safety issues, among others. These themes are not always in sync with country needs since each country has its own particular set of circumstances (political, institutional, environmental, social, economic and technological). While development organizations prioritize their particular development themes, countries must deal with problems along the complete agricultural value chain (from planting the seed to consumption of food by consumers). To resolve priority problems in the agricultural value chain both donors and countries use the project format. When projects achieve their objectives they contribute to sustainable development; however, most agricultural development projects fail for multiple reasons.

Over the past 50 years international organizations and governments have spent billions of dollars on agricultural development projects with less than desired results. The improvement in the quality of agricultural projects is essential to bring about sustainable agricultural development.

Agriculture project defined

From a development perspective, an agricultural project is an interrelated set of activities starting and ending at specified points in time and aimed at achieving the intended beneficiary's desired results, with a pre-determined quantity of resources. For a project to succeed, the inputs and activities must be sufficient to achieve the project's desired results and a few specific objectives. If the project is well-designed and well-executed difficulties (problems and their causes) will be eliminated and this will contribute to the sustainable development of the project's long term goal.

Why agriculture projects fail: priority pitfalls

In 1973, the Iowa State University Press published a book by William and Elizabeth Paddock titled: "We Don't Know How: An independent audit of what they call success in foreign assistance." The Paddocks found that the information provided in dozens of final project reports they examined did not coincide with the real conditions on project sites they visited in seven countries in Central America and Mexico. They concluded that:

"Development professionals do not know how to carry out an effective economic development program, either a big one or a small one."

"No one knows how – not the U.S. government, not the Rockefeller Foundation, not the international banks and agencies, not the missionaries,"

And, they reached the conclusion that:

"The problem lies in the fact that we do not know that we do not know how. We have no knowledge of our own ignorance."

When information was being gathered in the 1970s/1980s for the first edition of the Commodity Systems Assessment Methodology (CSAM), every country visited in the Caribbean, Central America and South East Asia had stories to tell about failed multi-million dollar agricultural investment projects. The projects were not just of one type but ranged across the whole agriculture sector; including, over exuberance of governments in promoting "grow more crops" that led to gluts; construction of storage facilities of the wrong type or built in the wrong place; sophisticated information systems designed without clear understanding of intended user's needs for information; research programs based more on researchers' interests rather than on farmers' needs; processing and cold storage plants built in the wrong place or to the wrong scale, and planting of fruit orchards of the wrong variety for the existing market. These are just a small sample of failed efforts found in countries in South East Asia and the Americas.

More recently, a case study of agricultural and rural development projects in one geographical region of Guyana, South America, found that of a total of seventy attempts at agriculture development, fewer than ten showed any degree of success. The others just became a faded memory, leaving little more than lessons learned for the occasional researcher or practitioner of agriculture and rural development.

With the improved access to worldwide information on the Internet, it is now much easier to find reference to failed projects; for example: the International Finance Corporation of the World Bank found that only 50% of Africa projects succeed (meaning the other 50% failed) (AP 2007). The International Project Leadership Academy has prepared a list of 101 common causes of project failure (International Project Leadership Academy 2016a). In fact, failed projects are becoming so common there are now special events to identify failed projects. In 2015 the World Bank co-sponsored Fail Fair which celebrates projects that fail as a way of making developers more aware of the pitfalls leading to

their failure. This is an innovative way of educating persons interested in improving the efficiency of development projects.

The rest of this section identifies some of the main **pitfalls** contributing to the failure of agriculture and rural development projects in today's world. People engaged in project formulation, implementation and evaluation should be aware of the following types of pitfalls.

Pitfall #1: Underestimating the role of project beneficiaries.

In any agricultural value chain there are many actors (e.g. farmers, technical and service personnel) and institutions (e.g. ministries, NGOs, donors, banks, corporations) involved. The most important participants are the project beneficiaries, for obvious reasons. The purpose of most projects is to remove the constraints (and their causes) negatively affecting the particular project's intended beneficiaries. Projects tend to fail when they neglect to fully comprehend the conditions, problems, needs and priorities of these beneficiaries. The problems and causes hindering farmers and other rural groups of people are the most often misunderstood.

Project designers often assume they know what the rural folks need and want, but they frequently blunder. According to the International Project Leadership Academy's Catalogue of (project) Catastrophes the classic mistake is "**failure to identify or engage the stakeholders**". A project is considered a failure whenever it does not meet the expectations of its stakeholders.

Pitfall #2: The discipline bias trap.

There is no doubt that humans are biased creatures and they tend to be biased in favor of those areas for which they have the most information and knowledge. Economists look for problems and solutions in areas linked to costs and benefits; agronomists prioritize problems with soil and plant diseases; entomologists focus on insects; weed specialists highlight weed problems, and food technologists and postharvest specialists zero in on constraints caused by improper sorting, cleaning, packing, cooling, transport and processing.

Specialists, given the task of identifying priority problems in a particular food system, nine times out of ten will come up with problems and solutions in their respective fields of expertise. That is understandable and is the reason that project teams must be interdisciplinary. Any project that is designed and implemented with a disciplinary bias will be hamstrung, offering only partial solutions. Such projects have a high risk of failure.

Pitfall #3: The hazards of multi-institutional projects.

If only one institution is included in project design it will likely fail for lack of support from other key institutions. The involvement of more than one institution in a project will probably result in failure due to lack of effective coordination and integration. Working with multiple institutions is

extremely difficult but the success of the project hinges on this. Effective integration of institutions in a development project requires absolute transparency, centralized management of resources, effective and detailed planning, competent management, and a manager with leadership and communication skills. Most projects lack these characteristics, and consequently they fail. Effective project planning can reduce the danger of falling into this trap.

Pitfall #4: The danger of projects having too short a duration.

Some projects have a life expectancy of just one year but most fall into the range of two to three years. Occasionally a three year project will be extended for an additional few years. What determines the length of a project, in theory, is the period of time it takes to implement the programmed activities and achieve the project's specific objectives and desired results. In practice, the length of most projects is determined by the period of time allowed by the donors. The smaller the amount of money the shorter the length of time allowed by donors for implementation. In reality, projects with greater longevity have a much better chance of success. The reason is that project beneficiaries are people, or institutions consisting of people, and changing their habits is a long term process. Even the best projects risk failure if forced by donors to end too soon.

Pitfall #5: The money snare: too little or too much.

The "money snare" comes into play when project designers negotiate with donors. The designer may be asked to downscale the project budget (leaving activities unchanged) to coincide with the money available from the donor. Such an action cripples the project from the beginning since there will be insufficient money to implement the necessary activities to achieve the desired results.

At the other extreme are donors well into their budget year with too much money on hand to be disbursed wisely in the time remaining; however, rather than roll the funds over to the next year (and, heaven forbid, risk their budget being cut the following year) they hurry to spend the money unwisely on weak projects that have not been properly vetted.

Pitfall #6: The "commodity system methodology is too-complex" trap.

Commodity systems have grown significantly more complex over the past 50 years as a result of a much larger urban population; more products and types of products in the food system; increasing types of packaging materials, new marketing channels (internet and social media, etc.) and expanded storage, processing and transportation networks.

However, it is still possible to effectively study any commodity from farm to consumer. In fact, it was for that purpose that the first edition of CSAM was published. Those who get caught-up in "the whole system is too-complex trap" find themselves studying only part of a system, thereby discovering only part of the problem, and consequently, implementing only part of the solution. Decision makers are often in a hurry and quick to claim they cannot afford the time it takes to implement individual

commodity studies over a few months; they then waste several years implementing projects that are doomed to fail because they were poorly designed.

Pitfall #7: Overdependence on readily available information.

Consultants on short term contracts, especially international experts unfamiliar with local conditions, do not have time for primary research and often base their conclusions on available documents found in the host country. Since they are unaware of local history, they may base their research on books and reports that are out of date or contain mistaken facts. Analyzing production and marketing value chains using out of date information and/or erroneous can leads consultants reach the wrong conclusions and to make the wrong recommendations in their reports; information that serves as the basis for future development projects. Information on the causes and quantities of postharvest food losses is usually missing and can only be obtained from on the spot research. Inaccuracies in consultant's reports often lead to weaknesses in project design and ends in project failure.

To minimize the risk of this pitfall, decision makers should compare the total costs (money and quality of information) of hiring consultants with the total costs of using local personnel to research value chains.

Pitfall #8: A chain is only as strong as its weakest link.

Common sense tells us that a necklace with three broken links will not serve its purpose if the jeweler only repairs one or two of the broken links. However, in real life there are thousands of examples of politicians, bureaucrats, professionals, and donors who try to repair just one link in an agricultural value chain that has multiple weak or broken links. They undoubtedly see the broken link they are trying to repair but they don't see the other weak and broken links in the same chain. They don't see them because they are looking in the wrong places, or they only have money to fix one broken link, or they plan to fix one first and then the others later but never get around to the others because governments change.

Another possibility is that the specialist heading up the project identified, for example, the need for cold storage but failed to diagnose weaknesses at other points in the cool chain. Or perhaps he/she did not analyze the faults in farmer organization, take note of the high bank interest rates or recognize the threats from the carambola fruit fly, missing roads, or the weak extension service. The commodity system is more than just one value chain between farm and consumer. It is a complex system of interconnected food chains and support services.

Pitfall #9: We don't know how to prepare a project and we don't know that we don't know how syndrome.

Project formulation can be very easy or quite difficult. The more one knows about the basic problems and their causes at each point in the commodity system the easier it becomes to formulate a good

project, i.e. one that resolves the stakeholder's problems. A commodity system is made up of many sub-systems, each of which affects efficiency. Since there are very few people who understand all the components of any one commodity system it is necessary to use an interdisciplinary or team approach to diagnose the problems and choose the best solutions. An agronomist can deal with the agronomic problems and solutions; the economist may provide technical advice on costs and benefits; the sociologist or anthropologist will consider the social concerns and the farm engineer and food technologist will search for technical problems and solutions. Since institutions and politicians play a critical role in project design and implementation it is necessary to have their participation in all stages.

The first step in project formulation is the diagnosis of the main problems of the intended beneficiaries. Too often this step is bypassed because a political decision maker defines *a priori* what project to formulate. By making such a top-down decision the politician is cutting to the chase, bypassing the diagnostic stage. In so doing he/she is hammering the first nail into the project's coffin. Rather than focusing on the intended project beneficiaries' priority problems, the politician has inserted his/her personal bias. From that point on the technical team will be formulating a project doomed to failure and team members will not know that they do not know what they are doing.

Pitfall #10: Failure to convert problems and their causes into practical activities and objectives.

A project is a set of interrelated activities aimed at achieving desired results and specific objectives that contribute towards the achievement of a more general development goal. Once the costs of the necessary actions to achieve each activity are quantified the total project cost can be estimated. However, to determine the projects necessary actions the problems and their causes must first be described. This process embraces a logical framework that facilitates the design and formulation of realistic projects from the bottom up. It begins with specific problem identification and ends by stating the projects goal and title. The eight important steps in this bottom up process are identified below:

1. Identify and list problems.
2. Describe causes of main problems.
3. Identify and quantify actions needed to eliminate causes of problems.
4. Define projects main activities to achieve desired results.
5. Describe desired results.
6. Define specific objectives.
7. Define project goal.
8. Give project a name.

When donors, government institutions, NGOs, consultants, or other organizations assume they know what the problem is and dictate same to the project design team the bottom-up logical framework is converted into the traditional top-down decision making approach. The end result is usually a failed project. The project will fail because the causes of the real problems were not clearly defined and participation of the intended project beneficiaries was marginalized.

The easiest way to avoid this pitfall is by ensuring that intended beneficiaries are integrated into the process that identifies problems and describes their causes. The value chain problem and project identification methodology described in this document was created for that purpose.

Pitfall #11: Misjudging the importance of quality, place, timeliness and price is costly.

The purpose of production, postharvest and marketing systems (chains and channels) is to deliver a specified quantity of product of a desired quality to a specific place at a specific time for a competitive price paid by the buyer. At each point (link) in the system (chain) the product is affected by physical conditions, temperature, packing materials, means of transport and, most importantly, decisions made by the different product handlers (farmers, technicians, workers, intermediaries, and others). Every decision made by every participant at each link in the chain will impact upon one or more of the following: product quality, place and time of delivery and price of the product. When too many wrong decisions are made by decision makers in any agricultural value chain, postharvest losses increase and product quality and value decrease. During project implementation, decision makers often focus on increasing production, adding value or reducing postharvest losses while overlooking critical components such as policy decisions and food health issues and standards (e.g. certification of aflatoxin levels and quality control measures) that can lead to failed projects.

Pitfall #12: The lack of transparency is the mother of all pitfalls.

In a recent research paper the International Monetary Fund estimates that 2% of global GDP is now annually paid in bribes. The document argues that strategies to fight corruption require transparency, a clear legal framework and a credible threat of prosecution. The paper suggests that public sector corruption siphons off USD1.5 to USD 2 trillion annually from the global economy and much more in stunted economic growth, lost tax revenues and sustained poverty (IMF 2016).

The top ten classical mistakes causing project failures

There are an infinite number of causes of project failures. The twelve pitfalls listed above identify some of them. The shortlist of "classic mistakes" identified through interviews of leaders of failed projects by the International Project Leadership Academy showed that most failed projects fit into two categories: things the project team did poorly and things the team failed to do at all (International Project Leadership Academy 2016b). The ten most common classic mistakes are listed below:

1. **Failure to ask or answer the question: What are we really trying to achieve?**
2. **Failure to establish a decision making structure appropriate to project needs.**
3. **Failure to identify or wholly engage the stakeholders.**
4. **Failure to establish effective communication links between participants in value chain.**
5. **Underestimation of the complexity of the project.**
6. **Making key decisions without identifying or considering alternatives.**
7. **Failure to provide sufficient training of beneficiaries in project management.**
8. **Failure to think ahead and foresee and address potential problems.**
9. **Allowing a pet idea to become the chosen solution without considering options.**
10. **Team members developing individual components before thinking through total system.**

Every participant (institution, ministry, donor, bank, NGO, farmer, intermediary, technician, university, etc.) involved in a commodity system can cause a project to fail or help it to succeed. Every project has its own package of resources, participants and issues that contribute to success or failure. Those projects that use a holistic common-sense approach, involve key participants in decision making, and have adequate resources, longevity and a good communication system, will have a good chance of success; those that do not will have an excellent chance of failure.

A tale of two projects

During the 1st decade of the 2nd millennium two rural development projects with many similarities were formulated, financed and implemented in Guyana, South America: Sustainable peanut production for Amerindian Villages (the peanut project) began in 2001 and ended in 2013; biodiversity & sustainable development of butterfly production in Iwokrama reserve (the butterfly project) began in 2006 and ended in 2010. Each project was implemented in the North Rupununi of Region 9 in

close coordination with international universities, government institutions, NGOs and Amerindian Indigenous communities.

The first three years of the butterfly project were funded by the Darwin Initiative and Warwich University. The fourth and final year was funded by the British High Commission (BHC) and World Wildlife Fund. The five year peanut project was extended for seven years converting it into a 12 year project. Funding for the peanut project was obtained from the USAID Peanut CRSP program, the US Embassy and the Canada Fund. Each project cost was in the vicinity of USD 600,000; all were grant funded, with the exception of in-kind contributions from participating villages.

For the butterfly project the expected results were:

1. Increased awareness and knowledge of butterflies in Iwokrama forest.
2. Scientists with knowledge on butterfly densities, habits and economic value.
3. Village adults and youths educated on importance of butterflies in biodiversity.
4. Butterfly hub established at Fairview producing and exporting butterflies.
5. Sustainable jobs and incomes in the butterfly trade benefiting 5,000 people in 16 villages.

For the peanut project the expected results were:

1. Field trials conducted and best seeding rates and peanut varieties determined.
2. Nutrient needs for peanuts in diverse soil types determined.
3. Small-scale labor-saving devices and machinery obtained and demonstrated.
4. Village farmers trained in peanut production and postharvest technologies.
5. Most favorable economic and social applications for peanuts determined.
6. Seven cottage industries processing and marketing peanut products.
7. Cottage industries supplying school students with daily snacks on a sustainable basis.
8. Seventy women trained in business management and employed in school snack program.
9. At least 35 farmers selling peanuts, cassava and fruit on sustained basis.

The butterfly project achieved its first three expected results to a significant extent. Major outcomes from this initiative include the award of advanced degrees in biology to two Guyanese university students in the UK; the publication of a butterfly farmers guide on rearing methods, and life cycles for common butterfly species, as well as training of several students and farmers in its use; and publication of a field guide butterfly identification manual with the active participation of village leaders and Guyanese students.

Expected result (4) was partially achieved given that a large, round and screened butterfly house with a cement moat filled with water (to prevent predator access to the butterfly collection inside) was constructed. However, this structure proved to be unsustainable and was not predator-proof.

Marketing tests were not made until after the butterfly house was operational. It was only at this point that the managers realized that the five-day marketing window they had to get the pupas from butterfly house to international markets was insufficient, given local road and air service conditions. It was then realized that the butterfly house should have been located closer to an international airport. Following the closing of the project the butterfly house was abandoned and has since been taken over by the encroaching jungle. The butterfly house was the heart of this project and when it died so did the project. The project failed to create one job lasting beyond the end of the project in 2010. The main effect on the 5,000 intended stakeholders in the 16 Amerindian villages was one of frustration from seeing the failure of the project they had so fervently supported.

The peanut project achieved the first five expected results listed above by the end of the first four years; productivity per acre jumped by 50% and annual peanut production increased by 300%, to 1.4 million pounds. However, farmer celebration of the bumper crop lasted only as long as it took them to learn there was a glut of peanuts in the main market in Georgetown and their peanuts could not compete with cheaper imported peanuts. Even though a market study had been carried out, it did not identify a significant weakness in government statistics (two million pounds of contraband peanuts were being smuggled into Guyana annually along the Surinam border to avoid a 7% import duty).

In the fifth year of the peanut project the team managers modified the project to focus on adding value to peanuts for sales in local markets. In 2005 seven cottage industries were established and staff was trained to manufacture peanut butter for the school snack program. By 2007 all the cottage industries were employing personnel and operating at a profit. The remaining four expected results listed above were achieved. When the project ended at the end of 2012, 4,000 nursery and primary school students in 41 villages were receiving daily snacks consisting of a peanut butter and cassava sandwich and a glass of fresh fruit juice. More than one hundred and forty jobs had been created for village women and more than 400 farmers were selling peanuts, cassava and fruit to the school snack program on a small but significant scale. Total income received annually by the women employees and the farmers exceeded USD 137,000 approximately. Management of the school snack program was turned over to local government in January 2013 and as of July 2016 the program has expanded further; providing daily snacks to 4,500 children in 46 villages.

What were the factors that allowed the peanut project to achieve its desired results and what prevented the butterfly project from reaching its desired results?

Peanut project ideas developed from regional discussions with farmers over a two year period prior to project commencement and farmers participated in all decision making. A participatory approach was applied in project proposal development.

The butterfly project was prepared at Warwich University, funded by Darwin Initiative and promoted to local counterparts. A top-down approach to decision making led to the inability to consider other more practical options, a disciplinary biological bias and a shortage of market information.

The peanut team was interdisciplinary from its beginning, including planners, farmers, agriculturists, sociologists, economists and local coordinators, representing more than ten disciplines. The butterfly technical team consisted of mainly biologists and local coordinators, and thus it had a built-in discipline bias.

The peanut project researched the whole production, processing and marketing system from its inception. The butterfly research was focused almost entirely on the butterfly production system.

While marketing was a main constraint for both projects there was a significant difference in how the two projects dealt with their problems. For the butterfly project the marketing constraints were discovered too late, when financial resources were nearly depleted. The problems were too complex to deal with over the short time remaining in the project. The project manager declared the project a success in the final report, specifying that the actual production and marketing of butterflies would be the responsibility of the respective villages. When the peanut project discovered that peanuts could not compete pricewise in the coastal market of Guyana the strategy was switched to one of adding value and marketing peanut butter in the hinterland; to the school feeding program, the army, loggers and miners. This ability to change project strategy mid-way through the project turned potential failure of the peanut project into success.

The peanut project used the CSAM methodology to generate information on the full peanut production, postharvest and marketing system in Guyana and worked with village farmers and processors in formulating the project from the bottom up. The butterfly project failed because its objective was never properly scrutinized with intended stakeholders and institutional partners prior to commencement.

The peanut project used a commodity systems approach in problem analysis and spread its investment over a long period of time (12 years) during which it was able to achieve its specific objectives and most of its desired results. The butterfly project, on the other hand, used a piecemeal approach, with a discipline bias, and was unable to achieve its main outputs. It spent a relatively large amount of money in the first three years and ended the project with poor results in the fourth year. Whereas the peanut project created over 100 jobs, established seven sustainable cottage industries and helped institutionalize a school feeding program, the butterfly project ended in failure since it did not create even a single job for its targeted stakeholders (5,000 people in 16 villages).

The link between projects and sustainable development

Sustainable agricultural development requires that resources (human, physical and financial) be organized in such a way that humans, animals, wildlife and all natural resources are sustained over time to the benefit of all.

During the organizational stage of agricultural development projects diverse participants (stakeholders, beneficiaries, service providers, politicians, government institutions, donors, NGOs, volunteers, among others) make decisions that impact on project results. When right decisions are made in project design

and implementation, the desired project results are achieved and these contribute towards sustainable development. When wrong decisions are made desired project results are not achieved and the project fails, contributing to unsustainable development. Making the right decisions requires access to accurate and up- to- date information. There is a growing consensus that too many agricultural development projects fail. This implies a shortage of accurate decision-making information and weakness in method. It stands to reason that the quality of agriculture development projects could be significantly improved through two specific actions:

Action #1: Ensure that participants in any agriculture development project want the same thing.

Participants in an agriculture development project include the intended beneficiaries, those providing the funding, the key decision makers and members of the interdisciplinary project design team. Therefore it is important to know what each team member (or sub-group) expects or wants from the project. Implementation of the project will be made much easier if all participants are motivated and moving towards the same objectives.

The first questions that should be asked when starting a project are:

- **What do the beneficiaries/stakeholders want?**
- **What do the service providers want?**
- **What do government institutions and politicians want?**
- **What do the donors, NGOs and volunteers want?**

If all participants want similar or complementary things from the project there is scope for formulating and implementing a quality project that will contribute to sustainable development. If not, the scope of the project must be reconsidered and redesigned.

Action #2: Ensure that best quality information is available for decision making.

The high rate of project failures implies that people and institutions engaged in agriculture development lack understanding of product systems and knowledge of the the specific causes of the many problems

impacting value chains. This is not surprising considering the large number of participants engaged in decision making at each component of every product system. It is easy to conclude that things that can and do go wrong in an agricultural value chain are infinite in number. Given such a situation it is not feasible to try to develop an efficient agricultural value chain by trial and error methods or top-down decision making. Agriculture project failure can be linked to technical, social, economic, political, institutional and environmental causes. Consequently, it is imperative that research generate accurate decision making information on these six crucial areas. Herein lies the utility of the Commodity Systems Assessment Methodology (CSAM). CSAM generates the baseline information and knowledge required to understand value chains and crucial for the formulation of quality projects.

Farmers, the main beneficiaries of agricultural projects, tend to be temporarily satisfied when they have access to appropriate technologies, adequate economic returns from product sales, and satisfactory social benefits (Figure 1a). However, long term farmer satisfaction requires integrated development which entails adequate environmental safeguards, efficient institutionalized services and reliable political support (Figure 1b). The door to sustainable rural development opens only after these two sets of conditions have been met.

Figure 1.1. Sustainable development is derived from an integration of farmer's satisfaction and efficient government support services

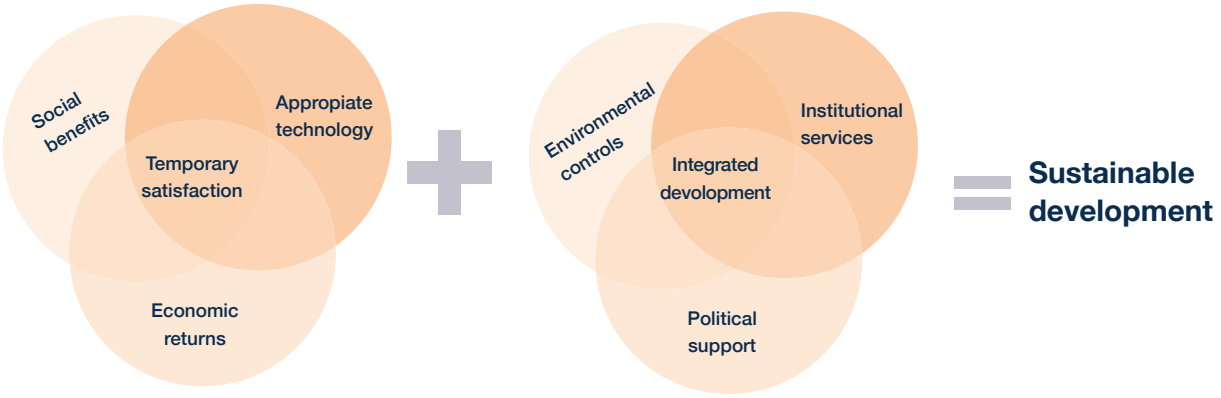


Figure 1a.
Temporary farmer satisfaction

Figure 1b.
Integrated rural development

A little bit about food systems

Food systems begin with pre-production planning and continue from production through postharvest handling to marketing and final consumption. At each step in the chain a variety of persons and institutions make decisions that affect the quantity, quality and value of the product. When decision makers implement agricultural development projects without being aware of the reality at each step in the product chain, they end up with a partial solution that soon becomes a failed project. CSAM provides diverse formats that researchers can use to document conditions at each component of a particular agricultural value chain, thereby generating quality information that decision makers can use in the formulation of efficient development projects. Quality information and effective and efficient project implementation are necessary for sustainable agricultural development.

Chapter 2

Food losses: Why does reduction matter?

This document refers to "food losses" as the reduction in the quality and quantity of food intended for human consumption along the agricultural value chain from harvest prior to the consumption phase which are namely production, postharvest handling, storage, processing, marketing and distribution stages (HLPE 2014; Gustavsson *et al*. 2011).

Around one third of the food produced (some 1.3 billion tons) for human consumption is not eaten. It has been estimated that halving such losses by 2050 would cover a quarter of the gap in food needs worldwide (Lipinski *et al*. 2013). The problem arises in determining which of the losses can be feasibly reduced.

The distribution of **food losses along agricultural value chains** varies by region and product. In mid/high income countries, the highest percentage of losses occurs at the level of distribution and consumption, while in low-income countries losses are higher at the pre-harvest, harvest and postharvest stages (HLPE 2014).

Food losses negatively impact the sustainability of agricultural value chains by causing physical and economic losses, reducing returns on investments, and diminishing food availability and quality (HLPE 2014). According to Kummu *et al*. (2012) one billion additional people could be fed if losses in food crops were halved.

Countries are also affected by natural resources being used in food production and then lost along the agricultural value chains; for instance food loss is associated with about 173 million cubic meters of water consumption per year, representing 24 percent of all water used in agriculture. The amount of land used to grow food that becomes lost has been estimated at 198 million hectares per year, an area roughly the size of Mexico, together with 26 to 28 million tons of fertilizers (Lipinski *et al*. 2013).

According to FAO (2013), global food losses are responsible for approximately 3,300 million metric tons of emissions of greenhouse gases (equivalent carbon dioxide). If this amount of food was lost from a country, it would be among the three largest emitters of greenhouse gases (just behind the United States and China).

Reducing food losses along the agricultural value chains would strengthen access and increase availability of food, generate greater exportable surpluses, and improve efficiency in the use of countries' natural resources.

Food security and nutrition: relationship to food losses

The best known and accepted definition of food security states that: "Food security exists when all persons at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996).

Food security involves meeting four interrelated conditions or dimensions: a) the **availability** or existence of sufficient quantities of food of appropriate quality for all individuals; b) **access,** understood as access by individuals to adequate resources and entitlements for acquiring appropriate and nutritious food consistent with their culture; c) conditions that ensure the **biological use** of food to achieve a state of nutritional well-being where physiological needs are met ; and d) **stability** in both availability and access to adequate food at all times.

By 2015, most countries had met the target set by the Millennium Development Goal to "halve the proportion of hungry people". However, progress has been uneven across countries and regions and some 795 million people still suffer from hunger and nearly one billion still live in extreme poverty. Extreme poverty is concentrated disproportionately in rural areas, and dependence by the poor on agriculture for their livelihoods and the high proportion of their spending on food, makes agriculture vital for the achievement of their food security (FAO *et al*. 2015).

Global agriculture is challenged to increase production by 70% by 2050 and improve accessibility to meet the food demand of a population estimated to be 9 billion people for that year. To meet this challenge, it will be necessary to achieve a more efficient, but environmentally sustainable agricultural production, capable of ensuring availability and access to safe and nutritious food for the entire world population.

As indicated, food produced but not eaten has environmental and economic costs. Food that is lost represents a missed opportunity to improve food and nutrition security for people and mitigate the environmental impacts generated by the agricultural sector.

In 2015, the United Nations proposed the Sustainable Development Goals which were adopted by world leaders. These seek to end poverty in all its forms, reduce inequality, combat climate change and promote environmental protection. The Objective 12: "Ensure sustainable consumption and production patterns" relates to food loss and waste and has as one of its goals: "By 2030, to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including postharvest losses" (United Nations 2016).

Purpose and origin of this manual

This manual describes a methodology for identifying problems and causes leading to food losses (postharvest losses) along an agricultural value chain. It then goes on to describe the process of converting problems to solutions using the project format.

In any attempt to solve problems there are three basic steps:

1. Identification and description of the problem.
2. Identification and formulation of the solution.
3. Execution of the solution.

This manual concentrates on steps one and two; both are interdependent, effective solutions that cannot be prepared without a clear understanding of the problem(s).

While numerous books and training courses concentrate on project identification, formulation, evaluation, and monitoring, relatively little information is available on problem analysis, particularly from the perspective of agricultural value chains.

During university training, students are taught to identify problems using a comprehensive and interdisciplinary approach. However, when students become professionals, they usually find themselves in very narrow positions within public or private sector institutions. Here, they tend to concentrate on very specific problems, making decisions with the limited information at hand. Even within many developmental organizations, there is often a lack of interdisciplinary communication and coordination, leading to projects which fail or achieve only partial solutions.

Most persons involved in project identification and formulation do not have the time, methodology or resources to organize and implement a proper diagnosis of problems, a process which could take several months. Consequently, problem and project identification becomes dependent on literature and secondary data which may lack detail and accuracy.

The key to problem solution is proper problem identification

Using the step-by-step methodology and instruments presented in this manual, professionals will be able to gather accurate information avoiding some of the pitfalls described earlier. Working together as an interdisciplinary team, they will be able to systematically organize their combined knowledge into a comprehensive overview of a particular agricultural value chain. This will produce the necessary information for quality problem and project identification, thereby improving the chances for success of the respective development projects. In this way, local participants will play a more direct role in the determination of those priority projects which get submitted to funding agencies.

A basic assumption made throughout this manual is that human resources are available in developing countries who, when presented with good baseline information on an agricultural value chain, will be able to identify projects and establish realistic priorities. The more complete and accurate the information base, the more likely the right decisions will be made to overcome the identified problems.

Application of this manual

This manual will prove useful to technicians and decision makers interested in rapid appraisals and development from an agricultural value chain perspective.

The application of the methodology requires an interdisciplinary or team approach. It is unlikely that one person will have all the knowledge to properly identify the problems related to pre-production, production, harvest, postharvest, and marketing which make up any agricultural value chain.

This manual can be used in a workshop environment to train professionals, farmers, and others, in the agricultural value chain approach, either from a theoretical point of view, or as an applied, in-service, case study form of training. In the first instance the trainees may be of the same or different disciplines. When the case study approach is used, the trainees should include persons with expertise in multiple disciplines, e.g. economics, agronomy, social sciences, food technology, postharvest, and marketing.

The CSAM methodology will prove useful to planning bodies, ministries of agriculture, marketing boards, corporations, research institutes, and other national institutions seeking systematic improvement within existing agricultural value chains. At the regional or national level, the methodology will prove valuable in the identification and formulaton of agricultural development projects. It will be of particular value in the execution of rapid appraisal exercises, using interdisciplinary teams of national specialists.

A systematic and interdisciplinary application of this methodology will allow a rapid appraisal of an agricultural value chain. It will facilitate the identification of priority problems, causes of problems and alterative project ideas, and permit the ordering of solutions into a development strategy and time frame.

Finally, for the student, this manual will promote a better understanding of the agricultural value chains and the interrelationships between the diverse components and participants. It should serve as a reference document for technical schools and universities teaching agricultural economics, food technology, postharvest handling, agronomy, sociology, and other subjects related to agricultural development.

An important feature of this methodology is that **it permits an analysis of the whole agricultural value chain as well as certain components of interest,** thereby facilitating the identification and prioritization of problems throughout the chain. This leads to the development of more realistic solutions to priority problems. The methodology brings many concepts, instruments and techniques together in one document and presents them as an integrated whole.

Origin of the methodology

The methodology presented in this manual draws upon the work of a great number of specialists and was developed over several years. The original idea for the methodology stems from a study executed in Haiti describing the production and marketing system for beans (*Phaseolus vulgaris*), using an anthropological case study approach (Murray and Alvarez 1973). This case study on bean marketing focused on the diverse participants in a particular agricultural value chain and their decision making processes. It served as a model for a series of marketing studies carried out in Haiti and the Dominican Republic by the Inter-American Institute for Cooperation on Agriculture (IICA).

In 1975, IICA's specialits developed a technological approach for describing a food system, integrating the industrial fIow diagram concept with a step by step case study method (Amezquita and La Gra 1979). Case studies using this technological focus were carried out in the Dominican Republic on white potatoes (*Solanum tuberosum*) and tomatoes (*Solanum lycopersicum*) (SEA and IICA 1976, 1977).

In analyzing the alternative approaches used by anthropologists, food technologists and agricultural economists, it became apparent that none of the three approaches provided a complete picture of an agricultural value chain. However, the integration of the three approaches yielded a comprehensive overview, facilitating problem and project identification.

During the 1970s and 1980s, development planners contributed valuable tools for project identification and design. However, by the mid-1980's, a paradoxical situation seemed to exist and continues today: while methodological instruments were available to study and evaluate food systems, while techniques and methods for project identification and formulation were commonly known and available at the national level, and while competent professionals were available in developing countries, a high percentage of agricultural development projects continued to yield poor results.

Analyses at the country level indicated that one of the reasons for this situation was the lack of integration and coordination among the diverse institutions involved in the development process, and among specialists in the planning and execution of their work programs.

Review of experiences in developing countries showed that many research, training, infrastructure, information, agriculture and other types of projects ended without producing the desired results. Some examples:

- Many governments established information systems without a clear definition of users' needs for information. The raw data collected often went unused and most systems were abandoned when external funding ended.

- Ministries of Agriculture often implement projects to increase production or productivity before markets are identified. This frequently results in higher production costs and lower returns to farmers- the result of increased output, gluts and a corresponding drop in market price.

- Universities and research centers often design and implement research programs without a clear understanding of farmers' problems and needs. This leads to scarce resources being allocated to problems of scientific interest but of low priority to farmers.

An interinstitutional effort

Brought together in 1983 by common interests, the Postharvest Institute for Perishables (PIP) solicited the assistance of IICA to develop a methodology for quantifying postharvest losses. The first joint activity was the application of a modified version of an IICA case study methodology (Amezquita and La Gra 1979) to salad tomatoes and Chinese cabbage (*Brassica rapa*) in Taiwan (La Gra *et al*. 1983) under the sponsorship of the Asian Vegetable Research and Development Center (AVRDC).

From this experience it was concluded that loss assessments should begin with a comprehensive overview of the agricultural value chain. It was further concluded that due to the high cost in time and resources required to accurately quantify losses, such exercises should only be conducted after an initial assessment of an agricultural value chain or when quantitative data is required to evaluate the economic feasibility of introducing changes. From that point on, IICA and PIP decided to concentrate on developing an approach to evaluating agricultural value chains using existing instruments and methods.

In 1985, the ASEAN Food Handling Bureau (AFHB) invited IICA to participate in a workshop on postharvest loss assessment in Manila, Philippines. IICA presented a comprehensive approach for studying systems and identifying those points in the system where food losses were greatest (ASEAN Food Handling Bureau 1985).

In an attempt to develop a comprehensive methodology for analyzing systems, from a postharvest point of view, PIP, AFHB and IICA formed an interdisciplinary team in 1986 to visit ASEAN countries and identify common problems and needs of public and private sector institutions dealing with postharvest problems. As a result of numerous consultations with professionals in five countries, the first version of this manual was prepared (La Gra *et al*. 1987).

In 1987, the University of California at Davis, and PIP at the University of Idaho, with support from USAID, FAO and IICA, combined forces in the organization of a training course for 20 technicians from the Eastern Caribbean. The training concentrated on methods for reducing postharvest losses in perishables, based on an agricultural value chain approach (PIP/UCDAVIS 1987).

The first edition of this manual was compiled in 1988 in draft form. It was field tested in Malaysia at the Malaysian Agricultural Research and Development Institute (MARDI), under the joint sponsorship of MARDI, AFHB, PIP and IICA. During the two week in-service workshop, 24 MARDI professionals, covering 12 disciplines, applied the methodology step-by-step, as presented in Chapter 5 of this manual.

During the 1990s the methodology was utilized by Extension Systems International in a variety of USAID and the US Department of Agriculture (USDA) funded projects in Egypt, India and Indonesia. In 2005 parts of the first edition of this manual were translated into Arabic for systematic training of scientists, extension officers and farmers in Egypt and Lebanon. Since 2008 CSAM has been used by consultants trained by World Food Logistics Organization (WFLO) to organize workshops and training sessions for scientists, university students and farmers around the world. Since 2011 the Postharvest Education Foundation (PEF) e-learning programs have trained more than 500 young people in the methodology, principles and practices. CSAM usage has been expanded by PEF from the original focus on fruits and vegetables to all types of cereals, pulses, roots, tuber crops, and cash crops such as coffee (*Coffea* spp.).

Chapter 3

Introduction to the agricultural value chain

Any agricultural value chain begins with decisions of what to produce and in what quantities. It continues through to the point where the product is consumed. Between these two points, many disciplines, including economics, sociology, political science, health, engineering, agronomy, entomology, pathology, planning, food science, and others, interact to contribute to the understanding and functioning of the system. The functioning and structure of the agrifood systems can be completely understood only if one spends the time to analyze them from the points of view of many disciplines. The methodology presented in this manual, therefore, emphasizes the necessity to include experts from a number of disciplines to ensure as complete an understanding as possible.

The fields of social science, food technology and economics have contributed valuable methods and instruments for analyzing food systems. Given each discipline's particular biases and different objectives, one should not be surprised that their respective research techniques and methods of data presentation vary. For example, when presenting a flow diagram of a marketing channel for a particular product, the social scientist is likely to emphasize the human element (Figure 3.1A), food technologists, the technical aspect (Figure 3.1B), and the economist, the institutional side (Figure 3.1C). None of these methods is necessarily more correct than the others; each is simply a means for facilitating the comprehension of a complex system from a particular perspective.

The three distinct methods, when treated individually, tend to produce a partial view of an agricultural system. However, when the three disciplines are combined for the study of a specific agricultural value chain, they provide a more complete understanding of the system, including better awareness of problems and better clarity of the roles of the diverse participants in the chain.

Researchers, regardless of their discipline, are normally under financial and time constraints and must choose between being very exact, about very little (the case study approach), or taking a broad overview of the subject of interest.

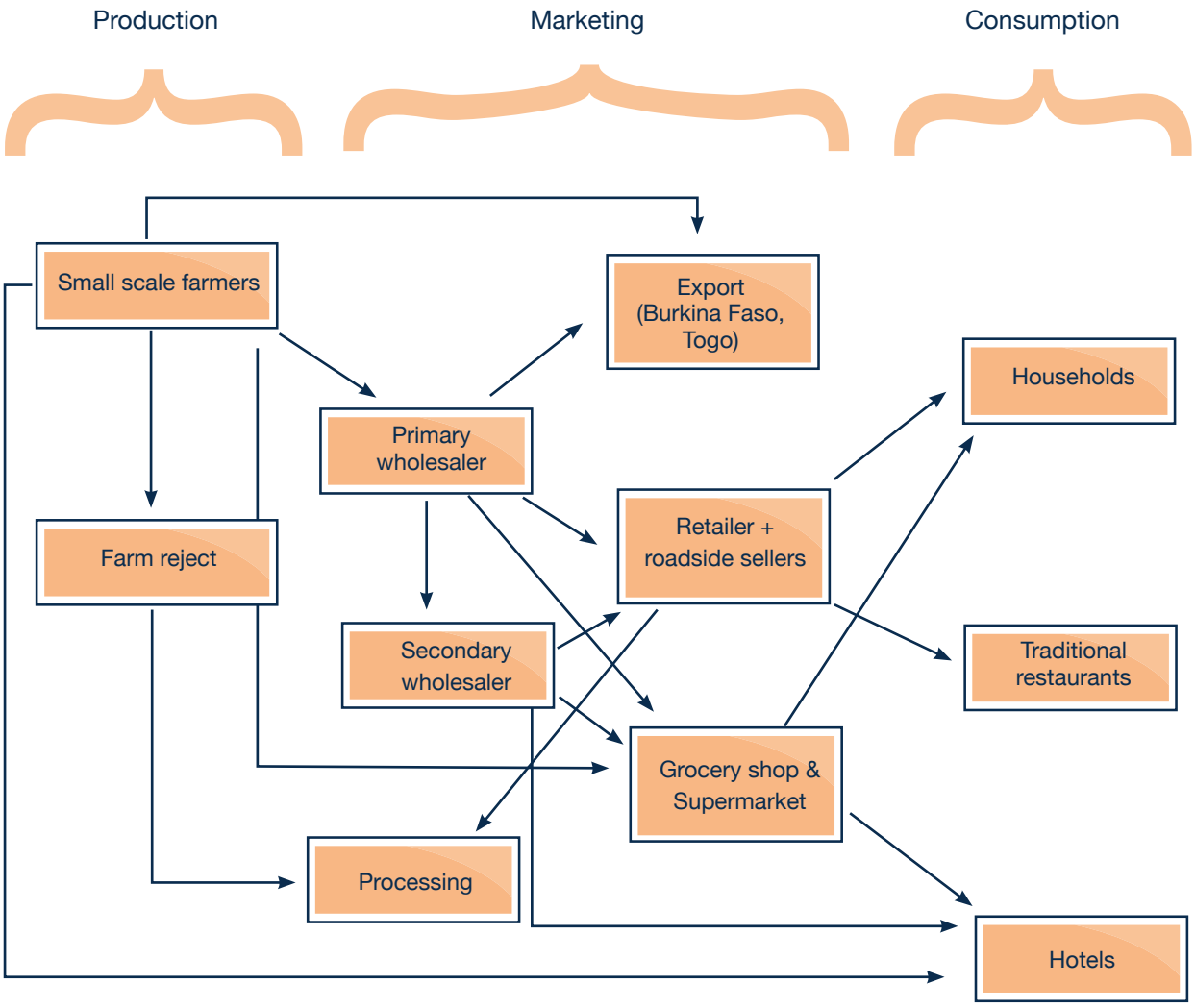
Researchers in all disciplines tend to ask the same basic questions:

Who? What? How? When? Where? Why? and How much?

However, the interpretations of the answers to these questions tend to vary with the discipline. For example, in analyzing why farmers do not apply best cultural practices, agronomists and economists may emphasize the lack of farmer knowledge or the lack of proper inputs while the social scientist may point to the farmers' tendency to minimize risk.

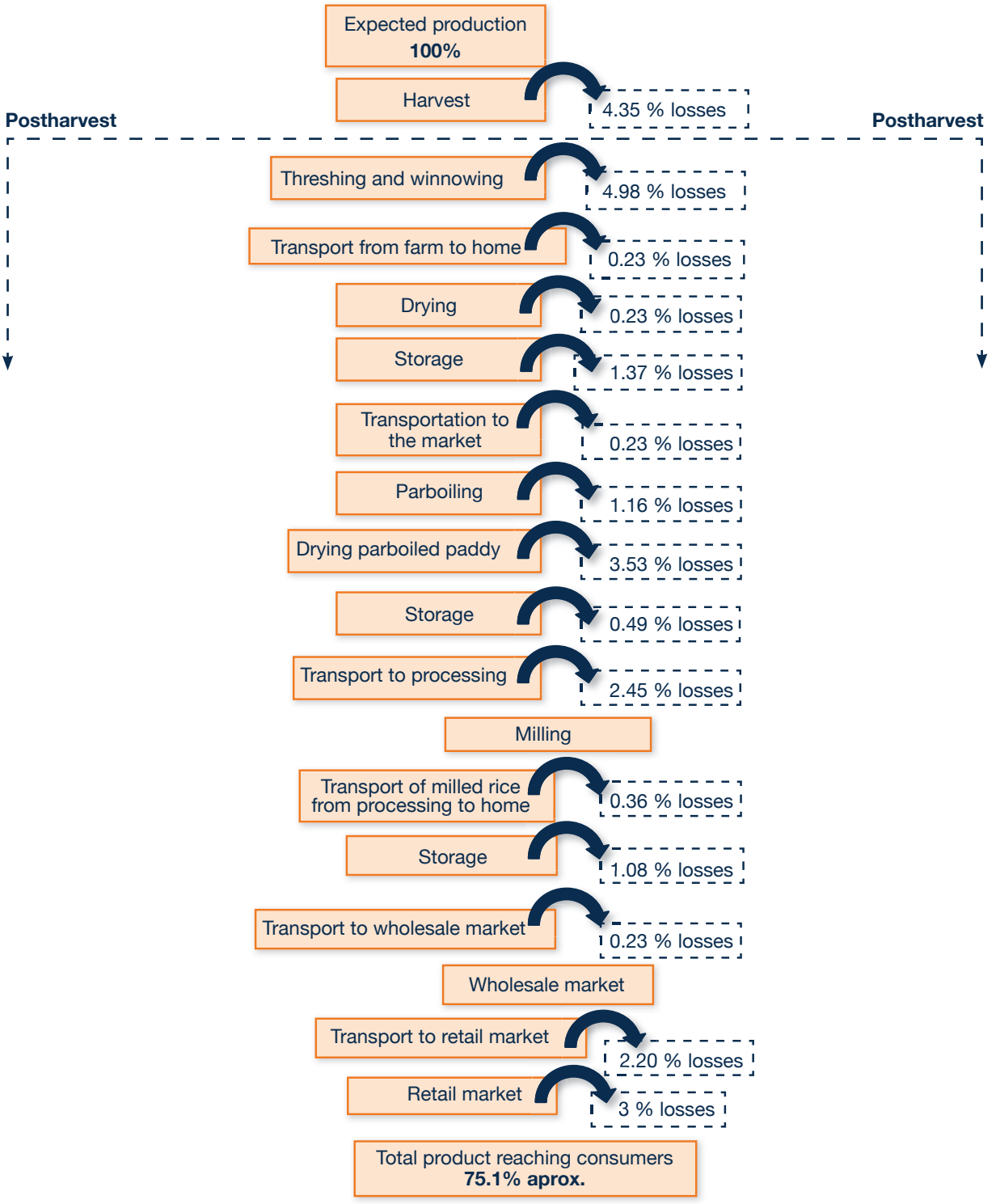
Solutions vary greatly depending upon which explanation is considered the cause of the problem. For example, in the first instance, the solution might call for training programs or the establishment of farm supply outlets; in the second case, emphasis might be given to reducing farmer risk by improving market certainty.

Figure 3.1A. The movement of eggplant (*Solanum melongena*) from producer to consumer in Ghana



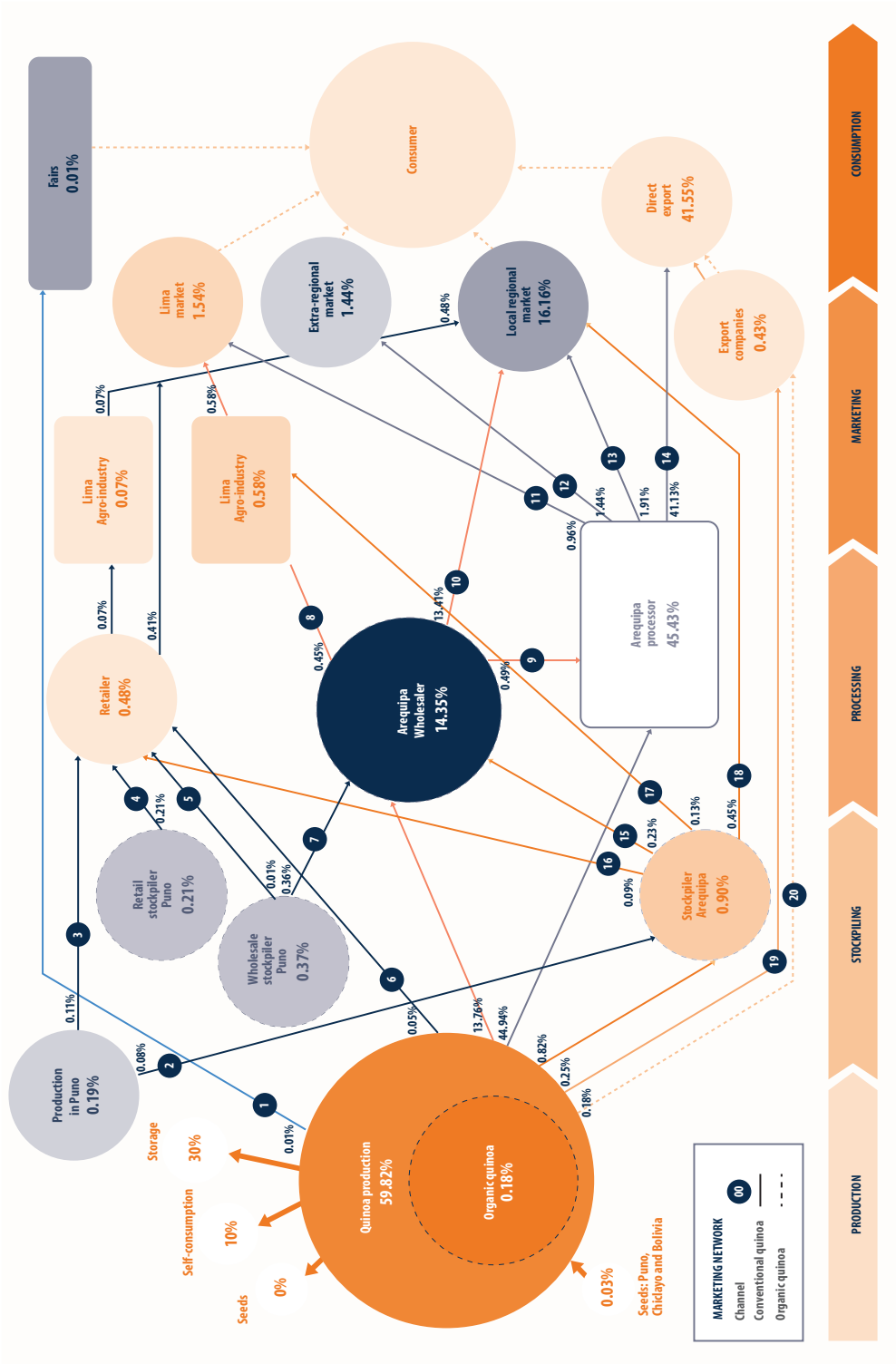
Source: Kitinoja 2010.

Figure 3.1B. Steps in the rice postharvest system *(Oryza sativa)* and percent losses at each step in Nigeria



Source: Based on data of Oguntade *et al*. 2014.

Figure 3.1C. Marketing channels for quinoa *(Chenopodium quinoa)* in Arequipa, Peru



Source: IICA 2015

Often mistakes are due to decision making without adequate situational and problem analysis. In other cases, the cause of the problem may be traced to a particular disciplinary bias, or too little participation from key disciplines or national politics.

While nearly all professionals and decision makers agree on the need for closer cooperation, effective coordination is more the exception rather than the rule. This may be due simply to a shortage of time or it may be as a result of interinstitutional jealousy and competition among professionals. Coordination does occur, however, when each participant has something to gain by cooperating. By using an agricultural value chain approach to problem analysis, participants can be shown that interdisciplinary exchange and coordination will produce better results, thus benefitting the nation and all those associated with a successful project.

Agricultural value chain

From a socio-economic standpoint, an agricultural value chain can be interpreted as a system that brings together socially and economically interrelated actors who participate in coordinated activities that add value to a particular good or service, from its production until it reaches the consumer. Such a system includes suppliers of goods and services, processing, manufacturing, transportation, logistics and other support services, such as financing and government policies. This value-adding connection does not necessarily represent a fair or linear process (Garcia - Winder *et al*. 2009).

At the same time, the agricultural value chain may also be interpreted from an analytical perspective for understanding relations between actors in agriculture and rural areas, from input supply and primary production to final delivery of the products to the consumer, where relations established may be contractual or commercial (Garcia - Winder *et al*. 2009).

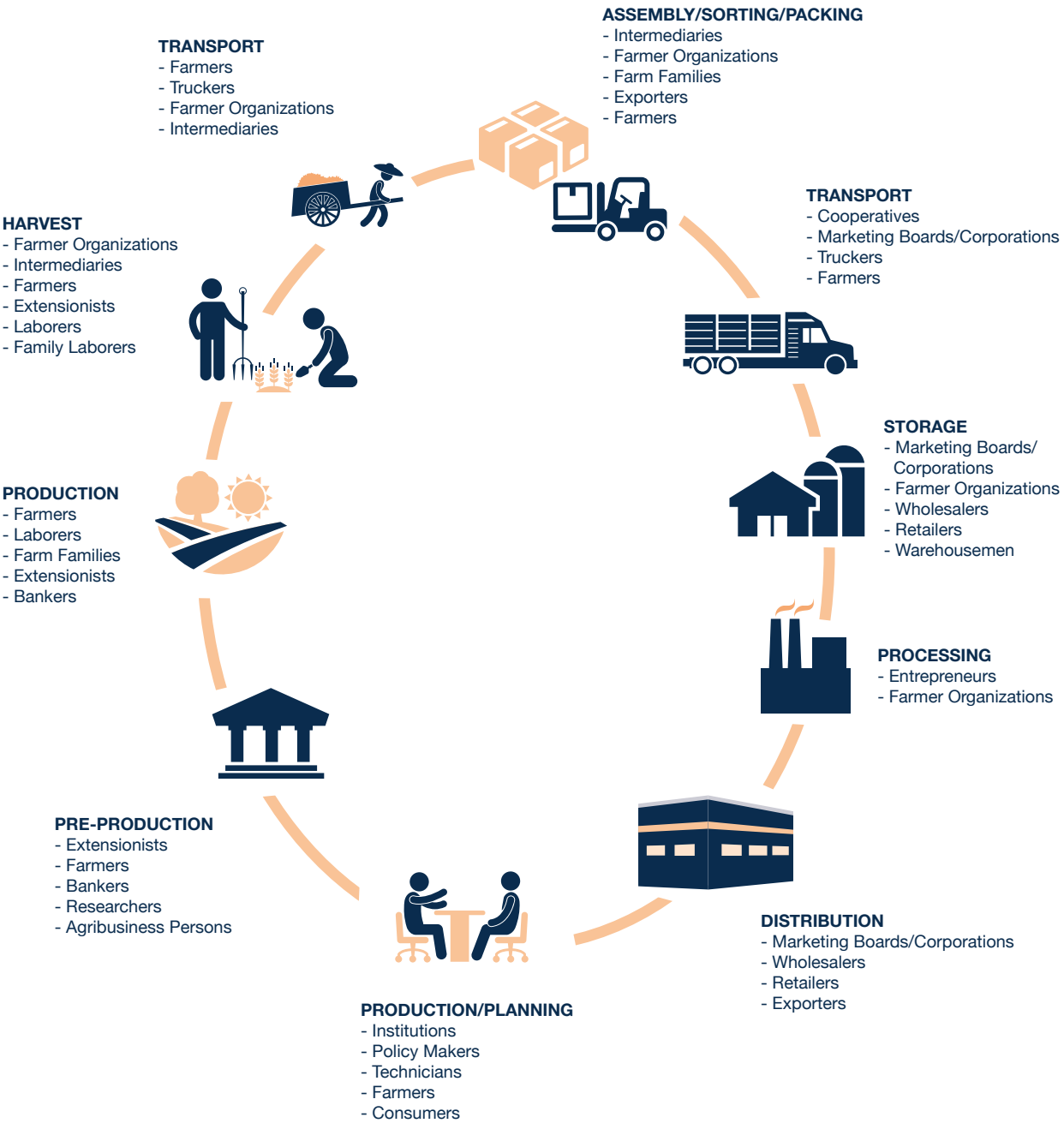
In Figure 3.2, the agricultural value chain is visualized as a circle, extending from production planning (decision making) through production, harvest and distribution to consumers, thereby setting the stage for the next cycle of planning, production, etc. The components depicted in Figure 3.2 are applicable, in general, to all food crops, as well as livestock and fisheries. All of these stages are interdependent since the decisions and actions at one point will affect the quantity, quality and price of the agricultural product at subsequent points.

For all agricultural products there exists a period of information analysis and planning; a stage of preparation for production (pre-production); a period of production; a time for harvest; usually several occasions for transportation; stages where assembly, packaging or selection occurs; one or several periods of short or longer term storage; and a stage where the agricultural product is distributed to the final consumers. The only stage in Figure 3.2 which may be irrelevant for some agricultural products is processing.

The complexity of an agricultural value chain will vary depending on such things as the level of development of the country, geographical location, type crop, time of year, weather, road conditions,

available technology, infrastructure, labor supply, distance to markets, market demand, and others. A systematic approach to evaluating the diverse components of an agricultural value chain is presented in Chapter 4.

Figure 3.2. Participants in an agricultural value chain



Participants in an agricultural value chain

In addition to identifying key points in an agricultural value chain, Figure 3.2 also identifies the different types of participants functioning at the diverse points in most agricultural value chains. These include private sector individuals such as farmers, truckers, and marketing intermediaries, and institutions such as ministries of agriculture, farmers' organizations, and marketing boards that belong to the public sector. Types of participants vary with the agricultural product, country and particular circumstances.

While all participants make decisions which may affect the quality, quantity and price of a particular product in an agricultural value chain, there is a basic difference between the two groups. Decisions made by private sector participants are normally determined by that person's desire to secure economic gain. Decisions made by public sector participants are guided by a number of non-economic motives.

In analyzing a particular agricultural value chain, it is very important to obtain a clear understanding of the diverse participants in the system and their respective roles and motivation. For example, decisions made by politicians to construct infrastructure to satisfy a local constituency may increase the costs of operation and food losses. Ideally, the higher costs (lower economic efficiency) can be justified by social or other remuneration, but often this is not the case.

A private sector, profit-motivated decision can also contribute to inefficiencies in the total system. For example, decisions made by farmers or intermediaries to minimize investments in packaging materials may maximize their individual returns but result in increased postharvest losses at later points in the food system.

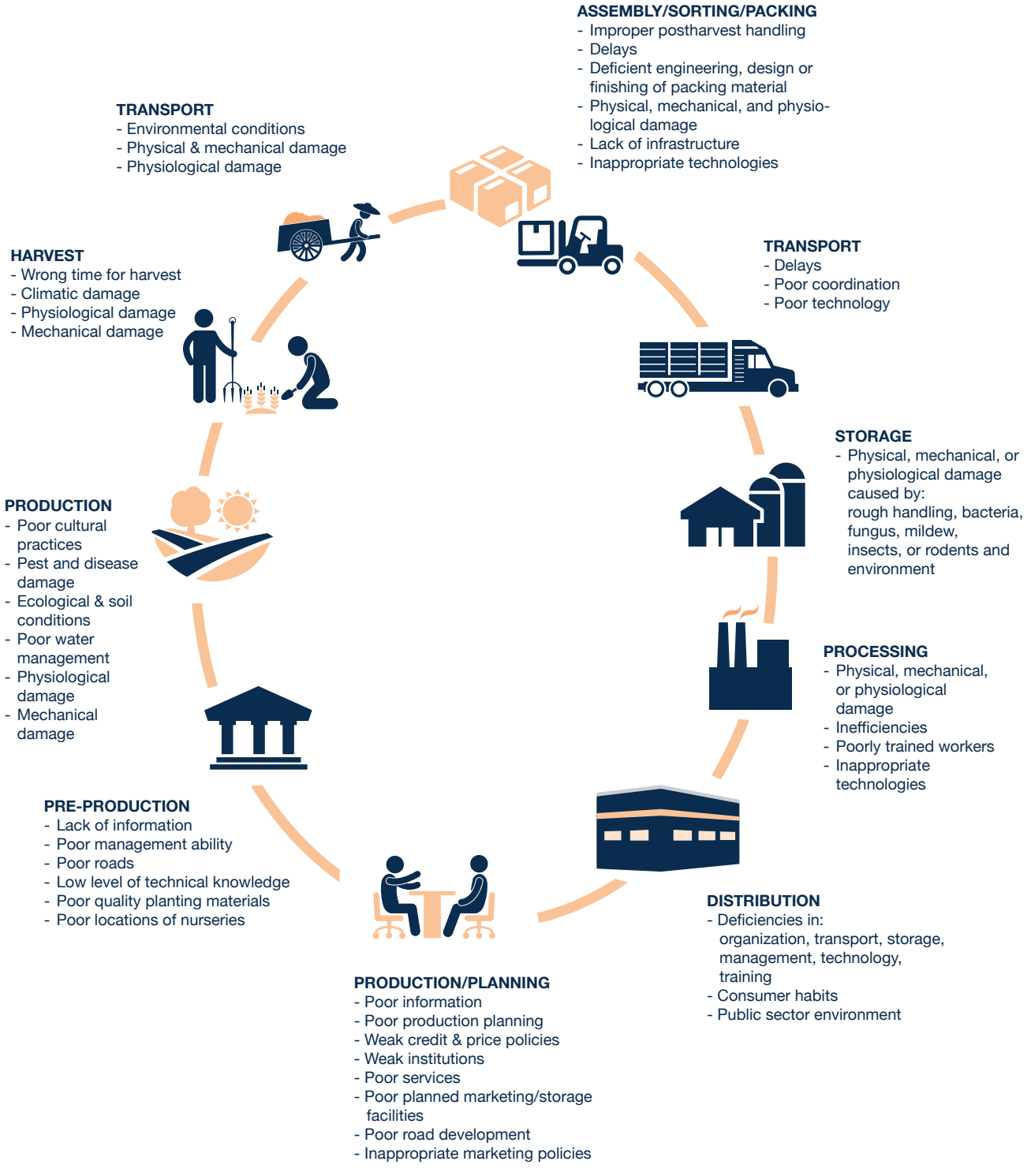
Causes of food losses

Some of the causes of pre and postharvest losses at different points in the agricultural value chain are indicated in Figure 3.3. While possible causes of food losses are infinite in number, some are more common than others.

Food losses may be the result of negative climatic conditions, poor physical facilities, technology used, cultural practices, high costs of farm inputs, low market prices, low motivation of human resources and an infinite number of other causes. It should be noted that these conditions may be specific to a region and time of year. When reporting the results of a study, this detail should be noted to determine if the results can be extrapolated to include neighboring territories.

In most cases, with the exceptions of climatic conditions and catastrophes, the causes of pre and postharvest losses are directly or indirectly related to decisions made by one or more of the diverse participants in the agricultural value chain.

Figure 3.3. Causes of pre and postharvest losses at different points in an agricultural value chain



It is important to stress how wrong decisions or problems occurring at an earlier stage in the agricultural value chain may affect food availability, quality, nutritional value and cost at a later stage. Some examples: A ministry of agriculture may introduce a specific cultivar which later proves to be unmarketable, poor quality planting material which may result in low levels of productivity and/or poor product quality; poor cultural practices may have these same effects, as will poor harvesting practices; physical damage during harvest, transport or packaging will affect product quality further down the line, resulting in both physical and financial losses; physiological damage during storage will not only defeat the purpose for which storage was intended (extending the life and availability of the product) but will also result in greater economic loss as a result of the high storage costs.

Food losses include changes in product quality. Such losses reduce shelf life, lower economic value in the market, produce nutritional losses and affect food safety.

According to Kitinoja (2010), there are four major factors that contribute to consistently high postharvest losses in perishable products:

1- **Failure to use harvest indices:** When horticultural produce is harvested at the proper time, it is at its peek eating quality, market value and potential postharvest life. Produce harvested too early or too late will not display its highest quality characteristics or have its optimum shelf life. Fruits harvested too early may lack time to develop their full complement of nutrients, will not ripen properly and could lack flavor or size. Many vegetables, if harvested too early, will suffer higher rates of water loss, while if harvested too late, may be fibrous or seedy, or be more susceptible to decay.

2- **Inadequate packages:** Poor quality packages such as sacks or baskets will allow the produce to be bruised, squashed and receive abrasions during handling and transport to market, and this damage will allow postharvest decay organisms to gain easy entry. Most postharvest organisms cannot gain a foothold if the produce has not been damaged or allowed to become stressed (from heat or water loss), so avoiding any abrasions, cuts or bruises will immediately reduce decay rates.

3- **Lack of temperature management:** As temperature increases, water loss and respiration rates increase, which immediately leads to weight loss, and farmers or marketers can have 10% less food to sell by the next day. As days pass, and if the ambient temperature is high, the overall quality of fresh produce will quickly decline and its market value will be lower than it was on the day of harvest. A conservative estimate is that the wilted, bruised, squashed or decaying produce will have a 20% to 30% lower market value compared to the same freshly harvested produce.

   These first three sources of postharvest losses might easily add up 30 to 40% in lower value compared to what was estimated at the farm gate, all without even one item of produce having been thrown away. It is well known that better packaging and some form

of cooling are effective in reducing these types of food losses. The use of proper sanitation procedures is very effective at reducing contamination with pathogens and decay causing organisms. The best type of package and the cooling method and degree of cooling will depend upon the agricultural product and its market value. Local costs and market prices will determine whether or not the practice is affordable for any given small farmer or marketer.

The fourth important factor that acts to increase postharvest losses is:

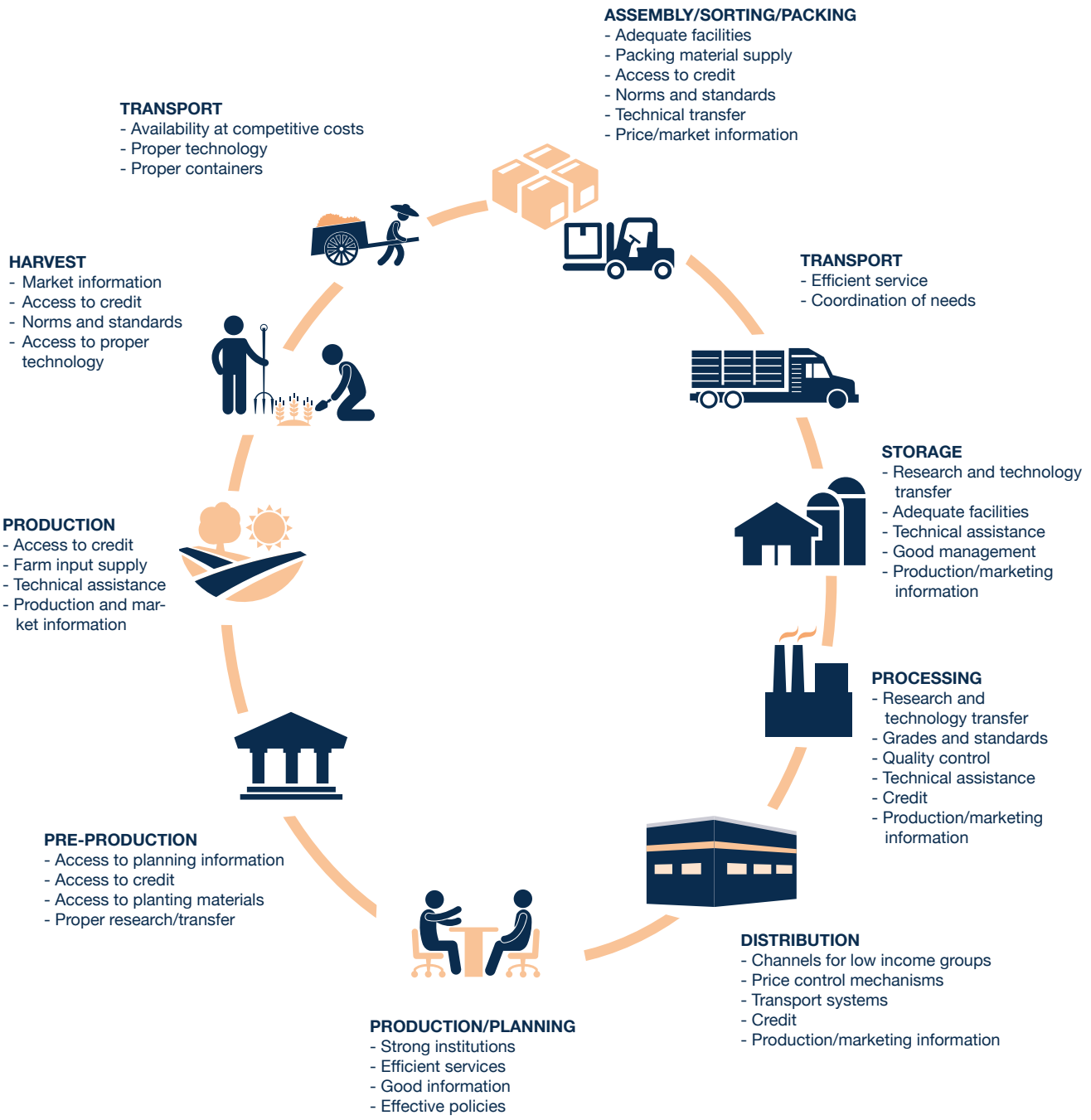
4- **Low market value:** It is not uncommon during times of peak production for farmers to sell their fresh produce at a loss, abandon their horticultural crops in the field, or utilize them as animal feed, since the cost of transporting the crops to market can be higher than their current market value. In these cases (for fruit crops), being able to slow down the rate of ripening by doing some kind of cooling or by using a treatment such as the ethylene action inhibitor [1-Methyl-cyclopropane (1-MCP)] can help spread out the supply peak, extend the marketing period and prevent prices from crashing. Alternatively, transforming fruits and vegetables of low value, at the peak of production, into more stable high value products (for future sale or consumption) can be done using simple, low cost food processing methods.

Facilitating services

To overcome constraints within the food system, both the public and private sectors must provide effective services which benefit farmers, farmer organizations, intermediaries, and other key participants who make the system work. The efficiency of any agricultural value chain is in direct relationship to the efficiency of the support services received by the diverse participants engaged in production, adding value and marketing. Some important services which are required at each point of the system are identified in Figure 3.4. While services such as information, technical assistance and credit are required at nearly each step in the food system, others may be specific to particular points in the food system, e.g. transportation, standards and quality control.

Figures 3.2, 3.3, and 3.4 thus show not only the interdependence of the diverse components of a food system but also demonstrate the usefulness of a multi-disciplinary, and preferably, multi-institutional approach in the identification and analysis of problems and alternative solutions.

Figure 3.4. Facilitating services to overcome physical and economic losses at distinct points in an agricultural value chain



Chapter 4

Priority components for problem analysis

In order to overcome problems, causes must first be identified. An economist dwelling on costs and prices is likely to overlook problems of a technical or social nature. Likewise, the technologist and sociologist may fail to recognize important economic factors. A clear identification of problems requires looking in the right places and asking the right questions. If all the relevant disciplinary areas are investigated, then the important problems can probably be identified and ranked in some causal order.

In the mid-eighteenth century the philosopher Rene Descartes, in his Discourse on Method, pointed out that reality can only be understood by breaking it down into smaller and smaller parts (Descartes 1975). He suggested the need to divide each of the difficulties under examination into as many parts as possible.

Although the relative importance of the different components of an agrifood system may vary with the country and other factors, a large number is common for agricultural value chains. In Figure 4.1, 26 components are identified. In some cases they are of an institutional nature, and focus on participants such as ministries of agriculture, farmers and intermediaries, and the roles each plays in the agricultural value chain. In other instances, the components are of a functional nature, such as harvest, storage and transport, concentrating on processes or activities which take place at a particular point in an agricultural value chain. In still other cases, the component may simply indicate a need to provide statistical or descriptive information which is considered important for the decision making processes, e.g., statistics on production/marketing of the crop or crop environmental requirements.

The 26 components in Figure 4.1 are presented in a circular format. The center part of the circle is divided in half, identifying those components which fall into the pre-harvest versus the postharvest stages. Each half circle is further subdivided to indicate whether the components deal with:

a. Pre-production (planning, policies and institutions).
b. Production.
c. Postharvest handling.
d. Transformation, marketing and distribution.

Each one of the 26 components is potentially important because the decisions or actions occurring at that point may affect production, productivity, quality or cost of the product at that or at some later point in the food system.

However, not all of the 26 components are relevant for each agricultural value chain. In some cases an agricultural product being produced in a particular geographical area may have a very short marketing channel and may bypass steps such as selection, packaging or storage. For example, industrial carrots may go directly from the farmer's field to the processing plant.

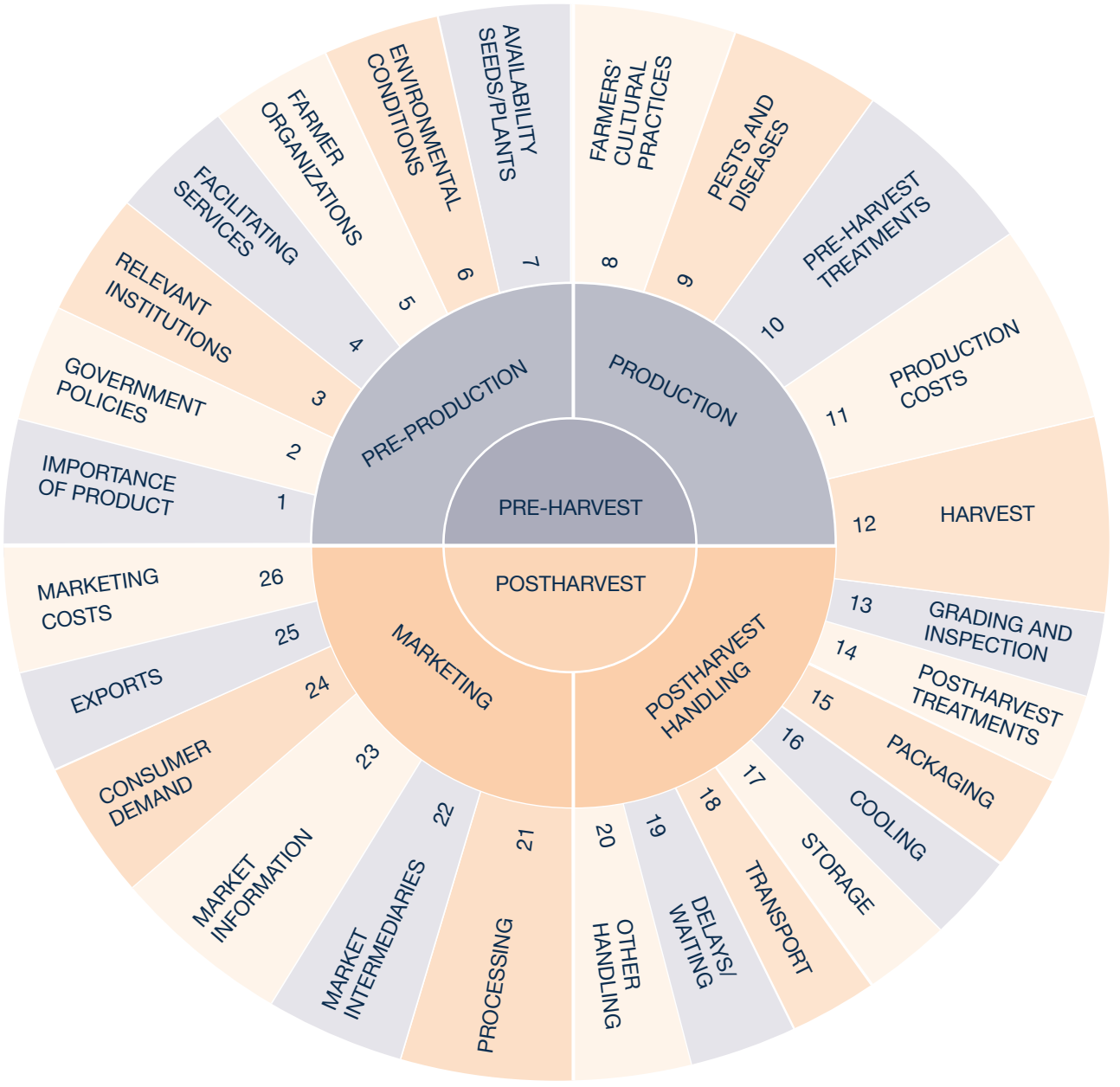
Components which may not be applicable to many crops include those such as pre-harvest treatments (component 10), delays (component 19), other operations (component 20), agroprocessing (component 21), and exports (component 25). The other components should be relevant for nearly all agricultural value chains. On the other hand, it is expected that researchers of a specific agricultural product in a particular country may identify more than 26 relevant components. The 26 components included here are indicative, but not all encompassing.

The remainder of this chapter presents a short description of each of the 26 components. In each case the importance of the particular component and the type of information to be collected are described. An analysis of each relevant component for a particular agricultural value chain will permit a good understanding of what takes place at each point in the agrifood system and how production, productivity, product, quality, or cost may be affected.

For the researcher interested in designing a questionnaire to collect information on one or more of the 26 components, guideline questionnaires are provided in Annex 2 and 3. A summary list of key questions related to each component of the agricultural value chain is included in Annex 4. It should be stressed that these questionnaires are of a general nature and for reference purposes only. **Each questionnaire should be modified to meet specific needs such as: the agricultural product, the geographic area, and the specific interests of the researcher and the institution he or she represents, among others.**

As with the design of any questionnaire, the researcher must have a clear understanding of the type of output desired and how the information will be presented (tables, graphs, descriptive paragraphs, etc.) and utilized. It is only after the researcher has a clear understanding of **what** information is required and **how** it will be presented and utilized that he or she should design the questionnaire to generate the desired results. In this way only useful information will be collected, thus minimizing time and expense.

Figure 4.1. Principal components for an agricultural value chain assessment from the food losses perspective



COMPONENT 01: RELATIVE IMPORTANCE OF PRODUCT

Agricultural products vary in their importance to the national economy from one country to another. For domestic consumption and for export can be ranked from most to least important either by quantities produced, imported or exported, the respective economic values of these quantities or the number of people involved in the agricultural value chain.

This section is intended to document the relative importance to the national economy of the agricultural product under study. The more important the agricultural product, the more likely it is to be taken into consideration in policy decisions and consequently allocated greater amounts of resources. Agricultural products of low volumes and values or with low social impact, are less likely to be provided with the infrastructure and services required for efficient operations.

The relative importance of the agricultural product can be determined by analyzing production, imports, exports, and national/regional development plans.

Specific questions might relate to the following areas:*

a. Quantity and value of national and/or regional production by year.
b. Total area harvested.
c. Volumes and values of particular cultivars/varieties/types.
d. Quantity and value of the agricultural product imported and exported.
e. Relative importance of the product in national development plans.
f. Ongoing or planned projects or plans which will affect the production and marketing of this agricultural product.
g. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 01.

COMPONENT 02: PUBLIC SECTOR POLICIES

When the public sector establishes developmental policies for the agricultural sector, objectives are normally oriented to increase production and provide higher returns to farmers or reduce costs to consumers. Generally, the aim is to improve the welfare of both the rural and urban populations.

Since policy decisions are often made with biased or incomplete information, public sector policies sometimes negatively affect specific social groups or the overall economy. Such is the case when government promotes production without considering the effective market for the selected crop or livestock, thus provoking gluts and reduced returns to farmers. Price policies can lead to decreased production; for example, fixing retail milk prices at near or below costs of production forces cutbacks on dairy herds and increased imports of low cost powdered milk. Although the consumer may benefit in price, the product may be of a lower quality and the national economy will lose foreign exchange.

In other instances, implementation of a particular policy may actually lead to greater postharvest losses or introduce inefficiencies into the agricultural value chain. For example, a government decision to undertake the marketing of perishable produce usually leads to increased food losses due to low levels of efficiency and poor management of storage facilities.

When analyzing public policy related to an agricultural value chain, it is important to identify those which either positively or negatively affect production, price, income, and product quality.

Questions to be asked can include: *

a. What specific policy or set of policies affect production, price and product quality?
b. What policies affect the internal marketing system?
c. What policies affect imports and/or exports of the product?
d. What policies affect consumption patterns?
e. What taxes cause incentives or disincentives to production or marketing?
f. What institutions are involved in determining the policies identified?
g. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 1, Component 02.

COMPONENT 03: RELEVANT INSTITUTIONS

All countries have a variety of public and private sector institutions carrying out actions which have an impact upon pre and postharvest losses of livestock and crops. The efficiency of the overall production and marketing system is often determined by the effectiveness of these institutions and the services they provide.

Because of the diversity of institutions, their internal complexity and their tendency to limit their activities to specialized areas, coordination and communication between them is normally lacking. Consequently, personnel from any one institution are unlikely to have a complete understanding of the whole agricultural value chain.

The purpose of this section is to identify the principal institutions involved in pre-harvest and postharvest aspects of the agricultural value chain under study and generate baseline information necessary to answer the following questions: *

a. What institutions are involved in actions which will affect the production, processing and marketing of the product(s) under study?
b. What functions, services or other actions are undertaken by the respective institutions which may affect the quantity, quality and price of the product in question?
c. Why are they (functions, services, actions) undertaken?
d. Where in the agricultural value chain are these actions undertaken?
e. When are they undertaken?
f. How are they undertaken?
g. With what resources are they undertaken?
    - human?
    - financial?
    - physical?
h. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 03.

COMPONENT 04: FACILITATING SERVICES

Productivity and product quality are often a function of the services available from public and/or private sector institutions. This is even truer in the case of small farmers with limited access to resources. If facilitating services (technical assistance, information, credit, farm inputs, and others) are adequate, yields and quality of products are likely to be high. When services are poor or nonexistent, yields and quality of produce are more likely to be low.

In this section, facilitating services offered by institutions identified in component 03 will be described and evaluated. The purpose is to determine their positive or negative impact upon the production, postharvest handling, and marketing of the product being studied.

Types of services to be considered include:

a. Construction and maintenance of farm to market roads.
b. Generation and transfer of technology.
c. Supply of planting material.
d. Supply of information for decision making.
e. Supply and access to credit.
f. Supply and access to farm inputs.
g. Availability of vehicles to transport produce.
h. Availability of technical assistance.
i. Availability of facilities for postharvest handling.
j. Others.

For each type of service, questions should address such things as:*

a. Frequency and quality of service.
b. Accessibility of the service to the intended recipients.
c. Timeliness of the service.
d. Duplication/competition between institutions.
e. Users' opinions of the service.
f. Impact of the service on production, harvest, postharvest handling, and distribution.
g. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 04.

COMPONENT 05: FARMER ORGANIZATIONS

Agricultural products from small scale or family farming are marketed in very small volumes and with a wide range in quality. If modern technologies are used, unit costs of production may be very high and net returns to the farmer quite low.

One way for small farmers to overcome this situation, in an attempt to increase net economic returns, is to organize into groups, associations or cooperatives. The assembly of relatively large volumes of a particular product by a group of farmers can lead to economies of scale, improved postharvest handling and therefore better quality produce, higher prices and increased net returns.

It takes years to organize and develop effective farmers' organizations with the capability of providing effective services to their members. In the meantime, their organizational weakness or non-existence can be a serious deterrent to development. Existing farmer organizations should be identified and their respective strengths and weaknesses evaluated.

Types of information to be collected should include: *

a. Names of farmers' organizations, whose members produce, handle and/or market the product being studied.
b. Quality of management and administration of the organization.
c. Level of participation of members.
d. Types, frequency and quality of services offered.
e. Types of products handled.
f. Experiences in production, marketing and processing.
g. Availability of human, financial and physical resources.
h. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 05.

COMPONENT 06: ENVIRONMENTAL REQUIREMENTS AND CONSTRAINTS

The natural resources and environment of the production area affect not only the quantity of yields but also the quality of the produce and the time of maturity (for fruits). Too much or too little rain, too high or too low temperatures, strong winds, steep slopes, or other negative environmental factors can significantly affect the quantity and quality of agricultural produce.

Since product quality normally cannot be improved after harvest, it is important to initiate the postharvest process with the highest quality possible. If low yields and/or low quality are due to particular environmental conditions, it is important to identify these constraints as early as possible. The object is to avoid unnecessary costs which reduce the product's competitiveness.

The types of information pertaining to the geographical area of production include:*

a. Soil conditions and fertility.
b. Amount and distribution of rainfall.
c. Period of drought.
d. Water logging.
e. Danger of flooding during the growing season.
f. Risk of damage caused by strong winds.
g. Average relative humidity.
h. Temperatures (high, average, low).
i. Slope of the land.
j. Altitude.
k. Comparative advantages of environment as far as market opportunities are concerned.
l. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 06.

COMPONENT 07: AVAILABILITY OF SEEDS AND OTHER GENETIC MATERIALS

The production of quality produce requires access to quality genetic material (seeds, plants, tubers, livestock, poultry, etc.) at the farm level. When farmers cannot obtain quality genetic material they tend to utilize whatever is available. This often leads to products of inherent poor quality, or even the wrong variety for the market. Proper genetic material can generate increased productivity and higher net incomes for farmers and intermediaries.

Sources of seeds and genetic material should be identified so evaluators can determine whether the quantity or quality is a constraint to production. If access to seeds and genetic material is determined to be a serious constraint, it may indicate the need for research, improving sources and/or delivery systems.

The type of information to be collected in this section relates to the following areas:*

a. Sources of seeds, planting and genetic materials.
b. Seeds and genetic material free from pests and diseases.
c. Farmers' access to seeds and genetic materials (traditional or certificate).
d. Overall quality of seeds and genetic material.
e. Farmers' and extension agents' opinions of seeds and genetic materials.
f. Government's role and efficiency in supply of seeds and genetic materials.
g. Cost of seeds and genetic material to farmers.
h. Advantages of alternative seeds, planting materials and genetic stock.
i. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 07.

COMPONENT 08: FARMERS' CULTURAL PRACTICES

Since product quality normally cannot be improved after the production phase, it is necessary to stimulate and train farmers to produce the best quality within their means. **One of the principal causes of low quality produce is the farmer's poor cultural practices**. In many cases poor cultural practices are a reflection of the farmer's attempt to minimize risks and use of farm inputs. For example, due to market uncertainties, the farmer may reduce production costs by declining to use certain farm inputs. In other cases poor cultural practices may simply be the result of a lack of information or lack of access to appropriate technologies.

The agricultural value chain evaluators should identify and describe the typical cultural practices used by most farmers and how they affect both product quality and productivity.

Types of information to consider are:*

a. Farmers' motives for growing the crop.
b. Source and quality of seeds, planting material or livestock.
c. Type of farming systems used.
d. Cultural practices with respect to:
   – soil preparation.
   – planting techniques.
   – fertilization.
   – irrigation.
   – use of labor.
   – use of machinery.
   – weed control.
   – pest control.
   – disease control.
   – pruning.
   – shade control.
   – management of farm waste.
   – others.
e. Harvesting techniques and tools used.
f. Postharvest handling practices.
g. Decision making process for harvest and marketing of produce.
h. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 08.

COMPONENT 09: PESTS AND DISEASES

Most agricultural crops, poultry and livestock are affected by pest and disease problems at some point in the agrifood system, either prior to harvest or during the postharvest stage. In some cases these pests and diseases may be economically insignificant, while in others, they may cause so much damage that the profitability is affected. In some instances the pests and diseases may be of quarantine significance, thus prohibiting the agricultural product from crossing borders. This reduces the potential for earning foreign exchange.

The purpose of this section is to identify pests and diseases affecting the agricultural product being studied and to determine whether or not they are, or could become, of economic or quarantine significance.

Types of information to be considered include: *

a. Identification of all economically significant pests and diseases which affect the productivity and/or quality of the product, in order of importance.

b. Identification of pests and/or diseases of quarantine significance, by country.

c. Identification, analysis or description of the type of damage done to the product by each pest/disease, with respect to:

   – quantity.

   – quality.

   – value.

   – consumer demand.

d. Identification and analysis of alternative methods and costs of control (pre-harvest and postharvest) of each pest and/or disease.

e. Identification of potential marketing constraints caused by chemical controls (toxic residues).

f. Identification of potential constraints to the introduction of an effective control program.

g. Description of ongoing or planned actions or projects to deal with constraints.

h. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 09.

COMPONENT 10: PRE-HARVEST TREATMENTS

Pre-harvest treatments, either physical or chemical, may have a favorable or unfavorable impact upon postharvest quality. Examples of treatments include such things as:

a. Folding the maize plant to dry the grains; this helps to reach best humidity percentage for threshing and storage. It also protects the cob from bird attacks.

b. Twisting of cabbage (90 degrees) before harvest to break some roots and induce wilting. This causes the wrapper leaves to tighten, thereby helping to protect head during postharvest.

c. Wrapping fruit while still on tree. For example: apples (*Malus domestica*), star fruit (*Averrhoa carambola*) and bananas (*Musa* spp.) may be wrapped with paper or plastic to prevent attack from birds, fruit flies and other pests or to enhance ripening or fruit color.

d. Chemical treatments while in the field to extend postharvest storage life or enhance marketability.

In some cases chemical application can lead to postharvest residues which create marketing constraints.

All physical and chemical pre-harvest treatments which affect the postharvest quality of the agricultural product under study should be identified.

The information to be collected includes: *

a. Identification and description of physical and chemical treatments used on the product under study.

b. Description of why, when and where each action is taken.

c. Identification of the type of participant carrying out the action.

d. Description of what impact the action has on:

- quantity of production.
- quality of production.
- storage life.
- marketability.
- price of product.

e. Identification of possible alternative treatments.

f. Costs and benefits of pre-harvest treatments.

g. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 10.

COMPONENT 11: PRODUCTION COSTS

Farming anywhere in the world is a high risk enterprise, for small farmers it is particularly risky. Failure to earn adequate returns from their efforts will directly affect their family's nutrition, health, and education, in addition to their future efforts to continue farming. If the farming business lacks economic incentives, the farmers' children and perhaps the farmer him/herself will migrate to urban areas searching for a better way of life.

The small scale farmer is cost conscious and will try to minimize his/her risks, especially when markets are uncertain. Production costs vary greatly with farm type and size. Minimizing costs can affect the quality and quantity of produce.

A complete analysis should consider labor, inputs, agricultural insurances (if the farm uses such), administration, and their relations in any given agricultural value chain. An analysis of all production costs can provide useful insights into possible causes of low yields and/or low quality of produce. It may also demonstrate the economic advantages and disadvantages of using different inputs and different production strategies.

The type of information to be collected includes: *

a. Establishment of assumptions regarding the size and operations of a typical farm.
b. Identification of all types of production costs and their benefits.
c. Quantification of the production costs for a representative group of farmers.
d. Comparison of costs of production recommended by the technician and those actually incurred by the farmer.
e. Analysis of advantages and disadvantages of using each type of input.
f. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 11

COMPONENT 12: CROP HARVEST

When and how a product is harvested (or an animal is slaughtered) affects its postharvest life. A product harvested too early, too late, or damaged by improper techniques or tools will have a shortened postharvest life.

Steep terrain in growing areas may cause further difficulty by increasing risk to laborers, labor costs and damage to produce. Socio-economic conditions which permit or stimulate the stealing of food may also be contributing factors. For example, where food theft is common, farmers harvest their produce before it reaches its proper stage of maturity and stop raising animals. This practice affects product quality, quantity and returns from sales.

The techniques used to harvest the product (or to slaughter an animal) can be identified and described. The impact of harvesting practices on marketable produce can be indicated.

The information to be collected should cover the following aspects*:

a. Identification of who harvests the crop.
b. Description of what actually takes place during harvest.
c. Description of why the crop or animal is harvested in a particular manner.
d. Identification of time when harvest takes place (time of year and time of day).
e. Evaluation of how the harvesting techniques may affect marketable quantity and quality.
f. Determination of relationships between harvesting practices and postharvest losses.
g. Identification of alternative methods for improving harvest techniques.
h. Identification and description of the harvesting tools and their positive and negative aspects.
i. Costs and benefits of crop harvest.
j. Others to be determined. *

* For GUIDE QUESTIONNAIRE see Annex 2, Component 12.

COMPONENT 13: SELECTION, SIZING, GRADING, AND INSPECTION

Selection, sizing, grading, and inspection are terms with closely related meanings. In all cases the objective is to categorize the product in such a way that it will satisfy the needs of intermediaries, agroprocessors and/or the intended consumers. In many developing countries, consumers tend to be more concerned with price than quality. In these circumstances, selection, sizing or grading may be minimal and appear to the casual observer as nonexistent. However, even in low income countries, consumers do have minimum standards and the marketing systems have evolved over time to satisfy these requirements.

Care should be taken to study the process and methods used in traditional marketing systems to satisfy consumer demand. Likewise it is important to understand marketing strategies adopted by wholesalers or retailers, e.g., to minimize their postharvest losses, marketers may mix produce of different sizes and quality and sell to consumers by the pile or bunch.

In developed countries, higher incomes allow consumers to demand higher quality produce. Consequently, more attention and expense is given to the act of selection, sizing and grading. In some cases, buyers (domestic or international) send inspectors to assure that the produce meets the desired quality standards. The more selection, sizing, grading, and inspection which takes place, the higher the cost of the product to the consumer. Due to high quality standards in export markets or agroprocessors, large percentages of produce are often selected out or rejected prior to shipping. The lower grade produce is then sold on the domestic market, fed to animals or becomes a postharvest loss.

This section identifies where selection, sizing, grading, and inspection occur in the agricultural value chain and describes what takes place. The type of information gathered should include*:

a. Identification of points in the agricultural value chain where some form of grading, selection, classification or inspection takes place.
b. Description of the actions carried out at each point.
c. Identification of who is responsible for each action.
d. Identification of when each action is carried out.
e. Description of where each action is carried out.
f. Analysis of why the action is carried out as it is.
g. Identification of the tools, equipment, other material and laborers used in carrying out the actions.
h. Identification of what criteria are used in carrying out the actions.
i. Description of the relationships between the respective actions and market requirements.
j. Magnitude of postharvest losses at diverse points in the system; where selection, sizing, grading and inspection take place.
k. Costs and benefits of selection, grading and inspection.
l. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 13.

COMPONENT 14: POSTHARVEST CHEMICAL AND PHYSICAL TREATMENT

Horticultural crops are frequently treated chemically and/or physically during the postharvest stage as a means of extending shelf life or making the product more attractive to the consumer. As an example, ethylene gas may be used to enhance ripening of bananas.

Physical treatments include such actions as washing root crops, waxing citrus and cassava, and bagging.

The types of chemical and physical treatments applied during the postharvest stage will be identified and described. The information to be collected should include the following*:

a. Identification of physical and chemical treatments and chemicals used.
b. Purpose of each type of treatment and how the quality of the agricultural product is affected.
c. Identification of where and when in the postharvest system the treatment takes place.
d. Description of how the treatment is carried out and what is actually done to the agricultural product.
e. Identification of who carries out the treatment.
f. Identification and description of the tools, equipment, materials and labor used in the treatment.
g. Identification of the potential impact of the treatment in the marketplace (how will consumers react?).
h. Costs and benefits of chemical and physical treatments.
i. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 14.

COMPONENT 15: PACKAGING

Packaging protects the product during postharvest handling and divides the product into more manageable units. It also improves the presentation of the product so it will be more acceptable to middlemen and consumers. Packaging is necessary for nearly all types of produce. As a general rule: the more perishable the agricultural product, the greater the importance of the quality of the package, and the more sophisticated the market, the more important the presentation of the package.

The characteristics of packaging materials, methods used in packaging, and the relevant costs should be determined. Types of information should include*:

a. Identification of the points in the postharvest system where packaging or repackaging occurs.
b. Determination of the specific purpose of packaging.
c. Identification of who undertakes the packaging and where it takes place.
d. Description of what is done to the product during the packaging process and how it is carried out.
e. Characteristics of the package: size, strength, presentation, color, label, availability.
f. Minimum packaging requirements on local and international markets.
g. Number of times package can be used and procedure for recycling.
h. Ownership of the package, if the package is reusable.
i. Information on reuse of package.
j. Costs and benefits of packaging.
k. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 15.

COMPONENT 16: COOLING

It is often good practice to harvest early in the morning to take advantage of lower prevailing temperatures. The respiration rate of the product increases with the ambient temperature: the higher the rate of respiration the shorter the postharvest life. However, early morning harvesting may not be feasible or temperatures may not be as low as desired. Rapid cooling (pre-cooling) of the product to the recommended storage temperature will prolong its postharvest life. Pre-cooling particularly benefits highly perishable products.

Pre-cooling is not commonly carried out in most developing countries. Cooling for holding purposes at airports, seaports and marketing terminals is a more common practice. However, poor administration and operation of these installations frequently results in high postharvest losses. The high costs of operation of cold storage facilities often results in their being abandoned. Many intermediaries prefer the use of refrigerated containers which are mobile and less costly to operate.

Information relevant to cooling which should be collected includes:*

a. Identification of the type of cooling presently carried out (pre-cooling, temporary storage, maintenance storage).
b. Description of the facilities, method(s) and equipment used in the cooling process.
c. Identification of locations where cooling is carried out.
d. Identification of who operates the cooling facilities.
e. Determination of the effectiveness of the system for removing field heat and extending shelf life.
f. Analysis of cool-chain: does product remain in controlled temperature environment until it reaches the market?
g. Costs and benefits of operating each cooling system.
h. Feasibility of introducing cooling systems.
i. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 16.

COMPONENT 17: STORAGE

To store a product and maintain its quality, the storage environment must be efficiently controlled. In general, the temperature and humidity of air around the product are the major factors which contribute to maintenance of product quality. Under optimum temperature and humidity conditions, storage life will be extended to the maximum. Concentrations of the gases oxygen, carbon dioxide, and ethylene in the storage atmosphere can affect the storage life of the product. Certain combinations can stimulate the ripening process (controlled atmosphere).

A complete assessment of storage will identify the strengths and weaknesses of the conditions and general characteristics of the storage environment. Storage takes place when the product is intentionally placed in a specific location to protect it from adverse conditions, or while it is awaiting sale.

The information to be collected should include*:

a. Identification of points in the postharvest system where storage takes place.
b. Description of the type of storage and reasons for storing the product.
c. Characteristics of the storage facility:
   – facilities and equipment (types and level of maintenance).
   – humidity range and methods of control.
   – temperature range and methods of control.
   – atmosphere of storage facility and control methods.
   – danger of contamination by toxic materials.
   – others.
d. Normal duration of the product in each type of storage.
e. Ownership of storage facilities.
f. Persons responsible for storage operations.
g. Method of operation of storage facilities.
h. Type of damage caused to the agricultural product while in storage.
i. Added costs to product price due to storage.
j. Costs and benefits of storage.
k. Location of the facility in proximity to the farm(s).
l. Number of and types of crops stored in the facility.
m. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 17.

COMPONENT 18: TRANSPORT

In order for agricultural products to be useful to consumers, they must reach the diverse markets on a timely basis. As the product moves through the value chain it may be transported by humans, animals, airplanes, boats, or ground vehicles. It may be transported many times and by different methods from remote rural farms. It may be carried by humans, animals, animal drawn carts or boats; from a rural assembly point, it may be transported by motorized vehicle to a regional or central wholesale market; from farms or from central assembly points it may be carried by airplane, train or ship to foreign markets.

Each time the product is transported from one point to another it is handled, delayed, vibrated, placed under pressure, and subjected to a variety of conditions which may negatively affect the quality of the product and therefore its marketability.

Types of transportation used and points in the agricultural value chain where transport occurs should be identified and described.

Information to be collected should include:*

a. Identification of the diverse points in the agricultural value chain where transportation occurs, as well as the participants, and methods used.
b. Description of the transportation process and the conditions during transport: enclosures, temperature, humidity, height of stacking, nearness of produce to heat source (e.g., engines, air circulation), time of day and others.
c. Sanitation of the transport units (how frequent and by whom?).
d. Distance (kilometers or miles) and duration (hours, days, minutes) of the transport.
e. Description of the type of damage which occurs to the product during transport and expected causes.
f. Identification of the costs added to the value of the product as a result of transportation at different points.
g. Costs and benefits of transport.
h. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 18.

COMPONENT 19: DELAYS OR WAITING

As any product moves through the agricultural value chain towards its final destination (the consumer) it undergoes periods of delay or waiting. For example, products may be forced to wait to be loaded, unloaded, or paperwork at border crossings.

While a product is undergoing a delay or is waiting, it may be adversely affected by temperature, humidity or other atmospheric conditions. The product may absorb undesirable odors, be subjected to direct sunlight, or in some other way be adversely affected by temporary conditions or circumstances, thus lowering product quality.

In some cases the delays are natural steps in the postharvest system, for example: tomatoes in a pile at the edge of the field awaiting the next step (packaging, grading). In other cases the delays may be for socio-economic or political reasons, for example, customs personnel may delay produce at a port or border until papers are completed and "informal taxes" are paid.

The information to be collected identifies where delays or waiting occur and why, and should include:*

a. Points in postharvest system where delays and waiting occur.
b. Characteristics of each delay:
   - cause of the delay.
   - person or thing responsible for causing delay.
   - length of the delay.
   - environmental conditions at point of delay.
c. Normal conditions of the product at the point of delay.
d. Damage done to the product as a result of the delay and cause of the damage:
   - in terms of quality.
   - in terms of quantity.
   - in terms of product value.
e. Alternatives for reducing the delays or waiting period.
f. Costs and benefits of delays or waiting.
g. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 19.

COMPONENT 20: OTHER OPERATIONS

As a product moves between the points of harvest and consumption, it passes through a series of steps which may be referred to as postharvest processes by the technologist or marketing functions (storage, transport, packaging, etc.) by the agricultural economist. Since it is not possible to include references to all the potential operations that may occur between harvest and consumption, "other operations" is included here as a catch-all.

The operations may be sub-divided into two types. Major operations are those of considerable significance in the particular agricultural value chain; for example, the field curing of onions. Minor operations are important but to a lesser degree; for example, the act of placing a product in a container during harvest, unloading the product from the harvest container, loading a package onto a vehicle, or off-loading. These minor operations are usually conducted rapidly and at low cost, but in some instances may be significant in increasing or reducing damage to a product.

This section identifies significant major and minor operations which may affect postharvest losses in the agricultural value chain but are not included in any other section of the study.

The data collector should analyze the movement of the product from the point of harvest to the point of retail and list all operations that occur and the point in the system where they take place.

The type of information to be collected includes the following:*

a. Identification of the specific operations and the points in the postharvest system where these operations occur.
b. Description of each operation.
c. Identification of who executes the operation and where and when it is carried out.
d. Details as to why it is carried out in the present manner.
e. Determination of what impact this operation may have on product availability and quality.
f. Evaluation of the costs and benefits each operation adds to the value of the product.
g. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 20.

COMPONENT 21: AGROPROCESSING

Agroprocessing includes any operation which chemically and/or physically changes the character of the raw product for the purpose of extending its shelf life or converting the product into a more marketable form. The processing of food tends to stop or delay degradation and is a useful way of reducing postharvest losses. Agroprocessing is an important method for increasing the marketability of products which cannot compete in fresh markets.

This section will identify all types of agroprocessing undertaken by participants in the value chain and describe their most relevant characteristics. Types of information to be collected include:*

a. Identification of the types of agroprocessing the product undergoes and the point in the postharvest system where they occur.
b. Distance from the production field to the agroprocessing facilities and transfer time.
c. Description of the process which takes place.
d. Identification and description of the market for which the product is processed.
e. Participants involved in the processing function and their level of expertise.
f. The costs and benefits as a result of agroprocessing.
g. Impact of processing on postharvest losses and markets:
   - reduction in losses.
   - increase in earnings to farmers.
   - benefits to consumers.
h. Problems of supply of raw material.
i. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 21.

COMPONENT 22: MARKETING INTERMEDIARIES

In the marketing of any product there are a wide variety of intermediaries, for example, wholesalers, retailers and exporters. These can be further subdivided depending upon characteristics such as the size of their operations, products handled and the consumer groups they serve. Since different consumer groups demand different levels of services, the functions and characteristics of intermediaries vary widely.

This section will identify the principal types of intermediaries involved in the marketing of the product under study and describe their respective operations within the marketing system. Their characteristics should be outlined with the purpose of better understanding how the system works and identifying those factors which may affect quantity, quality and price of product being traded.

The types of information to be collected include:*

a. Identification of the principal types of intermediaries.
b. Description of the principal functions of each type of intermediary and where, when and how in the system the functions are carried out.
c. Evaluation of the reasons why the functions are carried out in the present manner.
d. Inventory of available equipment, facilities, infrastructure and other resources used by intermediaries.
e. Description of most important resources necessary for effective handling and marketing of products.
f. Identification of the differences in quality, if any, of the product handled by the different types of intermediaries and the reasons for the differences.
g. Deficiencies in the operations which affect the quality or lead to losses in quantity of a product.
h. Determination of the principal factors affecting marketing costs.
i. Major costs added by the intermediary and benefits received from such investments.
j. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 22.

COMPONENT 23: MARKET INFORMATION

The most important aspect of an agricultural value chain is the price for which a product can be sold. When prices are very low farmers may not even bother to harvest their crops. This occurs when farmers anticipate that the added costs of harvesting and marketing will be greater than the expected sales price. At the opposite extreme, when prices are high, farmers and intermediaries will be stimulated to use techniques to maintain quality and improve presentation, even at a high cost.

When prices are high, some consumers will accept lower quality for a lower price. On the other hand, when market prices are low, consumers demand higher quality. High levels of postharvest losses are sometimes caused indirectly by low market prices. An awareness of prices in the marketplace will provide useful insights on supply, demand, and possible causes of postharvest losses.

Market information includes more than just market prices. It is important to have access to reliable information on existing and future supplies, as well as trends and conditions of consumer demand. Market information is supplied by multiple sources including farmers, market wholesalers, retailers, truckers, governments and donors, among others. With the introduction of cell phones and smart phones farmers have increasingly easier and faster access to market information.

This section should identify types and sources of price and market information available and characterize that information.

Data to be gathered include:*

a. Price and market information available:
   - type of information available and source.
   - frequency, reliability and quality of information.
   - time period and markets covered.
   - types of analyses of market information carried out.

b. Availability of information on supply of the product:
   - type of information and source.
   - frequency, reliability and quality of information.

c. Analysis of price/market information:
   - seasonal price indices and high/low periods.
   - causes of price fluctuation.
   - relationships between price, quantity, quality and postharvest losses.
   - type of marketing arragements.

d. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 23.

COMPONENT 24: CONSUMER DEMAND

Demand for fresh and processed produce varies greatly by country and by consumer group within individual countries. Particular preferences are the result of diverse factors, such as income, time, traditions and religion.

Low income consumers tend to purchase lower quality produce, given their interest in minimizing costs. High income consumers are usually prepared to pay higher prices for better quality produce.

Social and religious traditions can be determinants for the type and quality of produce acceptable to consumer groups. Many religions have specific requirements for food preparation, specifying quality, content and timeliness of preparation.

In terms of the product being studied, it is important to be aware of the economic status and the cultural and religious preferences of the consumers and/or potential consumers.

Proposed changes in any agrifood system, whether to reduce postharvest losses, introduce new technology or modify packaging, must be tested to determine whether the proposed changes will be acceptable or not to the consumer in economic, cultural and/or religious terms.

Consumers can be identified and classified into categories, and their respective preferences for the product characterized.

Types of information to be generated include: *

a. Identification of principal markets: international, regional and domestic.
b. Identification of consumer groups within each important market: high, medium and low income; ethnic groups and religious groups.
c. Identification of particular preferences for the product: cultivar, size, color, flavor, texture, maturity, acid/brix ratio, quality desired, packaging requirements, number units/package, others.
d. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 24.

COMPONENT 25: EXPORTS

Developing countries are giving more attention to the export of non-traditional agricultural produce as a source of foreign exchange earnings. As production for exports increases, so does competition between countries for the same markets.

In order to export effectively, the exporting country must be able to compete favorably with other suppliers in terms of quantity, quality, price, and continuity of supply. In other words, they must have both comparative and competitive advantages in the production and marketing of a specific product in a particular market.

To determine the feasibility of exporting the product in question, the types of information to be collected should include: *

a. Identification of the specific product cultivar or breed to be exported.

b. Characteristics of the **demand** for a specific product in each potential market:

- country of destination.
- particular characteristics of the product desired by the importing country (size, weight, color, flavor, texture, maturity, type of package, weight of package, etc.).
- quarantine restrictions.
- religious, cultural and price preferences.
- present sources of supply and competitors to each market.
- tariff and non-tariff trade restrictions.
- transportation problems to importing countries.
- potential labor (off loading) problems of importing country and other constraints.
- reliability of importer/brokerage services.
- form in which payments will be made.

c. Characteristics of **supply** of the particular product:

- availability of product over time.
- volume of actual and potential exports.
- ability to meet the demand requirements (quantity, quality, price, product characteristics, transportation).
- pest, disease and food safety constraints.
- postharvest handling constraints.
- infrastructure constraints.
- ability to compete favorably with other countries.
- other constraints.

d. Others to be determined. *

* For GUIDE QUESTIONNAIRE, see Annex 2, Component 25

COMPONENT 26: POSTHARVEST AND MARKETING COSTS

In marketing systems around the world, people wholesale and retail a wide variety of produce in many forms. One can observe produce in woven baskets, fertilizer bags, new or used cardboard boxes, homemade wooden boxes, waxed or styrofoam boxes with ice and produce without packaging of any sort. Transportation may be undertaken with human or animal power, vehicles, boats, airplanes, or with other methods.

The hectic pace of traditional markets gives casual observers the feeling of disorganization. Within this apparent chaos of traditional marketing systems is a certain structure based on the precept of minimization of costs. Just as farmers attempt to minimize their production costs under conditions of market uncertainty, marketing intermediaries tend to minimize their marketing costs. They use a wide range of marketing strategies which may include packing produce in the field, minimizing investments in packaging material, utilizing public or rented transportation, or maximizing the use of family labor.

Although technical advisers and consultants constantly recommend "improved packaging," "better facilities," "new equipment," and "improved methods," all intended to contribute to better organization and improved marketing efficiency, intermediaries often find that these suggestions are not cost effective.

To determine the feasibility of introducing innovations into the marketing process, it is necessary to obtain real postharvest handling/marketing costs.

This section will generate information to permit the identification and quantification of marketing costs. As examples: *

a. For each type of participant (farmer, intermediary, cooperative, marketing board, wholesaler, retailer, exporter, etc.) identify all types of marketing costs between the farm and final market.

b. Quantify all marketing costs including such items as: transportation, packaging, labor, information, communication and paperwork, among others.

c. Identify strategies that participants use that increase or decrease postharvest and marketing costs.

d. Others to be determined. *

*For GUIDE QUESTIONNAIRE, see Annex 2, Component 26.

Chapter 5

Application of the agricultural value chain assessment methodology

The globalized economy and modern society have new parameters of consumption and demands for quality, which have resulted in greater standardization of the quality parameters for food. In addition, there is greater awareness and responsibility for health, the environment and the people who produce food. These factors together have set new trends in consumption and marketing patterns of agricultural products.

An ideal agricultural value chain allows a product to move from the farm to consumer, arriving at its final destination at a price the consumer is willing to pay and with only minimal losses in quantity or quality. Losses which do occur are indicative of inefficiencies within a particular value chain.

For society to improve the efficiency of existing agricultural value chains, it must increase the level of knowledge, technology and/or resources available to participants in the system and/or reduce the level of risk in production and marketing.

Facilitating the availability of financial resources to groups of farmers to permit the purchase of trucks, storage facilities and necessary equipment, may contribute to improved efficiency in an agricultural value chain and farmers' insertion into inclusive and fair trade chains. Training of farmers and intermediaries in improved methods of management, production, postharvest handling, and marketing are examples of ways to increase their level of knowledge, optimizing techniques and technologies and improving the profitability of all stakeholders or interest groups.

Any successful attempt to introduce innovations into a traditional system will require an integrated effort between those who make the existing system work (farmers, traders, bankers, and truckers, among others) and those who would like to see the efficiency of the overall agrifood systems improved (specialists, support institutions, politicians and other decision makers). Development of efficient agricultural value chains requires a joint effort between the private and public sectors.

Integrating the practical with the technical, or the private sector with the public sector, requires a detailed understanding of existing systems and how they operate. It requires the identification of the distinct actors in the system and an understanding of the role played by each. Generally, this type of information is not readily available in one document, one institution or individual; however, it can be obtained and organized through a systematic effort.

The rest of Chapter 5 will show how information on specific agricultural value chains can be collected and organized to identify main components, participants and priority constraints. This will facilitate the design of solutions and strategies oriented towards the improvement of agrifood systems. These solutions will be the focus of Chapter 6.

Formation of an interdisciplinary team

Describing and analyzing an agricultural value chain is a team effort requiring input from specialists of multiple disciplines. One of the first steps in organizing the study of an agricultural value chain is therefore the formation of an interdisciplinary team. The exact make up of this team will vary with the type of

agricultural value chain, the availability of human resources and support institutions, and the results desired from the study. This team should include the specialists most knowledgeable about the diverse components of a particular agricultural value chain. It should comprise persons from both the private and public sectors, including farmers, intermediaries, transporters, agroprocessors, storage facility operators, extension agents, planners, and policy makers.

If it is anticipated that the proposed solutions will require support from public sector institutions, then persons from such institutions should be included on the interdisciplinary team. In this way the study serves as in-service training for the individuals and may facilitate decision making during the implementation process.

The team should be as few in number as possible but broad-based enough to cover all important components of the agricultural value chain. If the group is too large for effective interchange, it may be subdivided into two or more interdisciplinary teams which will meet from time to time to exchange knowledge and reach a consensus.

According to Malaysian Agricultural Research and Development Institute (1988) another option that has worked successfully is to divide the group by discipline, allowing planners and economists to concentrate on **pre-production**, agronomists, entomologists and other production oriented people to work on **production**, postharvest related people to concentrate on **postharvest**, and agricultural economists and marketing specialists to work on **marketing** and **distribution**. Each group works separately as a team but reports frequently to the others. In this option, each subgroup is composed of persons from similar disciplines; therefore, their analyses are more likely to be carried out in greater depth.

The following sections on **pre-production**, **production**, **postharvest handling**, **marketing** and **distribution** present the steps to be taken and tools to be used by the interdisciplinary team(s) during the agricultural value chain assessment.

Review of existing literature, reports and records

The interdisciplinary team should undertake a review of literature, reports and records relating to the agricultural value chain under study, in order to describe the current knowledge base regarding the overall chain, postharvest losses, loss assessment methods, extent of losses and available technology.

Secondary sources will serve as an input to complement what is collected through the application of different methods of data collection (eg. questionnaires) taking into account each of the areas that make up the agricultural value chain: pre-production, production, postharvest and marketing/ distribution.

Data collection of primary sources

In collecting data from the field and stakeholders, the interdisciplinary team should select a sample that ensures the quality and representativeness of the information for each component of the agricultural value chain: pre-production, production, postharvest handling and marketing/distribution.

Unless there is an interest in a specific region, the sample should include those regions or territories with higher production volumes of the crop being studied. The team leader should identify the path that follows the product throughout the agricultural value chain.

Various methods of data collection for triangulating the information should also be used. Several examples are presented throughout this manual.

Analysis of the stages that integrate the agricultural value chain

Pre-production

Most of the components described in this quadrant (component 01-07, Figure 4.1) are applicable to more than one product and are of a more general nature than are the components of the remaining three sections, which tend to be product specific.

In the description of the **pre-production** phase it is important to ensure that the interdisciplinary team includes specialists from central and agricultural planning units familiar with institutional structure and services from both public and private sectors. The team should also include production specialists familiar with natural resources, environmental conditions, and existing systems for the production and distribution of planting material.

One of the first types of analysis to be carried out by the interdisciplinary team is regarding institutions. Given the often large number of public and private institutions involved in agriculture development activities, it is often a major achievement just to identify them and their respective divisions/units and functions relevant to the product under study. For each public sector institution pertinent to the production and marketing of the product of interest, a questionnaire similar to that shown in Annex 3-A should be completed.

In the case of private institutions, care should be taken to identify organizations of farmers and other support groups which affect the production, postharvest handling or marketing of the product being studied. Profiles of representative farmers' organizations can be prepared, including information on their backgrounds, organizational structures, characteristics of members, experiences, problems, and needs (see questionnaire format in Annex 3-B).

Information on development projects and activities which affect the agricultural value chain and are sponsored by private sector groups or bilateral, regional, international, or other types of development organizations, should be collected using the guideline questionnaire presented in Annex 3-C.

The interdisciplinary team should identify, analyze, and summarize existing policies, plans, programs, and projects which affect the product of interest. Likewise, existing tax and financial incentives should be identified and described, with a brief analysis of their present or expected impact on the specific agricultural product.

This analysis of **pre-production** aspects should provide a first indication of the feasibility of expanding and/or improving the production of the product. If, for example, the only feasible growing area requires a road which is not expected to be constructed for several years, it would be impractical to promote increased production. Likewise, if planting material is a constraint, the production program may have to be delayed. If institutional weaknesses are detected, policy changes or institutional strengthening activities may be required as a pre-condition.

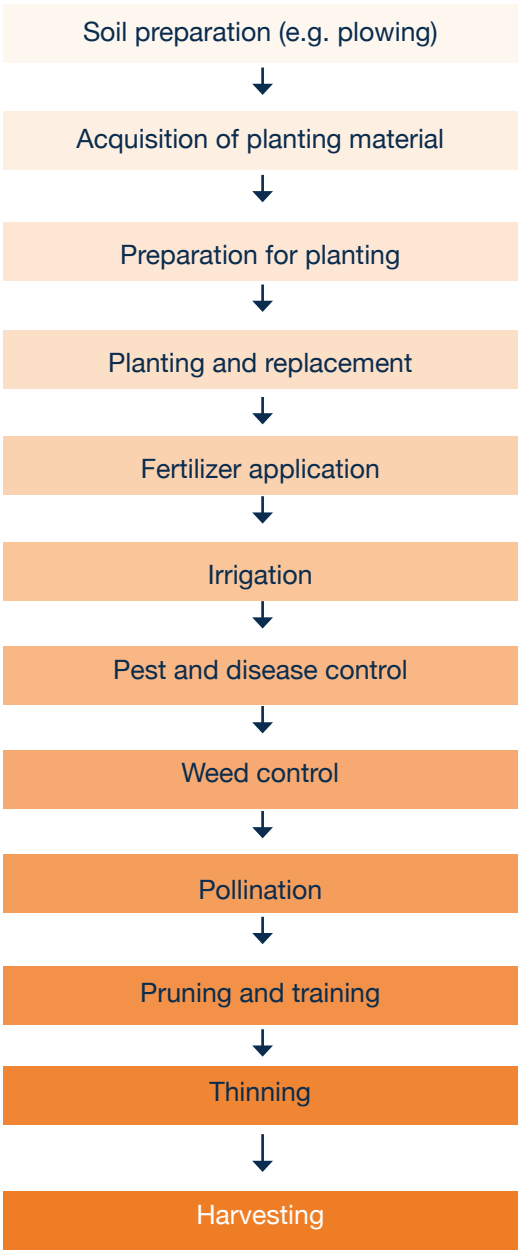
Production

While it is true that there are many differences in the production of fruit, vegetables, root crops, and grains, and that each specific crop has its own particular characteristics and needs, it is also true, in general, that nearly all agricultural crops have similar needs. For example, all require some soil preparation or planting substrate. Most crops are placed in the ground in the form of seed or plants. All require water, fertilizers, weed and pest control. Most undergo pollination and all are eventually harvested.

This commonality among crops facilitates the design of a model which can be used for describing the production process for any crop.

The best starting place for an analysis of the production system is the identification of the diverse steps in the production process. For most crops this entails some variation of those shown in Figure 5.1. Based on this general model, steps can be added and/or deleted until all the important steps in the production process have been identified for the particular product studied.

Figure 5.1. Steps in the production process of most crops



The formation of the interdisciplinary team should take into consideration these basic steps in the production process. This is to ensure that the team includes members with the necessary expertise for an in-depth and complete analysis. For each step in the production process, the team must identify the different types of participants and analyze the positive or negative impact of each upon product quantity and quality in the pre-harvest and postharvest stages. One way of beginning this process is by answering the following six basic questions:

1. Who is responsible for the action?
2. What action is taken?
3. How is the action carried out?
4. When is the action carried out?
5. Why is the action carried out in that manner and not some other?
6. Where is the action carried out?

After discussion and analysis in plenary sessions, the interdisciplinary team can summarize the answers to the above questions in a table format, with the steps of the production process along the vertical axis and the above six questions along the horizontal axis as shown in Table 5.1.

Table 5.1. Summary of production process for product X in country Z

Steps in the production process*	What action taken?	Who takes action?	How action taken?	When action taken?	Why action taken?	Where action taken?
Soil preparation						
Hole preparation						
Acquiring seeds/plants						
Planting						
Fertilization						
Irrigation						
Pest/disease control						
Weeding						
Pollination						
Pruning & training						
Thinning						
Harvest						

*The steps should be modified in accordance with the particular product being studied.

The summary table should be supplemented with additional detail presented in tables or text. Descriptive material might include information on such things as common farming systems, methods of propagation of planting material, nursery management and standards used, description of cultivars or seeds, type of fertilization, particular cultural practices, pest and disease control, and impact of pre-harvest factors on postharvest losses, among others.

The principal reason for describing the production system is to identify operations within the existing system which negatively affect product yields and/or quality, or contribute unnecessarily to costs of production. Although resources and time are not normally available to quantify the actual impact of pre-harvest factors on either pre-harvest or postharvest losses, the interdisciplinary team (including farmers) can make a useful subjective evaluation of their significance. The resuIts of such an evaluation can then be summarized following the format presented in Table 5.2.

Table 5.2 provides a format to indicate the magnitude of losses (both pre-harvest and postharvest) caused by preharvest factors. For example, improper practices in training fruit trees in the nursery, or on the farm, may cause fruit to come in contact with the ground, resulting in reduced quality, hence unmarketability. Losses may occur prior to harvest as a result of pests or diseases. Produce reaching the point of maturity may be of poor quality for a variety of reasons, for example: the lack of proper fertilization, poor water management, or inadequate control of birds or other pests.

The production specialists, including farmers, may decide simply to indicate the magnitude of the losses with an X in the respective column of Table 5.2, or if they have sufficient information, may choose to calculate the percent of losses at specific points in the system.

Table 5.2. Magnitude of losses caused by pre-harvest factors for product X in country Z

Steps in the production process+	Not significant		Significant		Very significant	
	Quan*	Qual*	Quan*	Qual*	Quan*	Qual*
Land preparation						
Hole preparation						
Acquiring plants/seeds						
Planting						
Fertilization						
Irrigation						
Pest/disease						
Weeding						
Pollination						
Pruning & training						
Thinning						
Harvest						

* "Quan" = Quantity of losses; "Qual" = Quality of losses
+ The steps should be modified to reflect the system being studied.
Note: Place "X" in the appropriate box for each step. In those cases where "X" indicates significant or very significant losses, details should be provided in writing. If reliable information is available, the "X" can be replaced by an estimated percentage loss.

The interdisciplinary team (including farmers) should be asked to address the following question: **Given the existing state of the art, can the pre-harvest factors causing pre-harvest or postharvest losses be reduced in technological and/or economic terms?** From Table 5.3, the experts should discuss in plenary session each of the causes identified as "significant" or "very significant" and decide whether the causes of pre-harvest and/or postharvest losses can be controlled or eliminated in technological and/or economic terms. Their responses can be summarized using a format similar to that presented in Table 5.3.

Table 5.3. Feasibility of reducing the pre-harvest factors causing pre-harvest or postharvest losses

Steps in the production process*	Reducible in technological terms		Reducible in economic terms	
	Yes	No	Yes	No
Soil preparation				
Hole preparation				
Acquiring plants or seeds				
Planting				
Fertilization				
Irrigation				
Pest/disease				
Weeding				
Pollination				
Pruning & training				
Thinning				
Harvest				

* The steps should be modified to reflect the system being studied.

By identifying those pre-harvest factors which experts feel significantly affect either pre-harvest or postharvest losses and which can be feasibly modified, decision makers are provided with necessary information to help them allocate scarce resources. They may decide to designate resources to eliminate or reduce the indicated constraint, for example, improve planting material by building nursery infrastructure and training nursery managers. On the other hand, if immediate solutions are not available, they may decide to allocate additional resources for research to identify solutions, for example, the selection of cultivars tolerant to a specific pest or disease.

Postharvest

No technology has yet been developed which can completely stop the deterioration of food, whether in the fresh or processed form. Consequently, once food enters the postharvest state it begins a process of continuous deterioration, and the success of food distribution depends in great part on the capacity and effectiveness of the marketing system and the methods used to reduce the speed of the deterioration processes.

Most chemical reactions in fresh food products are regulated by the catalytic action of enzymes. The activity of enzymes is in turn partially regulated by temperature and tends to increase from two to four times for each 10 °C rise in the temperature of the medium where the reaction takes place. For this reason temperature is considered the most important determining factor in the deterioration of food products and the consequent duration of postharvest life.

The second most important factor, especially in the tropics, is humidity. While high humidity favors growth of fungi, molds and bacteria, low humidity, especially when combined with high temperature, can cause produce such as fruits, vegetables, tubers, roots, and meats to dehydrate, thus affecting weight, quality and appearance. While the deterioration process is relatively slow in the case of grains, the postharvest life span of produce such as leafy vegetables can be as short as a few hours.

In the previous section, **production**, the product was attached to the mother plant and all efforts to maintain productivity and quality took place in the farmer's field. In the postharvest stage, the product depends on its accumulated reserves and moves from point to point where conditions, environment and types of treatment vary. In describing the postharvest process, the objective is to identify and describe each point where people, machines, tools, or other physical materials come in contact with the product, affecting its quantity, quality and appearance, and eventually its price.

For example, improper harvesting or the manner of placing a product in a container may break the skin on the product, exposing it to pathological damage at a later stage. Mechanical damage may occur as root crops are dug. Loose packing may cause damage due to vibration during transportation. Weak containers may cause damage from weight pressure. Products may inadvertently be left in direct sunlight or in storage under undesirable conditions of temperature or humidity.

The pressure for economic gain may lead some agricultural value chain participants to make decisions which will negatively affect product quality at a later stage, for example: farmers watering down products or adding soil and stones to increase weight. As the number of participants and steps in the postharvest system increase, the opportunities for damage also increase.

As a product moves from the point of harvest to its final destination, many types of handling and functions are carried out which affect the particular product. To facilitate the study of the postharvest process, these actions have been categorized into five types.

Operation: Those eventualities which a product undergoes and which prepare it for a following step. For example: the act of harvesting a product, trimming, washing, waxing, and packing, among others.

Transport: Transport takes place when a product is moved from one place to another, except when such movement forms part of an "Operation" or is caused by a participant at the site during an "Operation" or an "Inspection."

Inspection or classification: This occurs when products are examined to verify their quality, quantity or other characteristics. It includes the process of regrouping products into different categories or classes.

Delays (waiting): This occurs when conditions do not permit or do not require the immediate execution of a planned following step. When the delay is intentional, the action is classified as an "Operation."

Storage: This takes place when the product is intentionally placed in a specific location to protect it from adverse conditions or to hold until it can be marketed.

In describing the postharvest system, the interdisciplinary team should identify all the important steps where the product undergoes a particular treatment, and set-up a matrix similar to that shown in Table 5.4. As each important step in the system is identified, it should be categorized as an Operation (O), Transport (T), Inspection (I), Delay (D), or Storage (S). The movement of the product can then be diagrammed in columns of Table 5.4, by connecting symbols from step to step with a line.

The next step in describing the postharvest system is to generate the additional information to fill in the remaining columns of Table 5.4, indicating ambient temperature and relative humidity at each step, distance covered when movement is involved, and time required to complete the action. Any other relevant information can be included in the column for observations.

Table 5.4. Flow diagram of steps in a postharvest system

Steps in the postharvest system*	Symbols					Additional information				
	O	T	I	D	S	Temp.	Rel. Hum.	Distance	Time	Observations
Harvest										
Transport										
Assembly										
Packing										
Loading										
Transport										
Unloading										
Waiting										
Stacking										
Storage										
Loading										
Transport										
Unloading										
Wholesale										
Loading										
Transport										
Unloading										
Retail										

O = Operation; T = Transport; I = Inspection; D = Delay; S = Storage

* Note: The steps should be modified to reflect the system being studied.

Once the important points/actions through which a particular product passes are identified, the subsequent step is the identification of the different participants carrying out the distinct actions. To facilitate this exercise, a format such as Table 5.5, which is similar to Table 5.1 used to describe the steps in the production process, can be utilized to describe the postharvest process.

In Table 5.5, each step in the postharvest process for a particular agricultural product is listed in the first vertical column. The respective answers to the six questions along the horizontal axis should be written into the corresponding boxes. An example of a completed table, based on a case study of mango *(Mangifera indica)* in Uttar Pradesh (India), is presented in Annex 5.

Since the information presented in table format is only a summary, it must be supported by more detailed information describing each step in the postharvest process, participants involved, equipment and materials utilized, and actions taken.

The information gathered by the specialists forming the interdisciplinary team will identify the principal causal factors contributing to postharvest losses. In plenary sessions, the specialists should agree on the level of significance of postharvest losses at distinct points in the system. These can be summarized in a format such as Table 5.6.

In the analytical process the specialists must keep in mind that:

1. A low percentage of losses can be significant if the total volume of products handled is large or if the cost of reducing losses is low.

2. What is viewed as insignificant for one socio-economic strata may be quite significant for another.

Based on the information from the previous tables, interviews with farmers and intermediaries, knowledge and experience of the postharvest specialists, and other descriptive information, graphical presentations can be made which will summarize the range of postharvest losses at different points in the agricultural value chain.

Table 5.5. Identification of participants and their respective actions in the postharvest process for product X in country Z

Steps in the postharvest system*	What action taken?	Who takes action?	How action taken?	When action taken?	Why action taken?	Where action taken?
Harvest						
Transport						
Assembly						
Packing						
Loading						
Transport						
Unloading						
Waiting						
Stacking						
Storage						
Loading						
Transport						
Unloading						
Wholesale						
Loading						
Transport						
Unloading						
Retail						

* Note: The steps should be modified to reflect the system being studied.

Table 5.6. Impact of postharvest operations on postharvest losses for product X in country Z

Steps in the postharvest system+	Not significant		Significant		Very significant	
	Quan*	Qual*	Quan*	Qual*	Quan*	Qual*
Harvest						
Transport						
Assembly						
Packing						
Loading						
Transport						
Unloading						
Waiting						
Stacking						
Storage						
Loading						
Transport						
Unloading						
Wholesale						
Loading						
Transport						
Unloading						
Retail						

* "Quan" = Quantity of losses; "Qual" = Quality of losses.
+ The steps should be modified to reflect the system being studied.
Note: Place "X" in the appropriate column for each step in the system. In those cases where "X" indicates significant or very significant, provide further details in writing. When reliable quantified loss information is available, replace "X" with a percentage.

As was done in the analysis of the production system, the interdisciplinary team can ask the question: **Given the existing state of the art, can the postharvest factors causing postharvest losses be reduced in technological and/or economic terms?** After discussion among the specialists, including farmers, intermediaries and other relevant participants, the answers can be summarized in a table similar to that shown in Table 5.7.

The identification of those points where postharvest losses are felt to be significant will facilitate decision making. If the interdisciplinary team feels that losses can be reduced in both technological and economic terms, then innovations and modifications to the system can be suggested. These may include actions or project ideas requiring investments in such things as infrastructure, equipment, tools, materials, training, or policy recommendations which affect the postharvest system.

If it is felt that losses cannot be reduced in either technical or economic terms, then perhaps recommendations can be made for specific research projects at different points in the system.

Table 5.7. Feasibility of reducing postharvest losses in technological and economic terms

Steps in the postharvest system*	Reducible in technological terms		Reducible in economic terms	
	Yes	No	Yes	No
Harvest				
Transport				
Assembly				
Packing				
Loading				
Transport				
Unloading				
Waiting				
Stacking				
Storage				
Loading				
Transport				
Unloading				
Wholesale				
Loading				
Transport				
Unloading				
Retail				

* Note: The steps should be modified to reflect the system being studied.

Marketing and distribution

Marketing must be considered during the planning of production and throughout all the business activities associated with the flow of goods and services from production to consumption. In this regard, as mentioned previously, it is necessary to identify the path that the product follows throughout the agricultural value chain.

The concept of market is present when the farmer makes decisions about what crops to plant, when to plant, which and how many inputs to apply, how much and what source of labor to use, when to harvest, and when to sell to whom. The intermediary is also thinking of the market when s/he decides what products to buy, what quantities, what quality and at what price; how and when to transport, select, store, package and sell the produce. **Marketing is the integrating force for all these different decisions.**

Developing countries are keen to increase their earnings of foreign exchange. They normally attempt to do this either by increasing their domestic production of imported items or by increasing their exports of traditional and non-traditional products. Most countries attempt to do both.

Effective marketing, whether local, regional, or extra-regional, requires the ability to provide some minimum quantity of an agreed-upon-quality product to a given market on a regular basis and at a competitive price. When analyzing the marketing distribution system, it is necessary to generate information which will permit a good understanding of the system and its potential for development. The make up of the interdisciplinary team should include persons knowledgeable of marketing institutions, transportation, agroprocessing, and both domestic and export marketing. As identified in the final quadrant of Figure 4.1, the components dealing with marketing, distribution and agroprocessing should be identified, described and analyzed.

Emphasis should be given to the collection of differentiated information on wholesale and retail marketing, taking into account the following:

- Participants in the marketing system.
- Market channels.
- Sales volumes, prices, marketing costs and profitability.
- Estimated volume of product losses.
- Availability and access to financing.
- Service institutions and quality of services provided.
- Characteristics of consumer demand (domestic and abroad).
- Agroprocessing capabilities.
- Availability of transport.
- Available marketing infrastructure.
- Potential to supply domestic and export markets.

The team should determine the marketing channels for the agricultural product under study by reviewing the literature on the product and interviewing participants in the marketing system. The information obtained can then be summarized in graphic form following the model presented in Figure 3.1C.

This type of diagram provides three kinds of information:

1. Types of traders or intermediaries involved in the marketing of a specific product.

2. Alternative channels foIlowed by the product from farm to consumer.

3. Estimated percentage of the total amount of produce moving through each point in the agricultural value chain.

Table 5.5 in the postharvest section will facilitate the identification of the different types of participants involved in the postharvest process, including the various marketing intermediaries. Specific information regarding the marketing channels and the percentage of the total product that is transported from one place to another must be determined or estimated by reviewing national production and marketing statistics, studying documents, and conducting interviews with persons who are knowledgeable on the topic. Detailed information can be collected from participants using questionnaires similar to those provided in Annex 2.

A marketing research study could provide an idea of the main marketing costs and the profit made by farmers and each type of intermediary. Efforts must be made to find case studies in the documents that provide marketing margins for the selected product. If this information cannot be obtained and sufficient resources are available, case studies can be carried out to get an overall idea of marketing costs and margins.

Case studies can be carried out by conducting interviews and observing different intermediaries in the marketing channel over the same period of time. A few interviews can provide a rough idea of the corresponding margins.

Postharvest losses often fluctuate based on the availability of products in the market. As more products become available, prices drop, consumers become more selective, and more products are discarded or fed to animals.

In the analysis of demand, whether domestic or foreign, consumer demand characteristics must be identified and described to help determine the real potential of a particular market as well as the national ability to supply that market. For any product it is necessary to know the intended consumer's preference in such things as size, color, weight, flavor, texture, degree of maturity, and preference for package. In addition, it is important to identify potential constraints such as pests, diseases, insecticide residues, and other factors that might affect ability to market. Table 5.8 is suggested as one method for summarizing such information.

Table 5.8. Characteristics of demand for product X in country Z

Demand characteristics*	Information for intended market	
	Domestic	Export
Preferred cultivar		
Preferred size		
Preferred weight		
Preferred color		
Preferred flavor		
Desired texture		
Preferred degree maturity		
Preferred type package		
No. units per package		
Preferred w/package		
Other preferences		
Constraints		
Pest problems		
Disease problems		
Insecticide residues		
Quarantine restrictions		
Other constraints		

* Note:
This list should be modified based on available information and information needs for the agricultural product being studied.

Food losses quantification

Food losses (postharvest losses) quantification along the agricultural value chain allows, among other things:

- Identification of the points along the agricultural value chain where more food loss occurs and identification of strategies (technologies and postharvest practices) most appropriate for loss reduction.
- Establishment of a base-line for comparing the progress following change in strategy. Targets can be set and progress can be compared.
- Monitoring and evaluation of strategies implemented to reduce food losses.
- Setting a goal for reducing food losses and tracking it over time.
- Estimating the financial cost of food losses along the agricultural value chain, or one of its components in particular.
- Generation of statistics on food losses in the agricultural value chain under study.

There are three major types of food losses:

Quantitative losses: loss of weight, loss of volume; discards due to physical damage or serious decays.
Qualitative losses: damage, loss of freshness, poor visual appearance, changes in color, wilting, yellowing, dehydration or water loss, decay symptoms, or nutritional losses.
Economic losses: loss of monetary value per kilogram (kg) or per unit.

Both quantitative and qualitative losses will result in monetary or economic losses. In the first case, there is less volume or weight to sell, and in the second case, the price offered for the produce will be lower than that offered for higher quality food products.

The CSAM process, involving interviews, observations and measurements of physical losses allow documenting the causes and sources as well as the amount of losses. Any existing data as well as new data can be gathered and analyzed. In addition to Tables 5.2 and 5.6, in Annex 6 there are a series of worksheets that enable rapid quantification of losses in quantity and quality for fruits, roots, tubers, bulbs, and leafy vegetables chains at the farm, storage, wholesale and retail levels.

Table 5.9 corresponds to an example of the information collected at farm level in India for different crops using the worksheets presented in Annex 6.

Table 5.9. Assessment of postharvest losses for different crops on farm level in India

Crop	Air temp. °C	Pulp temp. °C	Package size (lbs.)	Package protection	% decay	% mechanical damage	% sorted out before sale
Tomatoes	30.1	25.1	27	4	5	10.5	8.7
Mangoes	34.5	31.6	8.4	4.4	5	6.5	6.5
Eggplant	34.3	35.5	35	2.5	7.5	14	13.8
Cucurbits	30.5	26.9	21	2.9	4.5	9	12.7
Okra	31.2	32.1	34	2.3	2.6	8.8	18.5
Litchis	31.6	27.3	43	2.9	8.5	14	9.8

Notes:
Package protection rating: 5 = excellent
Physical losses: damage, decay and defective produce that is sorted out and not sold for human consumption

Source: Kitinoja 2010.

In 2016 the World Resources Institute (WRI), The Consumers Goods Forum (CGF), Food and Agriculture Organization of the United Nations (FAO), FUSIONS project, United Nations Environment Programme (UNEP), The Waste and Resources Action Programme (WRAP) and the World Business Council for Sustainable Development (WBCSD) launched the first version of the Food Loss and Waste Accounting and Reporting Standard. The document is available on the website: http://flwprotocol.org/

Socio-economic implications of food losses

Food losses have significant financial implications along the entire agricultural value chain in the form of direct costs and foregone benefits; these reduce profitability and competitiveness.

Environmental externalities linked to food losses can be monetized to consider the costs involved, not only for actors at a particular point in the agricultural value chain but also for society in general; this helps enhance the discussions on investment and policies.

According to the FLW protocol (2016), when quantifying the financial implications of food losses, it is important to keep in mind that a complex set of variables affects economic value. When an entity seeks

accurate estimates of potential financial gains or losses, factors such as the volatility of prices as well as currencies should be taken into account.

It is also important to be clear about which financial elements have been considered, for example:

- Price of inputs (e.g. for farmers: the cost of fertilizers and pesticides).
- Price of labor.
- Value of lost revenue (e.g. if 20 percent of produce is rejected due to poor quality).
- Costs associated with collecting the losses (e.g. in the field).
- Costs (or revenues) from disposing of or treating the food losses.
- Costs associated with environmental impacts (e.g. greenhouse gas emissions, water use, land use).

Chapter 6

Identifying problems and their solutions

Once the methodology has revealed the internal workings of an agricultural value chain and identified its main problems, it becomes relatively easy to identify possible solutions. The interdisciplinary team will have identified and described the principal characteristics of the participants and their respective actions throughout the agricultural value chain. As team members obtain information about the qualities of pre-production, production, harvest, postharvest, and marketing, they will begin to decide what is working well within the agricultural value chain and what is not. Team members will then be able to link problems and their causes with particular participants (farmers, intermediaries, companies, organizations, institutions, and others). This information, when properly organized and analyzed, will lead to the design of solutions, expressed in the form of projects.

The objective of this chapter is to present some instruments which will facilitate the identification and organization of problems and their causes, and the design of solutions.

Problem analysis

Problems occur at all points in any agricultural value chain and come in all sizes. Small problems (bad quality seeds, poor pruning and improper harvesting) occurring on the farm may become very large problems in the marketplace when the produce cannot be sold due to poor quality. Someone who observes a farmer in the marketplace unable to sell his produce might conclude that the problem is in the market. In fact, the inability to market a product is usually an indicator of problem(s) in the agricultural value chain. Unless we know the root problem and its causes, we cannot design effective solutions.

Any analysis of problems affecting an agricultural value chain must necessarily look for causes in each component of the respective value chain.

Problem analysis has been defined by GTZ (1983) as a set of techniques to:

- analyze the existing situation surrounding a given problem condition.
- identify the major problems and the core problem of a situation.
- visualize the cause-effect relationships in a problem tree diagram.

The starting point in problem analysis, therefore, should be the identification of as many of the related problems as possible and their respective causes.

As should be apparent from any analysis of an agricultural value chain, the problems vary in accordance with the type of participant. Farmers, for example, may have problems related to land, labor, information, financial resources, cultural practices, management, markets, and more. The farmers' problems are likely to cover the full range, from planning all the way through the system to marketing.

The more in-depth the agricultural value chain analysis carried out, the greater the number of problems and causes identified. The purpose of the detailed description of an agricultural value chain is

to provide an information base for problem identification. If each member of the interdisciplinary team is experienced and knowledgeable in his/her particular area, and if the description of the agricultural value chain is carried out in detail, then conditions will be set for a problem brainstorming session.

During the application of the CSAM methodology the interdisciplinary team will also identify new research, training and practical extension needs, as well as advocacy issues that could help to reduce food losses.

Research needs are problems that have no immediate solution and which require further study, adaptive research experiments, or field testing; for example, postharvest losses linked to a pest for which no known treatment is available.

Training and/or extension needs, such as existing information that growers, handlers and marketers need to learn about. Examples include: providing information on maturity indices so growers will know when to harvest for best quality and shelf life, and providing information on the costs and benefits of a postharvest handing practice or storage technology.

Advocacy issues are needs that cannot be addressed by individual farmers, traders or scientists, but need the government or society to take part in solving or making public investments. A good example is poor roads from the farming areas to the marketplaces.

Instruments for analyzing problems and finding solutions

Brainstorming for problem identification

Brainstorming about agricultural value chain problems and possible solutions can be made easier if participants are gathered in a pleasant and informal environment with an effective discussion leader.

Brainstorming sessions can be held by conducting a card dynamic. During this exercise cards and pens are handed out to the attendees, and they are asked to respond to the guided questions that are formulated one by one, in a brief and anonymous manner. For example: What are the limiting factors for crop X? What are your suggestions to solve the problems affecting crop X?

After allowing some quiet time to answer the questions, the cards are collected and placed on the blackboard for all the participants to see. Then there is a collective debate in order to group together relevant issues. The discussion and exchange of ideas that is generated with the cards is very rewarding and stimulating. It motivates the participants to freely express themselves, present possible solutions and express their commitment to participating in future activities. Subsequently, this tool becomes a valuable instrument for building a problem tree.

Problem checklist

Once the brainstorming session is completed, the interdisciplinary team may choose to review the checklist of potential problems presented in Annex 1. Since this is a rather long list, it could take several hours or days to analyze point by point. To avoid inappropriate use of scarce time, the checklist should be reviewed quickly by each team member, to jog the memory, with the purpose of identifying important problems or causes of problems that may have been overlooked in the brainstorming session.

The checklist may also be used as a format to summarize problems as shown in Table 6.1 or to serve as a guide in organizing the problems from the brainstorming exercise by particular components of the agricultural value chain. By grouping the problems according to their respective points in the agricultural value chain, the team puts them in a perspective which contributes to understanding of cause and effect relationships.

The priority problems identified in Table 6.1 were obtained in 2009 as follows: First, an interdisciplinary team carried out a brainstorming session to identify the problems affecting the mango value chain in Uttar Pradesh, India. A very long list of problems was obtained which was then reordered following the guideline checklist in Annex 1. The same team of specialists then reviewed the complete list of problems to identify those of highest priority. These were then listed as presented in Table 6.1. The point in the system where the problem occurs and the nature of that problem are presented in the first column of Table 6.1. More specific details of the problem are indicated in the last column on the right. In this latter case, details should be included, showing how the problem affects quality, quantity, price or availability of product.

Table 6.1. Priority problems in the production of mango in Uttar Pradesh, India

Point in agricultural supply chain where problem occurs	Indicate priority problems	Outline problems impacting quality, quantity, price or availability
AGRICULTURAL POLICY		
- Price control	X	No involvement by the Agricultural Product Marketing Board.
- Pesticide control legislation	X	Not enforced.
INSTITUTIONAL ISSUES		
- Coordination among institutions	X	Poor coordination in planning, processing and marketing.
PRE-PRODUCTION		
- Planting material	X	No credit available for purchasing planting materials.
CROP CHARACTERISTICS		
- Farmers	X	40% own 2 or fewer hectares (small, marginal farmers). They sell harvests to intermediaries up to several years in advance.
- Intermediaries	X	Take care of the plantations & harvest and market the fruits. Control information on market prices.
PRODUCTION		
- Agricultural inputs	X	Use of toxic products such as monocrotophos and chlorpyrifos.
- Technical knowledge	X	No access to technical information for increasing productivity and reducing production costs.
HARVEST		
- Harvest	X	Inadequate harvesting methods.
POSTHARVEST HANDLING		
- Treatment with chemicals	X	Use of calcium carbide although prohibited by law.
- Cooling	X	No infrastructure available.
PROCESSING		
- Processing Units	X	No opportunity for small and marginal mango producers.
MARKETS /MARKETING		
- Organization	X	Farmers' unorganized.
- Price	X	Information not easily accessible.
	X	Crops sold two to three years in advance to intermediary.
- Transport	X	Trucks with cooling systems available only for export.
CONSUMPTION		
- Domestic	X	Demand by each region for particular variety.

* Note: The data for this table was prepared by going through the problem checklist in Annex 1. Only the priority problems checked with an "X" are summarized here.

Problem tree diagram

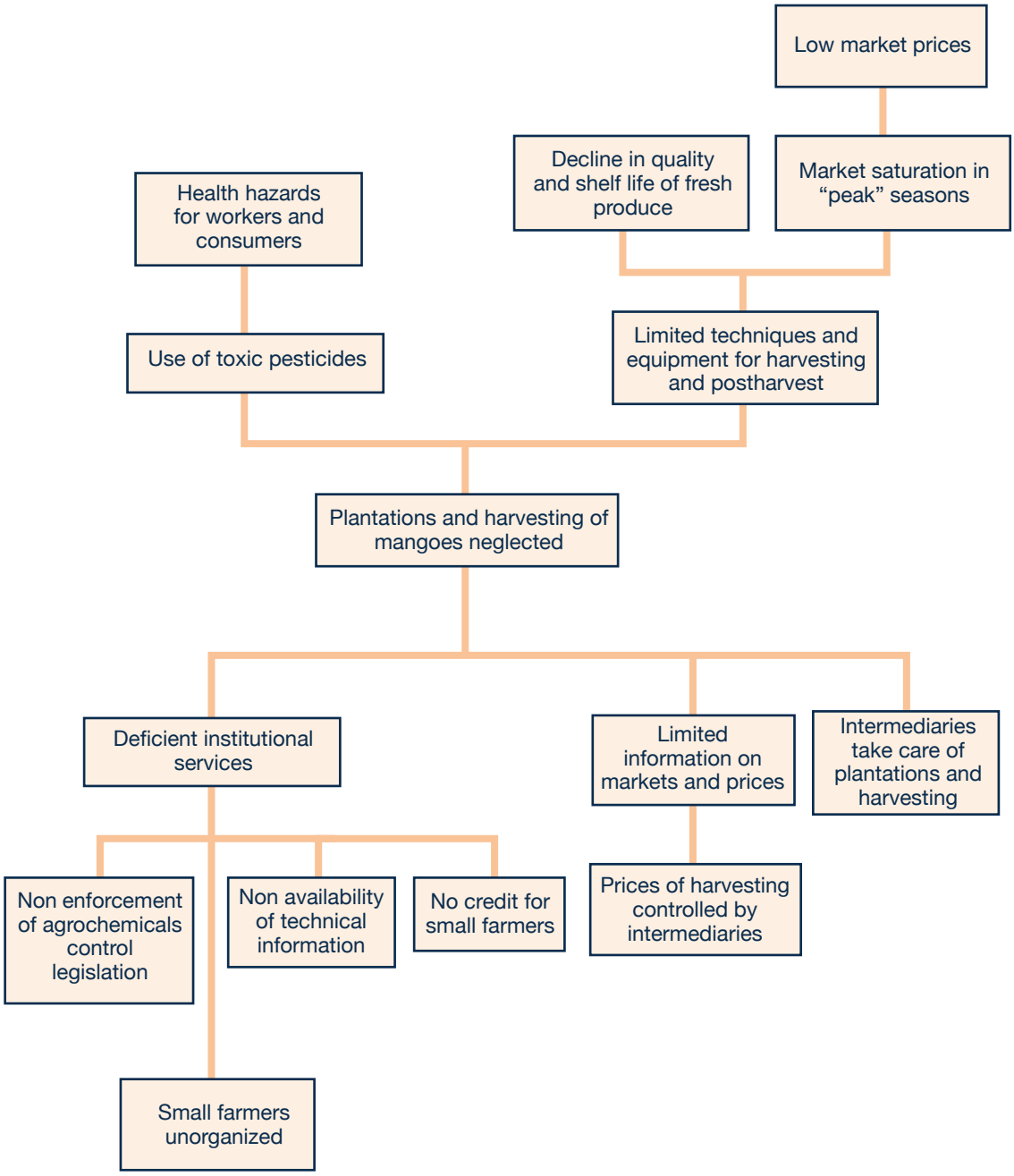
A problem tree diagram is a way of visualizing the cause and effect relationships regarding a particular problem situation. In such a diagram the causes are presented at lower levels and the effects at upper levels. The core problem connects the two. Thus the analogy with a tree: the trunk represents the core problem, the roots are the causes, and the branches represent the effects. The more specific the causes, the more likely they are to lie at the lower levels of the tree diagram; however, **the location of a problem on a tree diagram does not necessarily indicate its level of importance**.

There is no one correct way of formulating a tree diagram. Different individuals or groups, given the same list of problems and causes, will normally organize them differently in a tree diagram. This is due to the different levels of knowledge and experience of each person, and the amount of time available for analysis. Given sufficient time and exhaustive discussion, however, different interdisciplinary teams are likely to produce very similar results. In general, the more complete the level of knowledge of the participants and the longer the time dedicated to analysis, the greater the likelihood of similarity in results.

As has been stressed earlier, **the key to problem solution is proper problem identification**. The tree diagram facilitates the organization of problems into a logical sequence which will lead to logical conclusions and the identification of cost-effective solutions.

Figure 6.1 illustrates the information presented in Table 6.1 in a problem tree format. In this instance the **core problem** is established as "plantations and harvesting of mangoes neglected". The **causes** of this core problem, as shown in Figure 6.1, are due to: "poor institutional services", "lack of information on markets and prices", "intermediaries take care of plantations and harvesting". The causes of each of these respective problems are identified in the lower levels of the problem tree.

Figure 6.1. Problem tree showing cause and effect relationships in the production and marketing of mango in Uttar Pradesh, India



Two effects from the core problem have been identified in Figure 6.1. These are: (1) use of toxic pesticides that become health hazards for those involved in applying and those consuming its residues in fruit; (2) limited equipment and techniques for harvesting and post harvesting handling. Such limitations decrease the quality and shelf life of fresh produce and saturate markets in the "peak" production season.

As desired, causes and effects can be detailed to the point where several pages might be required to present the entire problem tree. In general, **the more detailed the analysis, the more complete the understanding of the agricultural value chain and the greater the probability of designing effective solutions.**

The problem analysis can be concluded when the interdisciplinary team decides:

a) That the essential information has been included in the causal network, and

b) The cause-effect relationships which characterize the problem situation can be clearly distinguished.

Objectives analysis

The objectives analysis is the process whereby the problems are converted into objectives and goals towards which activities can be directed. It also includes an analysis of the objectives to determine whether they are practical and can be achieved.

In carrying out the objectives analysis there are five basic steps:

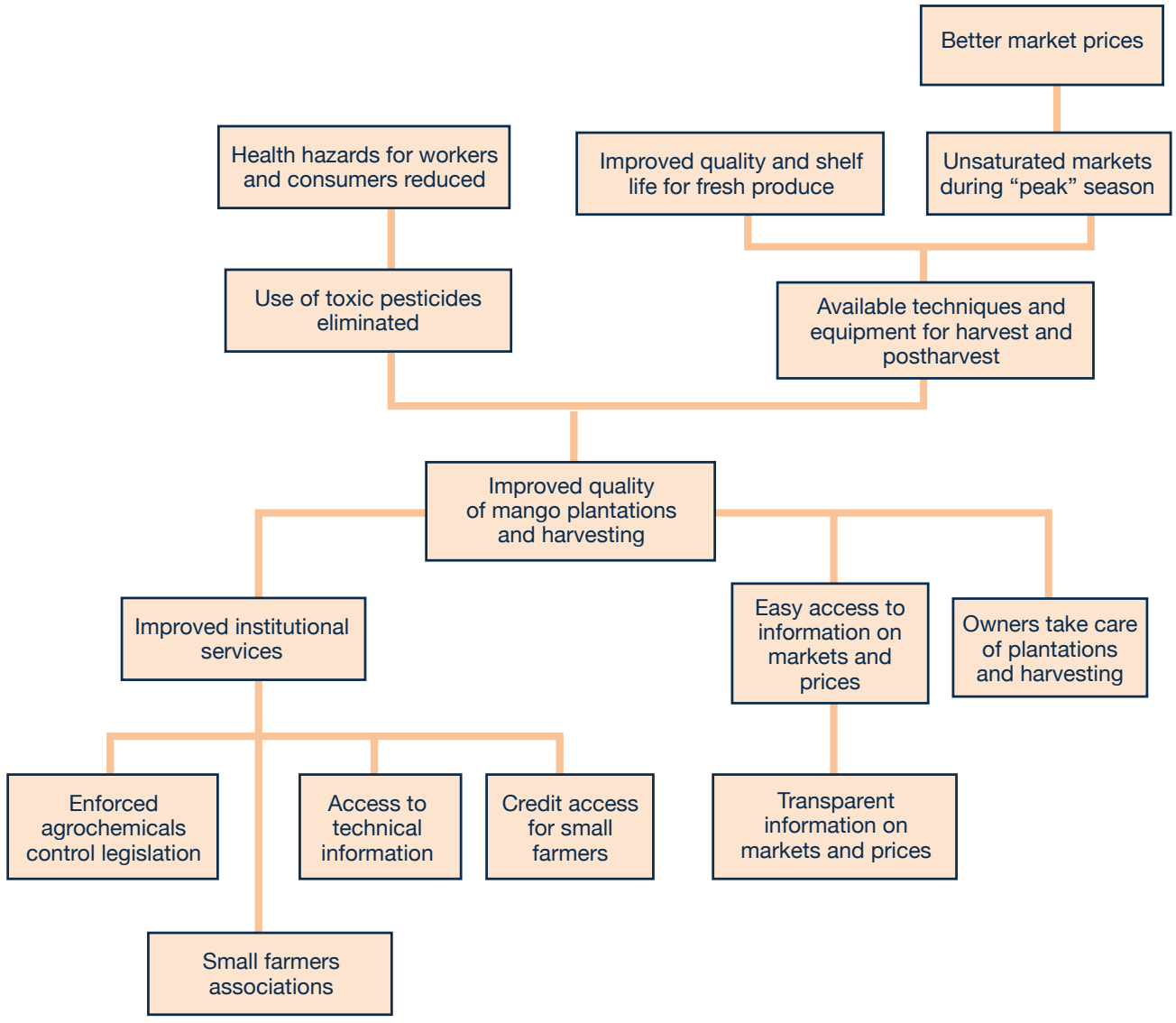
1. All the negative statements shown on the problem tree are restated as positive statements.
2. All the objectives are reviewed to assure that they are desirable and realistically achievable in an acceptable time frame.
3. Those objectives which do not meet the conditions mentioned in (2) are modified. Those which are undesirable or cannot be achieved are deleted.
4. Any new objectives which are desirable or necessary to complement existing ones should be added to the diagram.
5. The "means-end" relationships thus derived should be thoroughly examined to assure validity, logic and completeness of the diagram. Modifications should be made as necessary.

When the problem cannot easily be converted into positive statements (objectives) it may indicate an unclear statement of the problem. In that case the problem should be reconsidered and rewritten.

In the final analysis of each objective, the question should be asked whether the achievement of the lower level objectives is sufficient to achieve the next highest objective. In other words, has the cause-effect relationship (Figure 6.1) been transformed into a means-end relationship (Figure 6.2)?

By starting at the bottom of the objectives tree (Figure 6.2) and working upwards, it can be seen that the achievement of the lower level objectives will lead to the achievement of the objective at the next highest level. Each objective seems to be realistic and attainable within the actual circumstance of the local culture and environment. Thus we can conclude that the objectives contained in this tree diagram are viable and can give direction to development projects.

Figure 6.2. Objectives tree for the production and marketing of mango in Uttar Pradesh, India (derived from Figure 6.1: problem tree)



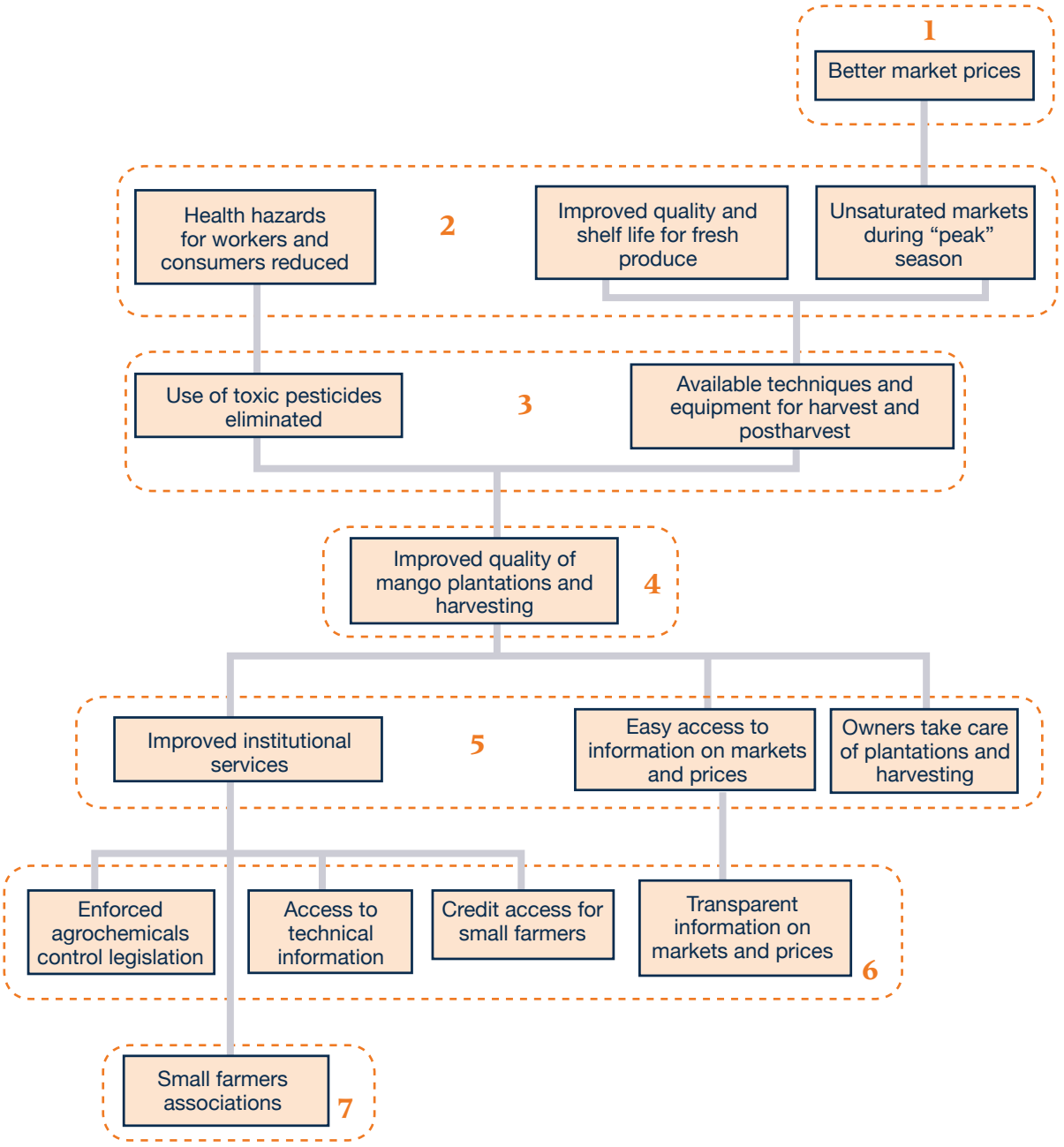
Analysis of strategy alternatives and project identification

Continuing with the mango example in Uttar Pradesh, Figure 6.3 shows some worksheet notations which can help in an analysis of the situation. Each of the rows of objectives has been assigned a number from one (top row) to seven (bottom row). The objectives in the top rows are quite general whereas those in the bottom rows are more specific. If the problem tree had been developed to its full extent, the bottom-most rows would be even more specific. As the objectives become more specific, they might better be called expected results or outputs. For example, in row 7, expected results might include: an association of small mango farmers in Uttar Pradesh up and running.

If an attempt were made to define one general objective which encompasses all these objectives (rows 1 to 4) it might be as follows: **"Improve quality of mango plantations and harvesting".**

At the fifth level of objectives (Figure 6.3), there is a distinct dichotomy in which one branch specifies objectives to be achieved within public sector institutions, e.g., ministry of agriculture, and the other branch specifies objectives which can best be achieved by working directly with the private sector (farmers). Since target groups are different in each case, it would make sense to consider these as two distinct project areas within an overall strategy.

Figure 6.3. Identification of alternative strategies and projects, based on the objectives tree (Figure 6.2)



Participant analysis

When persons, groups, institutions, and organizations see that they have something to gain from a project, they are much more likely to play an active role in working toward the success of the project. **Problems do not exist in isolation but are closely linked with people, groups, institutions, and organizations, and usually more than one person or group.** This leads to a further complication in that a problem affecting one person or group in a negative way may be beneficial to others. Therefore, any attempt to remove a particular constraint may come up against resistance. For example:

- Import laws disadvantageous to farmers may have been lobbied into place by traders. Since traders (importers, wholesalers, exporters) normally have more political and economic clout than do farmers, the laws are difficult to change.

- The organization of a marketing cooperative may put some intermediaries out of business. These might then use their economic strength and political influence to weaken the cooperative.

- A government marketing board may be suffering great losses in both money and produce while benefitting employees with jobs, and consumers through low prices. Any attempt to improve operational efficiency by reducing staff will be met with strong resistance.

- Two or more institutions may be duplicating research or training efforts, but professional pride and competition may keep them apart.

Parallel to the process of describing systems and identifying problems, the interdisciplinary team should analyze the various types of participants and their characteristics, for example: status, interests, resources, motives, attitudes, strengths, weaknesses, and their potential support or opposition to actions that remove constraints. Important questions are: Which are the target groups? Which will play a supporting role? Which will benefit from the actions (potential supporters)? Which will be affected negatively (potential opponents)? An attempt should also be made to identify how the persons or groups will be affected.

In the execution of the participant analysis, the interdisciplinary team should collect the necessary information to fill in Table 6.2. The steps involved in this process are indicated below:

1. List all types of participants (persons, intermediaries, groups, companies, organizations, institutions, projects etc.) identified in the analysis of the agricultural value chain. These are all potential target, support, or opposition groups (Note: At this point the reader should refer to Tables 5.1 and 5.5 where different participants in the production and postharvest systems were identified).

2. Review the list to determine whether each represents a homogeneous unit or whether the group can be further subdivided. For example, government institutions can be divided into the ministry of agriculture, planning unit, and marketing board. Intermediaries may be categorized as wholesalers, retailers, and exporters.

3. Characterize and analyze each participant type, considering his/her social characteristics, organizational structure, status, interests, motives, attitudes, strengths, weaknesses, shortcomings, and potential role to be played.

4. Identify possible positive and negative consequences of introducing changes into the agricultural value chain and the potential impact upon the different participant groups.

5. Fill in Table 6.2 indicating whether participants are target, support or opposition groups, or whether they belong to some other group affected by changes in the system. Describe how they are affected, emphasizing the economic or social impact.

6. In the case of ongoing projects, identify those which complement, duplicate or compete with the proposed project.

7. Develop strategies for coordinating with the more important persons, groups and/or ongoing projects.

Projects benefitting large numbers of participants are more likely to receive support during the implementation phase. Projects having a negative impact on some participants with strong economic and/or political clout are more likely to run into delays during the implementation phase.

Table 6.2. Expected impact of efforts to modify an agricultural value chain

Participants in the agricultural value chain*	How affected:	
	Positive effects	Negative effects
Target groups: - - - -		
Support groups: - - - -		
Other groups affected: - - - -		
Ongoing projects affected: - - - -		

* Note: Refer to table 5.4 and 5.8 to identify the participants.

Summary of project identification

The results for the analysis of Figures 6.1 to 6.3 are summarized as follows:

- A causal relationship has been identified between problems occurring on the farm, with intermediaries, during postharvest handling and within public sector institutions.
- It therefore stands to reason that resolution of the problems at the lower levels of the problem tree could produce a positive impact across the subsector under analysis.
- The objectives tree facilitates the identification of objectives and desired results which lead to the formulation of projects to overcome the identified problems.
- By identifying participants, ongoing actions, and means-end relationships, conditions are set to identify priority project areas.

Given this information, a possible strategy to improve quality of mango production in Uttar Pradesh can be summarized as follows:

- Execute a series of actions through both public and private sectors to improve the quality of the plantations and handling of mangos during harvest and postharvest and thus improve the quality and safety of fresh produce in the domestic market.
- Focus efforts in the selected areas of production by improving institutional services to small mango producers, including access to credit, technical and market information, and assistance in strengthening their association.

Criteria for establishing priorities

Since there may or may not be sufficient resources for implementing all activities and projects simultaneously, some projects or activities should take precedence over others. In the case of Uttar Pradesh, for example, tools for improving harvest and postharvest techniques are top priority while actions such as access to credit for small producers, though important, are lower priority.

Criteria to be considered in determining priority should include technical feasibility, costs and benefits of the project or action, social impact, and political support for project or action. Criteria of local significance can be added as conditions warrant. To quantify the relative importance of the different projects, the interdisciplinary team carrying out the analysis can arbitrarily assign numbers to each criterion; say one for low priority and five for high priority. An application of this methodology for the case of mango in Uttar Pradesh is presented in Table 6.3.

Table 6.3. Prioritization of selected actions and projects for improving mango production in Uttar Pradesh, India

	Actions and projects				
CRITERIA*	Credit for small farmers	Encourage small farmers organization	Improve harvesting tools	Improve knowledge of postharvest techniques	Improve supply of non-toxic agricultural inputs
1. Technical feasibility	1	1	5	5	4
2. Benefits/costs	5	5	3	3	5
3. Social impact	5	5	3	3	3
4. Political feasibility	1	3	5	5	3
Total	12	14	16	16	15
5. Falls within national objectives	No	No	Yes	Yes	No
6. Falls within executing institution's objectives	No	No	Yes	Yes	No
7. Priority of timeliness	4	4	5	5	3

*1. If technology readily exists, it is 5; the more adaptive research required, the lower the rating.
2. The higher the benefit to cost ratio, the better the rating; 5 is the highest.
3. The greater the social impact, the higher the rating; 5 is the highest.
4. The lower the degree of political opposition, the higher the rating; 5 is highest.
5. "Yes" if action is in line with national objectives; "No" if it is not.
6. "Yes" if action is in line with implementing institutions' objectives; "No" if it is not.
7. The higher the number (5 highest), the more timely the action and the more likely that the action is a precondition for other actions. Lower numbers indicate that the action can be delayed until other actions are put in place.

After totalling the number of points, however, there are at least three additional questions which should be asked:

- Does the project fall within national objectives?
- Does the project fall within the objectives of the organization that will implement them?
- When should the action be initiated relative to the other actions?

The responses to these three questions, for the case of mango in Uttar Pradesh, are presented in the second part of Table 6.3. Only two out of the five actions fall within national objectives.

With regard to the implementation sequence, the third and fourth activities have top priority, followed by activities five and two, then activity one, in that order. The reason for this arrangement is that with the implementation of activities three and four, results for achieving the objective: "Improve quality of

mango plantations and harvesting" will occur more quickly. For this objective, as well as activities three and four to be successful, participation and access to credit for small producers would be very helpful.

At this point it is useful to ask another question:

- What important political decisions must be made before implementation can take place?

This question should be asked for each project identified, considering that sometimes the implementing agency is unable to execute certain actions without the authorization of another agency or institution. Some examples:

1. Licenses may be needed to import inputs that are not produced in the country.
2. A policy change may be required before a new marketing strategy can be applied.
3. A change in the organizational structure of an institution may require cabinet approval.

If these possible bottlenecks can be identified during the design stage, then strategies can be developed to keep them from becoming hindrances to the project during implementation.

Other useful questions are:

- What are government development policy priorities?
- Is available manpower sufficient to implement the project?
- Will the action or project complement or compete with similar actions by other donor or support groups?
- Are there any other local, regional, or national conditions which may affect project implementation?

Project profiles

While there are many definitions for development projects, the important thing is to understand a project's characteristics. The more salient are the following:

1. Projects have a physical dimension which establishes limits to their available resources.
2. Projects have a temporal dimension. Since they begin and end at specific times, they can be differentiated from ongoing institutional activities.
3. Projects conform to a well-defined unit (group of actions) which can be evaluated to determine its success.
4. Projects have clearly defined objectives which tend to be innovative rather than perpetuating an existing situation.

Hence, a project is a set of interrelated activities aimed at a common goal/objective and implemented during a given period of time with a predetermined quantity of resources (objectives + resources + activities + time).

If we accept this definition of a project, then we can prepare a project profile by:

1. Defining its goals, objectives and expected outputs.
2. Describing the project's principal activities.
3. Indicating the resource requirements to implement the activities.
4. Establishing a time frame for the beginning and ending of the project.

Anyone capable of analyzing an agricultural value chain and identifying priority problems and needs is also capable of identifying a project idea and expressing it in the form of a project profile.

The key to project identification and formulation is knowing what the priority problems are. Since the priority problems have been neatly organized in the problem tree (Figure 6.1), converted to objectives in the objectives tree (Figure 6.2) and analyzed in alternative strategy analysis (Figure 6.3), the writing of a project profile is a straightforward task. That is, the system analysis has identified all the basic information necessary to prepare one, or several, project profiles.

While different people and organizations use different outlines for project profiles, basically they all contain the same type of information to greater or lesser degrees. Based on the definition of a project given above, the following minimum information should be included in a project profile:

1. Title (reflects the most important feature of the project).
2. Definition of problems/justification (derived from the problem tree).
3. Goals or general objectives (derived from an analysis of objectives tree and alternative strategies).
4. Specific objectives (derived from analysis of the objectives tree and alternative strategies).
5. Expected outputs (identified from the lower levels of the objectives tree). The expected outputs are the results wanted at the end of the project.
6. Activities to be executed under the project which will produce the expected outputs. (These are a logical extension of the expected outputs and must be carried out to achieve the expected outputs).
7. Expected duration of the project (determined by the time required to complete all project activities in their proper sequence).
8. Estimate of costs (derived from an analysis of inputs required to implement activities).
9. Implementing organization or agency (determined through an evaluation of organizational capability, source of funding, and local politics).

Project profiles are short descriptions of potential projects. As noted, they can be written in many different formats.

Points for inclusion when drafting a project proposal for postharvest loss reduction

Kitinoja (2010) proposes including the following issues for achieving success in a project oriented to reduce postharvest losses (food losses):

1) Focus on the beneficiaries

Many project assessments point to the need to advocate farmers' agribusiness skills, attitudes and aspirations, for example:

- Treat farmers as agribusiness people rather than just farmers.
- Aim to be not only more productive but more profitable.
- Ask smallholder farmers to consider issues beyond their farm plots (address the entire agricultural value chain and understand the needs of their buyers).
- Deliver targeted training or agricultural extension services that help improve the quality of produce, postharvest handling and marketing linkages.
- Provide training in local languages and incorporate audio-visual training aids.

2) Work through groups whenever possible

Whether via informal groups, cooperatives or formal associations, it is vital to work with groups to impact policy and reach large numbers of people. Groups are the key to:

- Assessing local needs, facilitating targeted training, introducing new crops and technologies.
- Strengthening marketing capacity and market linkages.
- Managing contracts and sales beyond capacity of individuals.
- Building privatization efforts (moving from project provided services to community provided services).
- Development of financing opportunities (eg.micro-credit).
- Designing appropriate, cost effective and innovative delivery systems (providing people with the information and skills they need, when, where and in a way they can best understand and use it).
- Include women in all relevant issues like access to credit, training and extension services. Women participation in such areas has proven to increase productivity and efficiency.

3) Postharvest best practices should be incorporated early on in projects

There is a long history of agricultural development projects to improve production and marketing that have been biased towards production and have overlooked postharvest activities. One cause of this problem is discipline bias. The purpose of development projects is to improve the efficiency of the

agricultural value chain; consequently, emphasis should be given to strengthening those links in the chain where profits to farmers, intermediaries and other participants can be increased the most.

- Do not neglect the postharvest components of the agricultural value chain.
- Identifying appropriate postharvest interventions is crucial to increasing farm profitability. Barriers affecting adoption of postharvest interventions include complexity, unavailability of technologies and perception that investment costs are too high.
- Advantages of sorting, grading, packing, cooling, storage and other topics should be addressed via agricultural extension.
- Best practices training should be supported by appropriate infrastructure development and technology improvements.

4) Invest more wisely in postharvest infrastructure

Most countries have examples of high profile and costly projects that failed. These include significant postharvest infrastructure; silos, warehouses and cold storage facilities, among others. Causes of failure include poor planning, wrong location, poor design and high costs of operation, among others. Some guidelines to making wise investments in postharvest infrastructure are as follows:

- Develop the infrastructure to enhance agribusiness activities (consider location, access, costs, etc.).
- Match the facilities (cost, size, scope) to local needs and management capabilities.
- Avoid over-building. Large facilities are very difficult for smallholders to manage and can be too costly to be profitable.
- Develop or enhance the agricultural value chains by assisting buyers to meet and interact with farmers (market linkages).
- Make investments earlier in the project (on the farms, at packinghouses, for transport or storage, in markets, and market information systems).
- Deliver training to ensure that infrastructure is utilized, managed and maintained properly. Training in postharvest issues increases readiness and willingness to make changes, but if postharvest infrastructure and marketing support is not there for participants, the results of training can be frustration. Similarly, providing infrastructure without training can be a disaster waiting to happen, since successful postharvest management requires complex knowledge and skills.
- Make sure that technical support is available and a program is financed to ensure an effective transfer of appropriate technologies to the operators of the infrastructure.

5) Build local capacity (strengthen institutions, human resources, community services)

Training should leave behind a cadre of local trainers and support service businesses to continue the work that is started by a development project. Capacity building includes:

- Technical and educational program development.
- Training of master trainers.
- Network creation (helping members of the value chain meet and get to know each other).
- Resource identification and strengthening of support services (local postharvest suppliers, repair services, engineers, credit).
- Building functional local capacity seems to have a strong relationship to sustainability.
- Sending farmers on "study tours" to regional or capital markets helps them to better understand the value chain for their crops.
- Designing appropriate innovation delivery systems depends upon first developing this local capacity.

6) Projects should have a longer term focus, rather than the traditional 2 to 5 years, to increase the likelihood of sustainable results

- Project cycles should not be too short. Two to five years does not provide enough time to build a solid base that will allow a project to work successfully with low resource communities.
- Projects that follow on past projects and follow up on any evaluation based recommendations can achieve good results.
- Development project plans should be flexible enough to allow for adjustments during implementation.
- Ten years for a full scale project cycle is recommended.

Calculating relative costs and expected benefits of postharvest technologies and practices

Calculating costs and benefits can provide information to determine profitability and whether the use of certain technologies and agricultural and postharvest handling practices can improve the income of farmers or marketers. Besides, it allows comparisons using two or more different practices in the context of the same operation.

For comparing a current practice to a new postharvest technology or practice, actual local market prices can be used. The amount available for sale will depend upon estimations of postharvest losses percentage.

To rapidly determine potential economic benefits for a specific postharvest technology or practice, a simplified cost/benefit worksheet can be used. In each of cases developed for the CSAM process, data on the relative costs of the traditional versus improved practices, estimations of percentage produce losses and local market value/kg can be used to calculate potential benefits.

By considering only the costs which differ between the two practices for a sample load (100 kg or 1000 kg, whichever is more appropriate for the farmer or trader), it is simple to calculate the additional market value of one load of the crop that is related to the change in the handling practice. There may or may not be recurring costs to consider.

Sometimes the local market price may vary with quality or size (grade 1, grade 2, etc.), so you may have more than one price to consider. The return on investment (ROI) that you determine for the crop and technology combination can be negative or positive; if negative, it may take several uses of the new practice or technology before reaching the break-even point.

Annex 7 provides a worksheet that can be used to determine the relative costs and expected benefits of using a new postharvest practice or technology. The following table demonstrates how a positive return of investment (ROI) can be obtained in less than one season. Not only are postharvest losses reduced but plant health and productivy of harvesters is greatly improved at a very low cost.

Table 6.4. Cost-benefits use of secateurs for eggplant harvest in Jessore, Bangladesh

Type Information	Current/ Traditional Practice	New / Improved Practice
Description of action taken	Pulling fruit from plant.	Using secateurs to cut fruit from plant.
Disadvantage	Risks damaging both fruit and plant and is a slower process.	-
Costs		
USD 2 per secateurs (4 secateurs)	-	USD 2 x 4 = USD 8
Relative cost	0	+ USD 8
Expected benefits		
% losses	5-10%	0%
Amount for sale	900-950 kg	1000 kg
Value/kg (average price)	USD 0.30 / kg	USD 0.32 /kg
Total market value	From USD 270 to USD 285	USD 320
Market value minus costs	(USD 285 – USD 0) USD 285 maximum	(USD 320 – USD 8) USD 312
Relative profit for the season		(USD 312 – USD 285) USD 27
ROI		Less than one season. Tools are fully paid for during the first season of use.

Source: Kitinoja 2016.

General observations on the use of the CSAM methodology and project profiles

The purpose of this manual is to provide a methodology to study a particular agricultural value chain, to identify priority problems occurring throughout and the means of resolving them. The careful reader will then have the necessary information and tools to identify problems and to prepare project profiles.

What do we do with a project profile? The answer is to move them into the proper channels where they will be seen and read by decision makers and hopefully be converted into funded projects. This funding can then be used to execute priority activities which will improve the efficiency of agricultural value chains. These outputs will hopefully generate economic or social benefits for the intended beneficiaries of the project.

In all countries, there are local, national, multinational, international, bilateral and non-governmental organizations active in agricultural development activities. They may provide loans, grants and technical assistance. While some organizations only work through governments, others only provide their assistance through the private sector.

In whatever circumstances, the project profile plays a key role in obtaining assistance from development organizations. Project profiles resulting from the application of the methodology represent the principal results of a thorough, albeit rapid, appraisal of an agricultural value chain. Those individuals who have managed the implementation of the methodology must ensure that decision-makers, when presented with project profiles, understand the tremendous effort that has gone into the identification of priority problems and the subsequent design of appropriate solutions expressed in project format.

In most cases, project profiles are not immediately financed since they normally do not provide the potential donor with sufficient information to determine feasibility and level of risk. Still, it is the project profile which either stimulates the donors to ask for additional information (a positive sign) or indicate that they are not interested, avoiding further waste of time.

One way of contributing to agriculture development is by learning to formulate a good project. The first step in this process is learning to write a good project profile.

Chapter 7

Organizing a workshop

This chapter provides guidance on the considerations that should be taken into account to organize a workshop to apply the CSAM methodology.

Some or all of the following results can be obtained during the workshop:

1. Descriptive and quantitative baseline documents on the agricultural value chain of interest, including institutional, production, postharvest, and marketing aspects.
2. Identification of significant problems affecting the agricultural value chain.
3. Determination of the magnitude and causes of postharvest losses and other problems in the agricultural value chain.
4. Identification of appropriate projects and interventions to alleviate the problems identified.
5. Definition of a strategy or plan of action for developing solutions and implementing actions.
6. Training of national professionals in the application of the methodology.
7. Training of participants to have a better understanding of an agricultural value chain and all its interrelationships.

Participants in the workshops will form an interdisciplinary group, including farmers, marketing intermediaries, private sector businessmen and public sector professionals. A coordinating individual or group will be designated to oversee all aspects of the workshop, including planning, implementation and presentation of the results to appropriate authorities.

Coordinating committee

A coordinating committee for the workshop should be formed several weeks or months prior to the expected inauguration of the event. Members of this committee should be drawn from each of the sponsoring and support institutions. The coordinating committee should determine the objectives of the workshop, identify the needs in personnel, financial and logistical support to obtain the desired results, identify the type of support to be provided by the sponsoring institutions and take care of the necessary organization and management.

Chairperson: Selected as the head of the coordinating committee, the chairperson is responsible for communication and coordination with other institutions involved in the event, overseeing all sub-committees, and having the final word on all decisions affecting the workshop.

Secretariat: The secretariat includes a coordinator, designated by the chairperson, one or more secretaries and a support staff (as needed). Members will be provided on a full-time basis by the respective institutions sponsoring the workshop. The secretariat will provide all the necessary secretarial and administrative services. It will prepare, organize and distribute all draft documents, and distribute the final workshop report at the closing ceremony of the workshop.

Working groups: Prior to the execution of the workshop, working groups will be formed to generate baseline information in areas such as pre-production and institutional aspects, production, postharvest, and marketing. Each of these groups will have a coordinator who will form part of the workshop coordinating committee. Prior to the workshop, these coordinators will prepare baseline documents from secondary data in their respective areas and present them to the other participants during the initial days of the workshop.

Institutional support

The impact of the workshop will depend to a great degree on the type of institutional support received in terms of material and human resources. If the participants attend on a part-time basis and material support is weak, they will receive the message that their respective institutions are not considering the workshop as a very serious training event. Consequently, the level of learning and transfer will be low. However, if participants are relieved of their normal duties, allowed to participate on a full-time basis and are notified that they will be expected to apply the methodology in their future activities, a more positive message will be sent.

The type of institutional support required from the sponsoring institution(s) can be summarized as follows:

Participants: All participants will be expected to be involved on a full-time basis for the duration of the workshop. This will also apply to administrative and secretarial support staff.

Equipment: Sponsoring institutions will make available all necessary equipment to assure a successful workshop. This will include: administrative staff and field trips; access to computers, printers and projectors; access to photocopying services; and others as deemed necessary.

Materials: Participants and administrative personnel must have access to all the materials required to satisfactorily undertake their assignments.

Meals: For the duration of the workshop, arrangements should be made for participants to take their lunch as a group. This will facilitate maintaining a rigid schedule, a requirement if the desired outputs are to be achieved. Given the intensive nature of the workshop, morning and afternoon breaks with refreshments may be desirable. These breaks also help build rapport between participants.

Miscellaneous: There may be unforeseen expenses, and therefore a small fund should be established to cover miscellaneous expenses.

Baseline documents

Workshop participants will include a large number of individuals specialized in specific areas who, more than likely, are unfamiliar with other disciplines. For example, macroeconomists are likely to know relatively little about production and postharvest handling of a particular crop; agronomists and food technologists may well find economic terminology confusing, and marketing specialists may know little about pest and disease constraints.

As a means of informing the participants about the state of the art of a particular agricultural value chain, baseline documents should be prepared by the respective coordinators of the working groups prior to the workshop. During the first days of the workshop, the baseline documents will be presented and discussed among the participants. Each baseline document will provide descriptive and quantitative information on specific components of a particular agricultural value chain, as indicated below.

Macroeconomic baseline document: This document will include information on the relative importance of the particular agricultural value chain to the economy. It will identify the relevant public sector institutions and describe their functions, services, national agricultural policies, and special projects, programs and plans which may affect the agricultural value chain being studied. The document will identify incentive programs and policies (tax, finance, exemptions); private sector institutions and organizations (farmer organizations and non-profit support groups) and summarize their services and functions and principal problems, etc.

Production baseline document: This document should contain information on the importance of the particular product being studied; history of national production; environmental requirements; agronomical characteristics; actual production constraints and comparative advantages; planting or genetic material; cultural practices; pests and diseases; production costs; principal problems and needs, etc.

Postharvest baseline document: This document will cover the identification and description of existing postharvest handling practices; available infrastructure and equipment; agroprocessing potential and characteristics; principal problems and needs, etc.

Marketing baseline document: This document should consider imports and exports of the product being studied; national and external supply and demand; marketing channels; marketing margins; characteristics of demand; consumption patterns; marketing costs; market potential, etc.

The summary list of key questions related to each component of the commodity system (Annex 4) can assist the workshop team to gather available materials and prepare the baseline documents.

Resource persons

Agricultural value chain specialist: One resource person familiar with the CSAM methodology should be available for the duration of the workshop, including pre-workshop activities, in order to assist the coordinating committee in organizational arrangements and activities during the workshop. If the value chain specialist does not reside in the country of the workshop, he/she will liaise with workshop organizers using existing technologies to facilitate the organization of pre-workshop activities.

The functions of the value chain specialist will include:

a. Providing the terms of reference for preparation of the baseline documents by the coordinators of the working groups.

b. Coordinating with the workshop chairman to ensure that all necessary resources have been allocated for the workshop, including qualified participants, materials, transportation, equipment, eating arrangements, field trip arrangements, working and office space, administrative and support staff, copying service, etc.
c. Making an introductory presentation at the workshop on the methodology, the diverse tools presented in this manual and their use.
d. Opening the plenary sessions each day of the workshop with summaries of the previous day's accomplishments, material to be covered and expected outputs for that day.
e. Responding to questions from participants and leaders of the different working groups with regard to methodology and presentation of results.
f. Functioning as a central clearing house for all material produced for and during the workshop and assist the coordinating committee in the preparation of the final workshop report.
g. Other tasks that the coordinating committee may determine.

Planners: An introductory presentation to the workshop should be given by some decision maker from the agricultural sector (for example: national planning office, ministry of agriculture) focusing on national development plans with respect to the agricultural value chain being studied.

Farmers: In addition to the farmers selected to participate in the workshop on a full-time basis, representative farmers, with different size operations and methods of farming, should be selected as resource persons. Ideally, field trips to their farms should be arranged. These farmers should be asked to discuss such things as their cultural practices, pest and disease constraints, operation costs, methods of postharvest handling and marketing, decision-making processes for their farming operations, and their principal problems and needs, etc.

Intermediaries: Depending on the agricultural value chain, intermediaries involved in transportation, assembly, wholesaling, retailing, storage, and export should be identified and arrangements made for field visits to their sites of operation. These intermediaries should be asked to describe their operations, their interrelationships with farmers, other intermediaries and government, and their principal needs for improvement. Each visit should include a period for questions and answers.

Agroprocessors: Arrangements should be made to visit facilities of those products which undergo some form of agroprocessing and to discuss with management their operations, problems and needs.

Selection of participants

While the number of workshop participants should be adjusted to meet local demand, facilities and circumstances, in general, the number should not exceed twenty five. Groups larger than this become difficult to manage, particularly when making field visits. The participants should include farmers, intermediaries, businessmen, and specialists from disciplines such as economics, agricultural economics, agronomy, entomology, food technology, engineering, marketing, sociology/anthropology, resource development and other disciplines relevant to the case at hand.

Participants may be drawn from institution(s) sponsoring the workshop, as well as from other public sector institutions, private sector organizations and the farming community.

Development of workshop agenda

Each workshop agenda will be adapted to the local needs and the available resources of the sponsoring institution(s). While most workshops should be similar in content, the time dedicated to each element will likely vary. The workshop program should include:

- Registration of participants and inauguration of workshop.
- Presentation of the methodology.
- Presentation of baseline information documents on the product being studied.
- Identification and collection of missing information.
- Field trips to farms, postharvest handling and agroprocessing facilities.
- Description of the distinct components of the agricultural value chain.
- Analysis and prioritization of problems in the agricultural value chain.
- Identification of project ideas and required actions to overcome problems.
- Formulation of project profiles or projects.

The actual workshop program will be determined by the coordinating committee, assisted by the CSAM methodology specialist, prior to the workshop.

As a general rule, most of the workshop time will be dedicated to the identification and collection of missing information, description of the agricultural value chain, problem analysis and the identification and formulation of solutions. The more information included in the baseline documents (prepared prior to the workshop), the less time required for information collection during the workshop. The more time remaining towards the end of the workshop, the greater scope there will be for formulating valuable project documents.

Conducting the workshop

The workshop should be conducted in an informal atmosphere and should be dynamic and flexible enough to adjust to needs as they develop. Each workshop should have a moderator or facilitator who specializes in communication and group dynamics. This facilitator should be a key person in integrating workshop participants so that they play active roles in the discussion of problems and solutions. He or she may also assist the chairperson in overcoming logistical and other problems as they arise.

After the opening ceremony has concluded, the methodology specialist will present an overview of the methodology to be used during the workshop, showing how a systematic, step-by-step analysis can result in a rapid assessment of a specific agricultural value chain. Immediately thereafter the coordinators from each of the working groups will summarize the information contained in their respective baseline documents.

The need for additional information will then be evaluated, and subsequent activities may include the design of questionnaires, interviews and field visits to collect missing information.

Due to the difficulty of working in large groups, the plenary body should be divided into interdisciplinary subgroups of between five and eight persons. Each subgroup should include farmers, people with postharvest and marketing experience and professionals from as many disciplines as possible. Whenever group work is required, i.e., for the collection of missing information, for problem analysis, for the identification of project ideas and other solutions, and for the formulation of project profiles, these subgroups should be convened. Each subgroup should select its own coordinator and rapporteur for reporting back to the plenary session.

Plenary sessions are required each time new information, methodologies or working instruments are introduced. Longer plenary sessions are required to present and discuss the results of the working groups and to carry out activities of mutual interest such as brainstorming.

The workshop facilitator and coordinating committee should periodically evaluate the progress of the workshop. When certain sessions seem to become tedious or boring, a field trip can be planned or new subject material introduced to stimulate the group. The order of presentation of subject material can be adjusted to meet the needs of the participants.

The workshop duration will depend on level of detail desired, resources available, and the complexity of the agricultural value chain being studied.

Collection of missing information

Chapter 4 describes in considerable detail the type of information which should be obtained on each of the relevant components of a given agricultural value chain. A comparison of Chapter 4 guidelines with the baseline documents presented by the working groups will give an indication of the missing information which may need to be collected. Some of the missing information may be obtained from secondary documents. Some may also be collected during field visits to farmers, intermediaries, exporters or other participants in the agricultural value chain. In cases where questionnaires are required, the guidelines in Annex 2, 3 and 4 may prove useful.

Each working group will determine its particular requirements for additional information and will develop methods to generate this during the time allocated for this activity. In some instances the necessary information may be impossible to collect in the time period available. In such cases, recommendations should be made for developing longer-term research activities to be carried out after the workshop.

Checklist for organizing a workshop

To facilitate the organization of the workshop and to ensure that all members of the coordinating committee and institutional decision makers are kept informed of the headway being made, a checklist of workshop activities should be maintained. The chairman of the coordinating committee, and each member, should keep their own copy of the checklist. A model of a workshop checklist is presented in Table 7.1

Table 7.1 Checklist for organizing a workshop

Workshop activities	Date action taken	Person responsible
1. Formation of coordinating committee: chairperson, secretariat, working groups		
2. Identification of all institutional support required		
3. Selection of the agricultural value chain specialist		
4. Selection and invitation of participants by source		
5. Preparation of baseline documents: - macro-economics - production - postharvest - marketing		
6. Identification of missing information needed: - macro-economics - production - postharvest - marketing		
7. Selection and invitation of national resource support persons: - planners - farmers - intermediaries - agroprocessors - others		
8. Detailed workshop program		
9. Materials and equipment: - paper - projectors - camera - computer - copying and printing facilities - other		
10. Food arrangements		
11. Field trip arrangements		
12. Transportation arrangements		
13. Execution of workshop program		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Annexs

ANNEX 1

Checklist of potential problems in an agricultural value chain.

Agricultural product: _____ Indicate whether the analysis is being undertaken on a: ( ) national; ( ) regional; or ( ) local basis.

Pre-production considerations on agricultural sector policies:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Institutional organization	( )	
Urban or rural salaries	( )	
Taxes: Import or export	( )	
Price policies	( )	
Credit policies	( )	
Land reform policies	( )	
Natural resource management	( )	
Irrigation policies	( )	
Production and distribution of planting material	( )	
Farm input supply	( )	
Technology	( )	
Farmer organization	( )	
Marketing policies	( )	
Agroprocessing policies	( )	
Import policies	( )	
Export policies	( )	
Incentives:		
- tax	( )	
- financial	( )	
- other _____	( )	

Public sector institutions (identify institutions):

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Political instability	( )	
Leadership	( )	
Deficient planning	( )	
Management skills	( )	
Insufficient staff	( )	
Poor quality staff	( )	
Staff motivation	( )	
Deficient equipment	( )	
Lack of operating capital	( )	
Weak services:		
- information	( )	
- credit	( )	
- research	( )	
- extension	( )	
- training	( )	
- technical assistance	( )	
- product standards	( )	
- coordination	( )	
- other _____	( )	

Private Sector Organizations (farmers, intermediaries, exporters, others):

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Legal structure	( )	
Public sector control	( )	
Leadership	( )	
Unclear role and functions	( )	
Small active membership	( )	
Low level member commitment	( )	
Members widely scattered	( )	
Communication	( )	
Lack of resources	( )	
Management skills	( )	
Insufficient staff	( )	
Staff skills	( )	
Staff motivation	( )	
Job description or terms of reference	( )	
Poor planning	( )	
Decision-making	( )	
Poor follow-through	( )	
Monitoring of staff	( )	
Financial management	( )	
Communication	( )	
Marketing policy	( )	
Pricing policy	( )	
Filing systems	( )	
Office space	( )	

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Inadequate equipment	( )	
Inadequate materials	( )	
Information deficiencies:		
- supply of produce	( )	
- markets	( )	
- prices	( )	
- farm input supply	( )	
- credit alternatives	( )	
- production packages	( )	
- proper postharvest handling of produce	( )	
- communication with members	( )	
-other _____	( )	
Filling system	( )	
Office space	( )	
Inadequate equipment	( )	
Inadequate materials	( )	
Information deficiencies:		
- supply of produce	( )	
- market	( )	
- prices	( )	
- farm input supply	( )	
- credit alternatives	( )	
- production packages	( )	
- proper postharvest handling of produce	( )	
- communication with members	( )	
Others_____	( )	

Ecological conditions which negatively affect the product:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Latitude/sunlight	( )	
Altitude	( )	
Soil	( )	
Rainfall	( )	
Wind	( )	
Temperature	( )	
Relative humidity	( )	
Others _____	( )	

Infrastructure/Equipment limitations:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Roads non-existent	( )	
Roads in poor condition	( )	
Irrigation systems	( )	
Storage facilities	( )	
Marketplaces	( )	
Packing houses	( )	
Packing equipment	( )	
Packing materials	( )	
Airports	( )	
Sea ports	( )	
Tractors or other equipment	( )	
Others _____	( )	

Planting material:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Deficient infrastructure	( )	
Lack of proper equipment	( )	
Lack of technical know-how	( )	
Unavailability to farmers	( )	
Poor quality plants	( )	
Others _____	( )	

Problem characteristics inherent to crop:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Seasonality	( )	
Height of plant/tree	( )	
Other growth characteristics	( )	
Susceptibility to pests/diseases	( )	
Short shelf life of product	( )	
Poor storage capabilities	( )	
Color	( )	
Flavor	( )	
Size	( )	
Shape	( )	
Quantity of fruit set	( )	
Others _____	( )	

Production related problem areas:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Climatic constrains	( )	
Soil constrains	( )	
Land constrains	( )	
Water related deficiencies:		
-too little water	( )	
-too much water	( )	
-inadequate irrigation systems	( )	
-poor water management	( )	
Seeds planting material:		
-unavailable	( )	
-poor quality	( )	
-expensive	( )	
Credit:		
-unavailable	( )	
-difficult to access	( )	
Farm inputs:		
-unavailable	( )	
-poor quality	( )	
-high costs	( )	
Lack of technical know-how with respect to:		
-farm management	( )	
-integrated pest management	( )	
-crop establishment	( )	
-crop maintenance	( )	
-pruning	( )	
-training	( )	
-spraying	( )	
-weeding	( )	
-fertilization	( )	
-pollination process	( )	

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
-water management	( )	
-large scale cultivation	( )	
-other _____	( )	
Labor:		
-unavailable	( )	
-inefficient	( )	
-high cost	( )	
Actual farming system:		
-limits yields	( )	
-affects crop quality	( )	
Pests/diseases:		
-effect on marketability	( )	
-lack of control method	( )	
-excess use of chemicals	( )	
-requirement of too much labor	( )	
-expense of control	( )	
High costs/production	( )	
Others_____	( )	

Harvest related problem areas:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Larceny	( )	
Stage of maturity unknown	( )	
Lack of technical know-how	( )	
Inadequate tools/equipment	( )	
Poor harvesting practices	( )	
Labor:		
-unavailable	( )	
-poorly skilled	( )	
-high costs	( )	
Height of trees	( )	
Closed canopy	( )	
Other _____	( )	

Postharvest handling problems:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Rough on-farm handling	( )	
Poor field containers	( )	
Poor in-field sanitation	( )	
Scarce labor	( )	
Lack of shade	( )	
Improper stacking	( )	
Rough loading/unloading	( )	
On-farm transport	( )	
Delays at ports	( )	
Poor roads	( )	
Chemical treatments	( )	
Washing	( )	
Cleaning	( )	
Sizing	( )	
Grading	( )	
Precooling	( )	
Packaging:		
-unavailable	( )	
-insufficient strength	( )	
-high cost	( )	
-poor packing facilities	( )	
-quality/weight controls	( )	
-improper labeling	( )	
Quality control	( )	
Wrong temperature	( )	
Wrong humidity	( )	
Lack of technical know-how	( )	
High costs of handling	( )	
Lack of infrastructure	( )	
Other _____	( )	

Agroprocessing limitations:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Raw material:		
-small volumes available	( )	
-lack of continuous supply	( )	
-poor quality	( )	
-high costs	( )	
Imported inputs (jars, etc.)	( )	
Lack of facilities	( )	
Deficient or outdated equipment	( )	
Poor product development	( )	
High production costs	( )	
Low quality output	( )	
Lack of technical assistance	( )	
Lack of operating capital	( )	
Lack of market development	( )	
Other_____	( )	

Markets and marketing problems:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Markets:		
-lack of market development or promotion	( )	
-small and/or specialized market niche	( )	
-limit to particular time of year	( )	
-quarantine restrictions	( )	
-other restrictions or trade barriers	( )	
-taxes, duties, etc.	( )	
-strong competition	( )	
-controlled by interest groups	( )	
-local/regional politics	( )	
-difficulty in obtaining payment	( )	
-other _____	( )	
Product:		
-lack of product development	( )	
-quality poor	( )	
-volumes small	( )	
-prices too high	( )	
-lack continuous supply	( )	
-collection system	( )	
-lack of quality control	( )	
-other _____	( )	
Transportation:		
-unavailable	( )	
-irregular	( )	
-limited space	( )	
-freight costs too high	( )	
-insurance expensive	( )	
-other _____	( )	

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Information:		
-supply statistics	( )	
-market intelligence	( )	
-poor analysis	( )	
-other _____	( )	
Technical assistance	( )	
Means of verification unavailable in importing country	( )	
Difficulty in collection of payments	( )	
Delays with documentation	( )	
Port facilities poor	( )	
Other _____	( )	

Pricing and consumer demand problems:

Nature of the problem	If problem area indicate with (x)	Describe how problem affects quantity, quality, price or availability of product
Imports sold at lower price than domestic supply	( )	
Irregular supplies to meet consumer demand	( )	
High costs to consumers	( )	
Consumers lack familiarity with product	( )	
Product poorly presented	( )	
Characteristics of consumer demand unknown	( )	
Other_____	( )	

There are approximately 250 potential problems listed here which can impact the quantity of product produced or its quality, price or availability. Due to the participants' lack of experience it may be difficult for them to understand how some of the potential problems listed above may impact the product. A useful classroom exercise is to dedicate approximately two hours going through the list as a group effort. Participants and instructors alike can make suggestions as to how a certain "potential problem" may impact the product. This is a good way to stimulate group discussion and to transfer experiences between the different participants.

ANNEX 2

Example questionnaires for agricultural value chain components.

COMPONENT 01: Relative Importance of Product

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Overall agriculture setting:

Total national land area: _____ (sq mi, acres, ha)

Area suitable for agriculture: _____ (sq mi, acres, ha)

Marginal land area:

- Steep land: _____
- Deep peat: _____
- Acid sulphate: _____
- Marsh land: _____
- Salty soils: _____
- Others (specify): _____

2. Area (ha, acres) suitable for cultivation of crop group, e.g., fruit cultivation: _____

Area (ha, acres) suitable for specific crop cultivation: _____

3. Common Name: _____

Scientitic Name: _____

Commercial Clones:

1. _____
2. _____
3. _____
4. _____

4. Total crop area planted and level of production for the past five years.

Year	Hectares	Production

5. Projected hectarage cultivated and expected level of production for the next five years (based on normal growth trend).

Year	Hectares	Production

6. Major producing areas and estimated hectares:

Region/location	Hectares	Production

7. Import/Export information for the last five years:

Year	Export		Import	
	Quantity	Value	Quantity	Value

8. Is this crop given priority in the National Development Plan? yes ( ) no ( )

9. If no, why not? _____

10. If yes, what are the criteria for selection?

( ) food security ( ) export potential

( ) market demand ( ) employment

( ) income generation ( ) marginal land use

( ) others (specify): _____

11. If the crop is for export, what are the country's major comparative advantages in production and export?

( ) low production costs ( ) fruit fly-free zones

( ) low transport costs ( ) high quality product

( ) few pest/disease problems ( ) others (specify): _____

12. Observations: _____

_____

_____

13. Summary of problems identified which may affect production, processing, postharvest handling or marketing of crop:

1. _____

2. _____

3. _____

4. _____

COMPONENT 02: Public Sector Policies

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Policies and strategies: Identify and describe existing governmental policies and strategies which directly or indirectly affect the production and/or marketing of this product or groups of products.

Policies: _____

_____

Strategies used for implementation of policies: _____

_____

2. Projects: Identify and describe existing or planned projects which will impact the production, processing, postharvest handling and/or marketing of this product.

_____

_____

3. Incentives/Disincentives: Identify and describe any existing or in pipeline incentives or disincentives which favor the production, processing, postharvest handling or marketing of this crop.

	Relevant institution	Brief description
Incentive		
_____	_____	_____
_____	_____	_____
Disincentive		
_____	_____	_____
_____	_____	_____

4. Are national production goals established for this agricultural product?

yes ( ) no ( ). If yes, what are they: _____

5. Which policy or policies most strongly impact the crop production system, to what degree, and why?

_____

_____

6. Do any of the policies/strategies impact the postharvest losses?

yes ( ) no ( )

Explain: _____

_____

7. Summary of problems identified which may impact production, processing, postharvest handling or marketing of crop.

1. _____

2. _____

3. _____

4. _____

5. _____

COMPONENT 03: Relevant Institutions

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Institutions responsible for planning:

Ministry	Department or Unit	Responsibilities

2. Institutions involved in production system:

Ministry	Department or Unit	Responsibilities

3. Institutions involved in processing of product:

Ministry	Department or Unit	Responsibilities

4. Institutions involved in postharvest handling and/or marketing of crop:

Ministry	Department or Unit	Responsibilities

5. Institutions responsible for research:

Ministry	Department or Unit	Responsibilities

6. Institutions/organizations that offer technical assistance:

Name	Functions or actions

7. Private sector institutions/organizations involved with crop:

Name	Functions or actions

8. Other ministries/departments directly or indirectly involved in the development of crop:

Ministry/Department	Responsibility or functions

9. Identify the coordinating body, if any, responsible for the development of the crop industry and describe its function:

Name of coordinating body: _____

Functions:

a. _____

b. _____

c. _____

10. Indicate level of coordination of the various institutional activities:

	Well coordinated	Satisfactory	Poorly coordinated
Planning	( )	( )	( )
Production	( )	( )	( )
Processing	( )	( )	( )
Marketing	( )	( )	( )
Research	( )	( )	( )

11. Summary of key public and private sector institutions for the development of the crop industry:

Name of institution, unit, department or organization	Principal constrains

COMPONENT 04: Facilitating Services

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Transportation:

a. Farm accessibility (road conditions):

( ) good ( ) acceptable ( ) poor

Observations: _____

b. Availability of vehicles for:

	Good	Acceptable	Poor
• Production inputs	( )	( )	( )
• Farm to packinghouse	( )	( )	( )
• Farm to market	( )	( )	( )
• Packinghouse to wholesaler	( )	( )	( )
• Packinghouse to port	( )	( )	( )
• Export: air shipments	( )	( )	( )
sea shipments	( )	( )	( )

c. Describe priority constraints affecting transportation: _____

_____

2. Information (info):

	Production		Postharvest		Markets		Prices	
	Yes	No	Yes	No	Yes	No	Yes	No
Institutional info available?								
Sufficient for decision making?								
Sources of institutional info?								
Other sources of information?								

Describe priority constrains related to information:

a. _____

b. _____

3. Credit:

Sources	Type of collateral required	Interest rate	Limits of credit	Sufficient	
				Yes	No

Describe constraints with respect to credit:

a. _____

b. _____

4. Farm inputs:

Types of farm input	Available when needed		Principal source of input
	Yes	No	
Fertilizers			
Chemicals			
Tools			
Irrigation Equipment			
Natural Pesticides			
Others			

Describe constraints related to supply of farm inputs:

a. _____

b. _____

5. Technical assistance (TA):

Operation	TA is available		Source of TA	TA is sufficient	
	Yes	No		Yes	No
Production					
Postharvest					
Marketing					
Processing					

Describe constraints with respect to technical assistance:

a. _____

b. _____

6. Postharvest facilities:

Type	Owner/Operator	Is capacity sufficient?		Is service efficient?	
		Yes	No	Yes	No
Cold room					
Packing house					
Refrigerated truck					
Others (specify)					

7. Describe constraints with respect to postharvest facilities:

a. _____

b. _____

8. Identify and describe any other existing or needed services or infrastructure relevant to the production, processing, postharvest handling, or marketing of the crop in question:

_____

_____

_____

COMPONENT 05: Farmer Organizations

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the active farmer organizations involved in the production or marketing of the crop. For each organization identified, provide the following information:

a. Name of organization: _____

b. Name of key person: _____

c. Location, address: _____

d. Number of active members: _____

e. Types of commodities handled: _____

f. Services offered to members, e.g., information, technical assistance, credit, transport, storage, grading of produce, farm input, supply, marketing, etc.: _____

_____

_____

g. Important experiences of the organization in production, postharvest handling, processing or marketing: _____

_____

_____

h. Quantify the organization's resources (human resources, financial resources, vehicles, equipment, buildings, etc.): _____

_____

_____

i. The management/administration of this organization is considered:

very good ( ) good ( ) satisfactory ( ) poor ( ) very poor ( )

j. Does this farmer organization have full time management?

yes ( ) no ( )

k. Does this farmer organization have an established financial accounting system?

yes ( ) no ( )

l. How important is the crop to this farmer organization?

( ) very important ( ) average importance ( ) not important

m. How important is the organization's participation in the production / marketing of the product nationwide?

( ) very important ( ) average importance ( ) not important

n. Describe the principal problems identified by the farmer organization: _____

_____

_____

2. Does government policy favor ( ) or disfavor ( ) the strengthening of farmer organizations?

3. Identify the active farmer organizations within the potential production areas. For each, provide the following information:

a. Name of organization: _____

b. Name of key person: _____

c. Location, address: _____

d. Number of active members: _____

e. Types of products handled: _____

f. Services offered to members, e.g., information, technical assistance, credit, transport, storage, grading of produce, farm input, supply, marketing, etc.: _____

_____

_____

g. Important experiences of the organization in production, postharvest handling, processing or marketing: _____

_____

_____

h. Quantify the organization's resources (human resources, financial resources, vehicles, equipment, buildings, etc.): _____

_____

_____

i. The management/administration of this organization is considered:

very good ( ) good ( ) satisfactory ( ) poor ( ) very poor ( )

j. Does this farmer organization have full time management?

yes ( ) no ( )

k. This farmer organization has an established financial accounting system.

yes ( ) no ( )

l. How important is the crop to this farmer organization?

( ) very important ( ) average importance ( ) not important

m. Describe the principal problems identified by the farmer organization: _____

_____

_____

4. If there are no farmer organizations dealing with the product, explain why not: _____

_____

Recommendations with respect to farmer organizations: _____

_____

5. Summarize the principal problems affecting the development of farmer organizations:

1. _____

2. _____

COMPONENT 06: Environmental Requirements and Constraints

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Optimum growing conditions for crop:

1.1 Soil: a. type: _____

b. pH: _____

c. slope: _____

1.2 Water:

a. Monthly water requirements: _____

b. Water quality: _____

c. Water source(s): _____

1.3 Temperature range within which crop does well: _____

1.4 Humidity range within which crop does well: _____

1.5 Photoperiod (length of daylight required): _____

1.6 Other: _____

2. Crop sensitivity to weather conditions:

	Sensitive	Moderate	Tolerant	Remarks
• drought	( )	( )	( )	
• heavy rain	( )	( )	( )	
• water logging	( )	( )	( )	
• strong winds	( )	( )	( )	
• high temperatures	( )	( )	( )	
• low temperatures	( )	( )	( )	

3. Optimum storage conditions:

	Shelf life (days)	
	Minimum	Maximum
Ambient temperature		
Cool storage (_____°C)		

4. Quality of soils in the production area in question is considered:

very good ( ) adequate ( ) deficient ( )

5. Typical soil conditions in production area:

Soil: a. type: _____

b. pH: _____

c. slope: _____

6. Rainfall (mm) in the production area during the growing season:

minimum _____ maximum _____ average _____

7. Rainfall is considered excessive ( ) adequate ( ) insufficient ( ).

Explain: _____

8. Are rains torrential to the degree of damaging the crop? yes ( ) no ( )

9. Does the crop suffer from water logging (excessive amounts of standing water) at any time during the growing season? yes ( ) no ( )

Explain: _____

10. Does the area suffer from flooding during the growing season? yes ( ) no ( )

Explain: _____

11. In case of drought conditions, is irrigation available? yes ( ) no ( )

Explain: _____

12. What is the temperature of the area during the growing season?

minimum _____ maximum _____ average _____

13. Is frost or cold temperature a constraint in this area? yes ( ) no ( )

Explain: _____

14. Are high temperatures a problem for this crop in this area? yes ( ) no ( )

Explain: _____

15. What is the average relative humidity of the area during the growing season? _____%

Is there a significant daily variation? yes ( ) no ( )

Explain: _____

16. What is the slope of most of the land in the growing area?

very flat ( ) gently sloping ( ) moderately sloping ( ) steep ( )

very steep ( ) rolling ( ) mixed flat and sloping ( )

17. How do the above ecological conditions generally affect crop production and/or yields?

_____

18. Summarize problems which may impact production and/or postharvest handling:

1. _____

2. _____

COMPONENT 07: Availability of Seeds and Planting Materials

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Commercial seeds available:

Name	Source

2. For each type available, answer the following questions:

	Type 1	Type 2	Type 3
Yield (good, moderate, poor)			
Quality (good, moderate, poor)			
Cost (high, medium, low)			
Demand (high, medium, low)			

3. Is there a need to introduce new seeds or cultivars? yes ( ) no ( )

4. If yes, what improvements are needed? _____

5. Principal source of planting material? _____

6. Is planting material imported ( )? produced by the government ( )?
commercial growers ( )? farmers ( )? others? _____

7. Are seeds hybrid ( )? open pollinated ( )? other _____

8. Is the quality of planting material considered high ( )? satisfactory ( )? low ( )?

9. Is the germination rate of seeds high (80-100%) ( )? medium (60-80%) ( )?
low (less than 60%) ( )?

10. Are seeds or planting material readily available? yes ( ) no ( )

11. What are the principal complaints from farmers concerning seeds/plants (quality, cost, availability, etc.)? _____

12. What are the opinions of extension agents with respect to these complaints?

_____

13. Are fruit tree plants obtained from private ( ) or public sector nurseries ( )?
Name of source: _____

14. If obtained from the public sector, are they subsidized? yes ( ) no ( )
Explain: _____

15. Age of plants when moved from nursery to field? _____

16. Are they seedlings ( )? or grafted ( )? If grafted, are they trained?
yes ( ) no ( )

17. Grafting success rate: high ( ) medium ( ) low ( )

18. Are plants certified disease free ( )? appear to be disease free ( )? or
do they appear diseased ( )?

19. Are plants available in sufficient quantity to meet demand? yes ( ) no ( )

Explain: _____

20. If credit available to the farmers to allow purchase of seeds or plant stock?

_____

21. Are seeds or plant stocks generally available at the proper time of year?

_____

22. Based on available seeds or planting material, are productivity and quality expected to be high ( ) medium ( ) or low ( )?

23. Summary of problems identified which may affect the production, processing, or postharvest life of product.

1. _____

2. _____

3. _____

24. Observations:

COMPONENT 08: Farmers' Cultural Practices

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Why does the farmer grow this crop?

( ) no other alternative ( ) tradition ( ) best money-making alternative

( ) other (specify) _____

2. Most common type of farming system:

( ) monocrop ( ) intercrop ( ) slash and burn ( ) plantation ( ) backyard garden

( ) rotation ( ) other (specify) _____

3. How is the ground prepared for planting?

( ) plowed by tractor ( ) plowed with animals ( ) worked by hand

Describe: _____

4. Planting hole size and method of preparation: _____

5. Describe type of planting material used: _____

6. Describe planting distance and pattern used: _____

7. Do farmers carry out a plant protection spray program for pests and disease? yes ( ) no ( )

If yes, describe methods: _____

8. Do farmers fertilize the crop? yes ( ) no ( )

If yes, describe method, formula, frequency, and quantity used: _____

_____

9. Do farmers use irrigation? yes ( ) no ( )

If yes, describe the method and frequency: _____

_____

10. What is the principal source of labor?

( ) family ( ) exchange of labor with neighbors ( ) hired full-time

( ) hired part-time ( ) other (specify) _____

11. Is the supply of labor a problem during production? yes ( ) no ( )

During harvest? yes ( ) no ( ). Explain _____

12. Laborers are: ( ) highly skilled ( ) satisfactory ( ) poorly skilled

13. Are attempts made to control shade? yes ( ) no ( )

Describe method/frequency of control _____

14. Do farmers prune this crop?

yes ( ) no ( ). If yes, how? _____

15. Describe method, frequency, and adequacy of weed control _____

_____

16. How do farmers make the decision when to harvest the crop?

( ) maturity ( ) market price ( ) danger from theft

( ) other (specify) _____

17. How is crop harvested?

( ) mechanically ( ) manual labor ( ) family labor

( ) other (specify) _____

18. What tools are used during harvest? _____

19. What is the average area (hectares, acres) planted by typical farmers? _____

minimum _____ maximum _____

20. Does the farmer grow the crop on land that is ( ) owned ( ) rented ( ) share-cropped

( ) communally farmed ( ) other? _____

21. What changes in cultural practices might contribute most to an improvement in product quality?

_____

22. What changes in cultural practices might contribute most to an increase in production?

_____

23. What changes in cultural practices might contribute most to a decrease in per unit production costs?

_____

24. Summarize the cultural practices which are likely to impact production, processing, postharvest handling, or marketing of product.

1. _____

2. _____

COMPONENT 09: Pests and Diseases

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

List all pests and diseases which impact upon the productivity or quality importance. In each case, indicate economic or quarantine significance.

Name of pest	Significance (Economic or Quarantine)	Name of disease	Significance (Economic or Quarantine)

For each pest or disease listed above, complete the following questionnaire.

1. The following information pertains to a pest ( ), or disease ( ), or economic ( ), or quarantine ( ) significance.

2. Common name: _____

3. Scientific name: _____

4. The damage done by this pest or disease affects the following:

	Yes	No	Describe negative impact
• Quantity available for market			
• Quality of product			
• Price of product			
• Consumer demand			
• Other:			

5. Technologies are available to prevent ( ) eradicate ( ) or control ( ) the pest and/or disease, or are not available ( ).

6. Costs of control are economically feasible ( ) or not economically feasible ( ).

7. In the case of export crops, in which foreign market(s) is this pest or disease of QUARANTINE significance?

8. What pre-harvest control methods are presently used for this pest or disease?

9. What postharvest control methods are presently used for this pest or disease?

10. What alternatives exist to control this pest or disease?

Pre-harvest: ( ) chemical control ( ) biological control Describe:

Postharvest: ( ) chemical control ( ) biological control Describe:

11. Does treatment produce a residue hazard? yes ( ) no ( ). If yes, explain:

12. Does treatment affect other organisms beneficial to the yield and quality of the crop?

13. How do the farmers decide to control the pest or disease in question? (Does the farmer apply at the first sign of insects or disease or only after the crop is severely infested?)

14. Type of pesticide most commonly used?

15. With what frequency do farmers spray?

16. Who does the spraying (farmer, worker, co-operative, ministry of agriculture, other)?

17. Does the farmer consciously attempt to minimize his chemical spraying costs?

yes ( ) no ( ). If yes, how does s/he do this? _____

18. What type of equipment do farmers have for chemical spraying? knapsack sprayers ( )

tractor operated ( ) airplane ( ) other: _____

19. What is the magnitude of the pest/disease damage with:

a. No control/treatment? _____

b. Optimum control/treatment? _____

c. Average farmer treatment? _____

20. Identify and describe any significant disorder to product caused by physiological and/or nutritional factors other than pests and diseases: _____

_____

21. Summarize problems caused by pests/diseases or use of chemicals to control pests/diseases which affect the production, processing, postharvest handling, or marketing of the crop.

1. _____

2. _____

22. Observations:

COMPONENT 10: Pre-harvest Treatments

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Do the farmers in the region carry out any type of physical treatment to the crop prior to harvest which may affect production or its postharvest quality? yes ( ) no ( )

If yes, please describe each treatment:

a. Name of physical treatment: _____

b. Description of action taken: _____

c. Why is this action taken? _____

d. Who carries out the action? _____

e. When is the action carried out? _____

f. Description of the impact or results of the action taken (how is the quantity, quality, storage, shelf life, market value, etc., affected)?

_____

_____

2. Do the farmers in the region carry out any type of chemical treatment to the crop prior to harvest which may affect production or its postharvest quality? yes ( ) no ( )

If yes, please describe each treatment:

a. Name of chemical treatment: _____

b. Description of action taken: _____

c. Why is this action taken? _____

d. Who carries out the action? _____

e. When is the action carried out? _____

f. Description of the impact or results of the action taken (how is the quantity, quality, storage, shelf life, market value, etc. affected?) _____

3. Are there recommended treatments which farmers are unaware of or do not use for some other reason? yes ( ) no ( )

If yes:

a. Name of treatment: _____

b. Purpose of treatment: _____

c. Why is it not used by farmers? _____

4. Identify and describe other pre-harvest treatments which might favorably affect postharvest quality.

a. _____

b. _____

c. _____

d. _____

5. Summarize the problems resulting from pre-harvest treatments which may affect production, processing, postharvest, and marketing of the crop.

1. _____

2. _____

3. _____

4. _____

COMPONENT 11: Production and Marketing Costs

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify and select different farming alternatives to be analyzed, e.g., alternative A could be one hectare size farms and alternative B could be 20 hectare size farms.

2. For each alternative, establish basic assumptions about how the farm is operated, e.g.:

   a. Labor: small farm may use all family labor and minimum purchased farm inputs; larger farm may hire labor and use optimum level of recommended farm inputs.

   b. Market: small farmer may sell all produce at farm gate while large farmer might export 60% of production.

   c. Product sales price: maximum, minimum, average.

   d. Product yield: high, low, average.

   e. Number of plants/hectare.

   f. Number of years productivity of perennials.

   g. Production or expected production.

   h. Others.

3. Identify all the cost components and calculate their contribution to the cost of a unit quantity of the product.

A. Capital investment	B. Operating and maintenance	C. Crop production costs
Land premium: • rent • taxes	Rent	Land preparation
Land clearing	Road and drainage maintenance	Holing
Drainage	Fencing maintenance	Planting: • material • labor • fertilizers • replacement plants
Fencing	Vehicle maintenance	Fertilization: • labor • material • machinery
Buildings	Facilities maintenance: • water supply • insurance • building maintenance	Irrigation: • water • equipment • labor
Vehicles	Agriculture tool replacement	Pest and disease control: • labor • material • equipment
Irrigation equipment	Fixed salary and wages	Weed control: • labor • material • equipment
Electricity	Administration and management	Bagging fruit on trees: • material • labor
Farm equipment/ machinery	Costs and credit	Pruning and training: • labor • equipment
Office equipment	Others	Harvesting cost: • labor • boxes and baskets • equipment

A. Capital investment	B. Operating and maintenance	C. Crop production costs
Processing facilities: • coldrooms • ripening room • table • weighing machine		In-field transportation: • labor • materials
Others: • agricultural insurance		Other production costs: • pollinating agents • others

COMPONENT 12: Crop Harvest

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Who defines the time of harvest? _____
2. Who harvests the crop? _____
3. Describe in detail the harvest operation: _____
4. Why is the crop harvested in this particular manner? _____
5. When is the harvest undertaken? Time of day _____
6. Under what conditions? Temperature _____ Relative humidity _____
7. Does the present method of harvest appear to affect: quantity of produce available for market ( ), quality of produce available for market ( ), value of produce available for market ( )?

   Explain: _____

8. Does the volume of produce unsuitable for market appear to be: high ( ), medium ( ), low ( )? Describe the causes, e.g., size of product, weather damage, pest damage, disease damage, lack of soil nutrients, sun damage, harvest damage, others _____

_____

9. Estimate percentage of crop suitable for market: _____%.
10. Identify and describe the harvesting tools: _____

_____

11. Is the entire crop harvested at one time? yes ( ) no ( ). If no, why not and how is selection made for that part which is harvested? _____

_____

12. Identify harvest seasons for each cultivar or variety of crop (if more than one):

Cultivar	Months of harvest	No. months in crop cycle

13. Which, if any, cultivar produces off season? _____

14. Optimum harvesting parameters:

Moisture content _____

Color/appearance _____

Tenderness/texture _____

15. Maturity index known: yes ( ) no ( ). If yes, describe: _____

16. What criteria are used by the pickers in selecting the product for harvest?

_____

17. For the principal cultivar(s):

What is a good yield per hectare under good growing conditions? _____ tons

What is a good yield per hectare under average conditions? _____ tons

18. Sensitivity to mechanical damage during harvest: high ( ) medium ( ) low ( )

19. Sensitivity to dehydration: high ( ) medium ( ) low ( )

20. Summarize the problems occurring at harvest which may affect the processing, postharvest handling, or marketing of the product.

1. _____

2. _____

3. _____

4. _____

5. _____

21. Observations:

COMPONENT 13-A: Selection

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the points in the postharvest system where some form of selection takes place.

Point in the system	Action that takes place

2. For each action identified above provide the following information:

a. Name of action: _____

b. Time required for the action to take place: _____

c. Describe the action: _____

d. Who is responsible for conducting the action? _____

e. When is the action carried out? _____

f. Why is this action carried out? _____

g. Where is this operation carried out? _____

h. Is the activity carried out with laborers? yes ( ) no ( )

If yes, how many? _____

i. Is the activity carried out with machines/tools/equipment? yes ( ) no ( )

If yes, identify and describe:

_____

_____

j. What criteria are used in this action?

	Yes	No	Describe
Product shape	( )	( )	
Product size	( )	( )	
Product weight	( )	( )	
Maturity	( )	( )	
Color	( )	( )	
Pest/disease damage	( )	( )	
Physical injury	( )	( )	
Mechanical injury	( )	( )	
Cleanliness	( )	( )	
Other	( )	( )	

k. Is this operation required to meet market demand? yes ( ) no ( )

Explain: _____

l. What is (are) the probable end use (s) of culled product? _____

3. If the product is divided into different groups or categories at this point due to the selection process, identify the different categories and the approximate % of produce moving into each channel.

For example:

Grade	% of Total	Destination
1st Grade	40%	Export
2nd Grade	35%	Domestic market
3rd Grade	15%	Agroprocessing
Culls	10%	Animal feed
Total	**100%**	

4. What portion of culled product, if any, is a complete loss and does not generate any economic return? _____ %

Explain: _____

5. Identify any problems occurring at this point which may affect postharvest losses.

1. _____

2. _____

3. _____

4. _____

5. _____

COMPONENT 13-B: Sizing and Grading

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the points in the postharvest systems where some form of sizing or grading takes place.

Point in the system	Action that takes place

2. For each action identified above provide the following information:

a. Name of action: _____

b. Time required for the action to take place: _____

c. Describe the action: _____

d. Who is responsible for conducting the action? _____

e. When is the action carried out? _____

f. Why is this action carried out? _____

g. Where is this operation carried out? _____

h. Is the activity carried out with laborers? yes ( ) no ( )

If yes, how many? _____

_____

i. Is the activity carried out with machines/tools/equipment? yes ( ) no ( ). If yes, identify and describe: _____

j. Is this operation required to meet market demand? yes ( ) no ( )

Explain: _____

k. What is (are) the probable end use(s) of culled product? _____

l. What criteria are used in this action?

	Yes	No	Describe
Product shape	( )	( )	
Product size	( )	( )	
Product weight	( )	( )	
Maturity	( )	( )	
Color	( )	( )	
Pest/disease damage	( )	( )	
Physical injury	( )	( )	
Mechanical injury	( )	( )	
Cleanliness	( )	( )	
Other	( )	( )	

3. Are any sizing or grading standards used for this product? yes ( ) no ( ). If yes, identify and describe the standard: _____

4. If the product is divided into different groups or categories at this point due to the sizing or grading process, identify the different categories and the approximate % of produce moving into each channel.

For example:

Grade	% of Total	Destination
1st Grade	40%	Export
2nd Grade	35%	Domestic market
3rd Grade	15%	Agroprocessing
Culls	10%	Animal feed
Total	**100%**	

5. What portion of culled product, if any, is a complete loss and does not generate any economic return? _____ %

Explain: _____

6. Identify any problems occurring at this point which may affect postharvest losses.

1. _____
2. _____
3. _____
4. _____
5. _____

COMPONENT 13-C: Inspection

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the points in the postharvest systems where some form of inspection takes place.

Point in the system	Action that takes place

2. For each action identified above provide the following information:

a. Name of action: _____

b. Time required for the action to take place: _____

c. Describe the action: _____

d. Describe the sampling procedure: _____

e. Who is responsible for conducting the action? _____

f. When is this action carried out? _____

g. Why is this action carried out? _____

h. Where is this operation carried out? _____

i. Is the activity carried out with machines/tools/equipment? yes ( ) no ( ). If yes, identify and describe: _____

j. What criteria are used in this action?

(A) Quality control (packinghouse line)

Criteria	Yes	No	Describe
Product shape	( )	( )	
Product size	( )	( )	
Product weight	( )	( )	
Maturity	( )	( )	
Color	( )	( )	
Pest/disease damage	( )	( )	
Physical injury	( )	( )	
Mechanical injury	( )	( )	
Cleanliness	( )	( )	
Other	( )	( )	

(B) Plant quarantine (exporting and importing)

Criteria	Yes	No	Describe
Disease	( )	( )	
Pest	( )	( )	
Chemical residues	( )	( )	
Other	( )	( )	

(C) Customs

Criteria	Yes	No	Describe
Drug control	( )	( )	
Pest/disease	( )	( )	
Other	( )	( )	

k. Is this operation required to meet market demand? yes ( ) no ( )

Explain: _____

3. Identify any problems ocurring at this point which may affect postharvest losses.

1. _____
2. _____
3. _____
4. _____
5. _____

COMPONENT 14: Postharvest Chemical and Physical Treatments

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

CHEMICAL TREATMENT

1. Is any chemical applied to the product during the postharvest stage?

yes ( ) no ( ). If yes, list the chemicals below:

Generic name	Brand name

2. For each chemical used, answer the following questions.

a. What is the name of the chemical? _____

b. Why is the chemical used? _____

c. Who applies the chemical? _____

d. When is the chemical applied? _____

e. Where is the chemical applied? _____

f. How often is the chemical applied? _____

g. How is the chemical applied (spray, dip, etc.)? _____

h. In what concentration is it applied? _____

i. Does the use of this chemical represent a health hazard for workers? yes ( ) no ( ), for consumers? yes ( ) no ( ). If yes, explain: _____

j. Costs of treatment? _____

Observations:

PHYSICAL TREATMENT

1. Does this product receive any special physical treatment in the postharvest stage which affects its quality, shelf life or marketability? yes ( ) no ( )

2. If yes, identify each type of physical treatment:

a. _____

b. _____

c. _____

3. For each physical treatment, provide the following information:

a. Name of physical treatment: _____

b. Description of treatment: _____

c. Purpose of treatment: _____

d. Who undertakes the treatment? _____

e. When is the treatment done? _____

f. Where is the treatment undertaken? _____

g. What costs are involved in the treatment? _____

Observations: _____

_____

4. Summarize the problems at this point which may affect processing or postharvest losses of product.

1. _____

2. _____

3. _____

4. _____

5. _____

COMPONENT 15: Packaging

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the points in the postharvest system where packaging or repackaging occur:

Location	Yes	No	Describe
On the farm	( )	( )	
Rural collection point	( )	( )	
Regional collection point	( )	( )	
Packing house	( )	( )	
Local market	( )	( )	
Wholesale market	( )	( )	
Cottage industry	( )	( )	
Agro-industry	( )	( )	
Supermarket	( )	( )	
Point of export	( )	( )	
Other	( )	( )	

2. For each instance where packaging takes place, provide the following information:

a. Why is it necessary to package? _____

b. Who undertakes the packaging? _____

c. Where does the packaging take place? _____

d. When does the packaging take place? _____

e. How long does the packaging process take? _____

f. How is the product handled/packaged (describe)? _____

g. What type of packaging material is used? _____

h. Why is that particular packaging material used? _____

i. What is the size of the package used?

- dimensions (cm) _____ x _____ x _____
- number of units of product per package _____
- weight of package: gross _____ net _____

j. Does the particular package have the mechanical strength to adequately protect the product during:

Activity	Yes	No	Comments
Handling	( )	( )	
Transportation	( )	( )	
Stacking	( )	( )	
Storage	( )	( )	
Other	( )	( )	

k. Is the packaging material readily available? yes ( ) no ( )

l. Does the package meet the handling and marketing requirements in terms of:

Package characteristics	Domestic Market		Export Market		If negative explain
	Yes	No	Yes	No	
Weight					
Size					
Shape					
Material					
Design					
Labeling					

m. Can the package be re-used? yes ( ) no ( ). If yes, state the estimated number of times:

_____

n. Who owns the package (container)? _____

o. If the containers are reused, explain the procedure. _____

p. What is the per unit cost of the package or container? _____

q. What is the cost of the labor involved in packaging? _____

3. a. Is cushioning material used? yes ( ) no ( ). If yes, what type? _____

Why that particular type? _____

b. Can the cushioning material be re-used? yes ( ) no ( ). If yes, state the estimated number of times: _____

_____

c. What is the cost of the cushioning material per container? _____

4. If produce is not packaged, why not? not needed ( ) lack of knowledge ( )

lack of materials ( ) not economical ( ) other _____

5. Summarize problems which affect postharvest losses due to packaging or lack of:

1. _____

2. _____

3. _____

4. _____

5. _____

6. Observations:

COMPONENT 16: Cooling

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Does this product undergo cooling? yes ( ) no ( ). If no, why not? _____

   If yes, provide the following information:

2. What time of day is the product normally harvested?

   early morning ( ) morning ( ) afternoon ( ) evening ( ) anytime ( )

3. What is the normal air temperature during harvest? _____

4. Is it considered important to pre-cool this crop? yes ( ) no ( )

   Explain: _____

5. What method of cooling is used?

   standard cool room ( ) hydro ( ) icing ( ) evaporative ( )

   forced air ( ) air conditioning ( ) other ( ) _____

6. How is cooling carried out (describe procedure and equipment used)?

   _____

   _____

7. How long after harvest is the cooling performed?

   0-3 hours ( ) 4-7 hours ( ) 8-16 hours ( ) 17-24 hours ( ) more than 24 hours ( )

8. Where is the cooling carried out? on the farm ( ) collecting center ( )

   packing center ( ) market ( ) other _____

9. Are there collective use installations where cooling is carried out? ( ) yes ( ) no

Explain: _____

10. Who performs the cooling?

farmer ( ) middleman ( ) buyer ( ) government ( ) other _____

11. Who monitors the correct use and maintenance of facilities? _____

12. How long is the cooling period? _____ hours

13. What is the temperature range of the cooling medium? _____

14. Once cooled, is the product ever removed from the cool chain on its way to the final market?

yes ( ) no ( ) Describe: _____

15. What are the costs of the cooling operation, per kg of produce? _____

_____

16. Summarize problems identified at this point which may affect postharvest losses and/or marketing of the product.

1. _____
2. _____
3. _____
4. _____
5. _____

17. Observations:

COMPONENT 17: Storage

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the points in the postharvest system where storage takes place.

Points in postharvest system	Yes	No	Duration of storage (days)
On the farm	( )	( )	
Rural collecting point	( )	( )	
Regional collecting point	( )	( )	
Packing house	( )	( )	
Retail market	( )	( )	
Whole sale market	( )	( )	
Agroindustry	( )	( )	
Supermarket	( )	( )	
Export warehouses	( )	( )	
Container terminal (export)	( )	( )	
Government marketing board	( )	( )	
Import warehouses	( )	( )	
Other _____	( )	( )	

2. For each instance of storage identified, provide the following information:

a. Type of storage (from 1 above): _____

b. Who is responsible for the storage? farmer ( ) middleman ( ) goverment ( ) wholesaler ( ) retailer ( ) processor ( ) other _____

c. What is the purpose of storage? await shipping ( ) await better market price ( ) maintain quality ( ) assemble larger volumes ( ) other _____

d. Describe the storage facilities and equipment. _____

e. How long after harvest does the product normally go into storage (hours and days)? _____

f. How long is the holding period? _____

g. At what degree of ripeness/maturity is the product when it is normally placed into storage?

_____

h. How does the quality of produce change during the storage period? _____

i. Is air temperature controlled in the storage environment? yes ( ) no ( )

Explain: _____

j. What is the range of air temperature in the storage environment? _____

k. Is humidity controlled in the storage environment? yes ( ) no ( )

Explain: _____

l. What is the range of relative humidity in the storage environment? _____

m. Is the atmosphere in the storage facility modified ( ) or controlled ( )?

Describe: _____

n. Is the product normally stored by itself ( ) or with other produce ( )? If with other produce, specify what kind: _____

o. Describe the type of container in which the product is packaged during storage

_____

p. Who owns the storage facilities? _____

q. Who operates the storage facilities? _____

r. Who gives maintenance to the storage facilities? _____

s. Does the storage facilities have a plan for pest control? yes ( ) no ( )

t. What is the cost of holding the produce? _____

u. Is the storage facility operated efficiently? yes ( ) no ( ). If no, explain: _____

_____

3. Summarize storage problems which may affect postharvest losses.

1. _____

2. _____

3. _____

4. Observations:

COMPONENT 18: Transport

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify each point in the agricultural value chain where the product undergoes movement from one point to another with the purpose of getting it to a new location.

Where transportation takes place		Method of transport
a. from	to	
b. from	to	
c. from	to	
d. from	to	
e. from	to	

2. For each case identified above, provide the following information:

a. From _____ to _____

b. Who is responsible for the transportation?

farmer ( ) middleman ( ) wholesaler ( ) retailer ( ) government ( )

other _____

c. When is produce normally transported?

early morning ( ) morning ( ) afternoon ( ) evening ( ) night ( ) anytime ( )

d. Method of transport?

human ( ) animal ( ) motorcycle ( ) truck ( ) ship ( )

airplane ( ) other _____

e. Describe the transportation process. _____

f. Describe the containers used during this stage of transport. _____

g. How is produce stacked during transport? _____

h. Identify and describe any type of damage/bruising which occurs to the product during transport.

_____

i. Identify the costs involved during this stage of transportation:

Type costs	Yes	No	Type unit	Cost/unit
Labor				
Packaging				
Animal rental				
Vehicle service				
Containers				
Other				

j. What is the duration of this stage of transport?

Hours _____ days _____

k. What is the distance covered? _____

l. Who owns the containers during this stage of transport? _____

m. Who owns the product during transport? _____

3. Summary of problems during transport which may affect processing, postharvest handling, or marketing.

1. _____

2. _____

3. _____

4. _____

5. _____

4. Observations:

COMPONENT 19: Delays or Waiting

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify all those points in the postharvest system where delays or waiting occur.

Points in postharvest system	Yes	No	Describe
on the farm	( )	( )	
during transport	( )	( )	
at packinghouse	( )	( )	
at wholesale market	( )	( )	
at retail market	( )	( )	
at processing factory	( )	( )	
at supermarket	( )	( )	
at airport	( )	( )	
at seaport	( )	( )	
other	( )	( )	

2. For each instance of delay or waiting, provide the following information:

a. Point in system where delay or waiting occurs (from 1 above) _____

b. What is the cause of delay? _____

c. Who is responsible for the delay? _____

d. How long is the normal delay at this point? minutes _____ hours _____ days _____

e. What can be done to reduce the time of the delay? _____

_____

f. How is the product protected at the point of delay? _____

g. What are the environmental conditions for the product at the point of delay?

direct sunlight or shade _____ temperature _____

relative humidity _____ air movement _____

other debilitating environmental conditions: _____

h. Describe how the delay or waiting may affect the quality of the product (changes in appearance, texture, aroma, flavor, weight loss/gain, disease development, etc.).

i. Does the delay affect the price of the produce? yes ( ) no ( ). If yes, explain: _____

3. Summarize those problems caused by delays/waiting which may negatively affect processing postharvest handling, or marketing.

1. _____
2. _____
3. _____
4. _____
5. _____

4. Observations:

COMPONENT 20: Other Operations

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1.

Operation name	Point in the agricultural value chain where operation occurs

2. For each operation, provide the following information:

a. Name of operation. _____

b. Describe what takes place. _____

c. Who executes the operation? _____

d. Where is the operation carried out? _____

e. When is the operation carried out? _____

f. Why is it done in the present manner? _____

g. What is the impact of this operation on quality or quantity of the product? _____

h. How could this operation be improved? _____

3. Identify and describe all problems related to these operations which can affect processing, postharvest handling, or marketing of the product.

1. _____

2. _____

3. _____

4. _____

5. _____

4. Observations:

COMPONENT 21: Agroprocessing

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Does the produce undergo any type of processing or semi-processing at any point in the postharvest system? yes ( ) no ( )

IF NO, ANSWER THE FOLLOWING QUESTION

IF YES, GO TO QUESTION #3

2. Is there any possibility over the medium or long term for developing a processing industry for this crop? yes ( ) no ( ). If yes, explain (type of industry, principal constraints, etc.):

_____

_____

3. Where does the processing take place? on the farm ( ), home industry ( ), plant-sized industry ( ), market ( ), supermarket ( ), other _____

4. What percentage of the produce arriving at the point of processing is culled before the processing begins?_____% . What is the destination of the culled produce?_____

5. What type of processing is carried out?

Type processing	Yes	No	Observations
• canning in glass jars	( )	( )	
• canning in metal cans	( )	( )	
• dehydration/drying	( )	( )	
• making jam & jelly	( )	( )	
• candying	( )	( )	
• pickling	( )	( )	
• juicing	( )	( )	
• slicing in brine	( )	( )	
• concentrating	( )	( )	
• freezing	( )	( )	
• other _____	( )	( )	

6. What percent of the national production is processed in this form? _____ %

7. What percent of the production in the geographical area under study is processed in this form? _____ %

8. How does processing facilitate marketing? _____

9. Is the estimated demand for the processed output greater than ( ), equal to ( ) or less than ( ) the supply?

10. Intended market for processed output: _____ % export _____% domestic

11. Why is the product processed?

( ) to satisfy consumer demand (import substitution)

( ) to reduce postharvest losses

( ) to extend shelf life

( ) other (specify) _____

12. Does the processor contract for raw materials? yes ( ) no ( )

If no, what guarantee does the processor have to receive adequate supply of raw materials?

_____

13. What are the principal constraints to processing?

( ) insufficient raw materials

( ) lack of packaging materials

( ) high costs of raw materials

( ) high costs of other inputs (specify)

( ) insufficient energy

( ) expensive energy costs

( ) lack of qualified labor

( ) antiquated equipment/machinery

( ) other (specify) _____

14. Observations:

COMPONENT 22: Marketing Intermediaries

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify the different types of intermediaries involved with the marketing of the product under study.

Type of intermediary	Brief description
Local collectors/traders:	
Wholesalers:	
Retailers:	
Government buyers:	
Exporters:	
Agroprocessors:	
Others:	

2. For each type of intermediary identified in 1, provide the following information:

a. Describe the principal functions of this type of intermediary. _____

_____

b. How does the intermediary carry out these functions? _____

_____

c. Where are these functions carried out? _____

d. When are these functions carried out? _____

e. Other persons involved in carrying out these functions? _____

f. Why are these actions carried out in the present manner? _____

g. What facilities, equipment, vehicles, etc., does the intermediary use to carry out the activities?

_____

h. What is an average sized operation for this type of intermediary (tons of product handled per calendar year)? _____

i. How could the handling of this product be improved? _____

j. Would improvement in handling increase costs for the operation? yes ( ) no ( )

k. If yes, can this cost be passed on to consumers? yes ( ) no ( )

l. What are the principal constraints for this intermediary which affect the efficient handling of the product? _____

3. Are there any ethnic groups which specialize in marketing? yes ( ) no ( )

If yes, how does this affect:

a. Quality: _____

b. Price: _____

c. Cost: _____

4. If possible, collect the following information from each type of intermediary:

a. What are the conditions of purchase to the supplier? _____

_____

b. How is price determined? _____

c. Who determines the price? _____

d. What are the payment terms to the supplier? _____

e. Is product quality a problem? yes ( ) no ( )

f. Is obtaining sufficient volume a problem? yes ( ) no ( )

Explain: _____

g. What tricks do farmers use when selling produce to intermediaries (e.g. adding foreign material, placing best produce on top, etc.)? _____

5. Summarize problems relating to intermediaries which affect postharvest handling and/or marketing and/or processing.

1. _____

2. _____

3. _____

COMPONENT 23: Market Information

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Is statistical price information available for the product under study? yes ( ) no ( )

2. If yes, for what calendar years? _____

3. Type of price information available

Source of price information	Frequency of Information			
	daily	weekly	monthly	yearly
Farm gate				
Wholesale				
Retail				
Export				

4. Has a seasonal price index been prepared for this crop? yes ( ) no ( )

5. If a seasonal price index exists, which are the months of the year when prices are lowest? _____ highest? _____

6. During those months when prices are lowest, are the low prices due to:

Causes of price fluctuation	Yes	No
decline in consumer demand		
favorable growing conditions/excess supply		
poor production planning/excess supply		
increase in imports		
reduction of exports		
trade regulations		
increase in supply of substitutes		
other		

7. During those months when prices are highest, are the high prices due to:

Causes of price fluctuation	Yes	No
increase in consumer demand		
poor growing conditions/scarcity		
poor production planning/scarcity		
reduction in imports		
increase of exports		
trade regulations		
decline in supply of substitutes		
other		

8. Does data include information on different qualities? yes ( ) no ( )

on different cultivars? yes ( ) no ( ) on quantities entering the market? yes ( ) no ( )

9. In what type of market are prices highest?

Type market	Describe for whom prices are higher
Public market ( )	
Supermarket ( )	
Agroindustry ( )	
Exporters ( )	
Institutions ( )	
Government buyers ( )	
Other: _____	

10. In the markets mentioned above, do prices vary due to quality differences?

yes ( ) no ( ). If yes, in which markets? _____

11. Is there reliable information about product supply on domestic markets? yes ( ) no ( )

on overseas markets? yes ( ) no ( )

12. If yes, for what period of time?

- indicate calendar years tor which supply information exists: _____
- is the information on a monthly ( ) or yearly ( ) basis?

13. What is the source of the supply information? _____

14. Is the supply information reliable ( )? questionable ( )? a guess ( )?

15. Provide following price information for year: _____

Type market	Low price		High price	
	USD per unit	Month	USD per unit	Month
Farmgate				
Local market				
Wholesale				
Retail				
Export				
Other				

16. Summary of price-related problems which may affect postharvest losses.

1. _____

2. _____

3. _____

COMPONENT 24: Consumer Demand

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. What percent of total national production of this product is sold on the domestic market? _____% export market? _____%

2. What percent of the production in the geographical area under study goes to the domestic market? _____% export market _____%

3. Which consumers purchase the product in domestic and export markets.

Type consumer	Domestic market	Export market
Low income consumers	%	%
Medium income consumers	%	%
High income consumer	%	%
Total (%)	**100**	**100**

4. Indicate ethnic group consumption of this product:

Ethnic group	Domestic market	Export market
	%	%
	%	%
	%	%
	%	%
Total (%)	**100**	**100**

5. For each <u>important</u> consumer group identified above, provide the following information for the applicable questions:

a. Preferred cultivar? _____

b. Preferred size? _____

c. Preferred color? _____

d. Desired flavor? _____

e. Desired texture? _____

f. Preferred degree of maturity? _____

g. Preferred type of package? _____

h. Desired number of units/products per package? _____

i. Consumer willingness to accept pest or disease blemishes? will accept ( ) will not accept( )

j. Which of the following is most important to this consumer group: quality ( ) or price ( )?

k. How sensitive is this consumer group to fluctuations in product prices?

( ) very sensitive (small price increase decreases consumer purchases)

( ) moderately sensitive

( ) slightly sensitive

( ) not very sensitive (large price increase won't decrease amount purchased)

l. Desired product characteristics for religious, cultural, and medicinal uses:

religious: _____

cultural: _____

medicinal uses: _____

other: _____

6. Summarize the characteristics of consumer demand which are most likely to affect the marketability of the product in question.

1. _____

2. _____

3. _____

4. _____

5. _____

7. Observations:

COMPONENT 25: Exports

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Name of crop to be exported: _____

Variety/cultivar/clone: _____

2. Characteristics of external demand:

a. For each potential export destination complete the following information:

- preferred cultivar _____
- preferred size _____
- preferred weight _____
- preferred color _____
- desired flavor _____
- acid/brix ratio _____
- preferred texture _____
- preferred degree of maturity _____
- desired packaging _____
- pest control requirements _____
- disease control requirements _____
- chemical residue limits _____
- grades & standards used _____
- other desired crop characteristics (e.g., due to religious or cultural preferences) _____

b. What trade barriers exist, or regulations are required, in the importing country? _____

c. What is the total volume of the product imported during the previous calendar year by country of destination? _____

d. What volume of product was imported from this study area by the country of destination during the last year? _____ and the previous four years? _____

3. Characteristics of supply:

Total national production over last five years

Years	Tons	Value ($)

4. Principal constraints which limit exports:

Type constraints	Yes	No	Describe problem
• Market information	( )	( )	
• Insect problems	( )	( )	
• Disease problems	( )	( )	
• Climatic problems	( )	( )	
• Postharvest handling problems:			
infrastructure	( )	( )	
technology	( )	( )	
technical assistance	( )	( )	
funds	( )	( )	
other _____	( )	( )	
• Transportation problems:			
sea transport	( )	( )	
air transport	( )	( )	
• Insufficient volumes	( )	( )	
• Trade barriers:			
excessive documentation	( )	( )	
import licenses	( )	( )	
• Delays in payments	( )	( )	
• Other _____	( )	( )	

5. Potential competition:

a. Which are the principal competing countries for this same market? _____

_____

b. What actions must be taken to compete favorably with these countries?

- with respect to quality: _____

_____

- with respect to supply: _____

_____

- with respect to price: _____

_____

- with respect to product safety: _____

_____

- shipping methods: _____

_____

- market research and development: _____

_____

- market information: _____

_____

- market promotion: _____

6. Can the farmers/intermediaries meet the external demand requirements with respect to:

Demand requirement	Yes	No	Comments
• proper cultivar/variety	( )	( )	
• product size	( )	( )	
• product weight	( )	( )	
• color	( )	( )	
• flavor	( )	( )	
• texture	( )	( )	
• maturity	( )	( )	
• freedom from pests	( )	( )	
• freedom from disease	( )	( )	
• appearance	( )	( )	
• quarantine controls	( )	( )	
• health regulations	( )	( )	
• trade restrictions	( )	( )	
• packaging requirements	( )	( )	
• product quantity	( )	( )	
• product quality	( )	( )	
• price	( )	( )	
• others: _____	( )	( )	
_____	( )	( )	

7. Summary of principal problems with respect to exports.

1. _____

2. _____

3. _____

4. _____

5. _____

8. Observations:

COMPONENT 26: Postharvest and Marketing Costs

Name of data collector: _____ Telephone: _____

Title: _____ Institution: _____

1. Identify each step (operation) in the marketing channel (for the product being studied), from the point of harvest to sales, and present them in a list. Consider such aspects as: harvest, selection, grading, packaging, cooling, transport, processing, wholesaling, retailing, exporting, and others.

2. Prepare a list of all the different types of participants involved in the marketing of the product in question, considering: farmers, farmer organizations, rural traders, intermediaries, wholesalers, retailers, supermarkets, agroprocessors, marketing boards, government institutions, transport companies, cool storage suppliers, packing house operators, customs, port personnel, and others.

3. For each participant in the agricultural value chain, identify respective postharvest and marketing costs which affect the price of the agricultural product, considering such things as: labor, materials, equipment, chemical and physical treatments, vehicles, transportation fees, storage, processing, cooling services, packaging, grading/sorting, inspection, custom fees, technical assistance, and others.

4. From point of harvest to retail, list the operations (steps in marketing channel) in the order in which they occur. For each operation, list the respective participants, type of cost, and the respective cost. For example:

Operation	Participants	Cost items	Cost
Harvest	Traders	Supervision	USD 8.00/day
	Pickers	Picking, selection	USD 0.06/kg
Packing	Packers	Labor	USD 0.01/kg
		Cushion material	USD 0.04/kg
		Cartons	USD 1.35/kg

ANNEX 3

Example questionnaires for collecting information on public sector institutions, farmer organizations and development projects.

Annex 3-A Format for the collection of information on public sector institutions affecting the agricultural value chain

1. Name of the institution: _____

Relevant subdivisions: _____

2. Names/titles of key persons within the institutions who directly or indirectly affect the agricultural value chain of interest, and how:

Name/Title	How person makes impact
Example: Samuel Jones/Project officer	Potato project coordinator

3. List staff who work with or in some way affect the product of interest:

Type of staff	Number	Functions impacting product
Example: entomologist	2	Control of fruit fly

4. Total amount of institution's budget in most recent year:

Allocated: USD_____ Spent: USD _____

5. Percent of budget which affects the product of interest: _____%

6. Identify institutionally provided infrastructure, equipment, materials, etc., which somehow affect the product of interest:

Description of item	#Units	Location/other information

7. Identify and describe ongoing projects by this institution which affect the product:

Name of project	Begin date	End date	Cost	Source of USD

8. Identify and describe planned projects by this institution which will affect the product:

Name of project	Begin date	End date	Cost	Source of USD

9. Summarize principal institutional actions and activities which affect the product of interest (repeat for each action/activity):

Action/activity #1: _____

Effective dates: from _____ to _____

Description: _____

10. Summarize services provided by the institution which affect the agricultural value chain (repeat for each service):

Service #1: _____

Type service: _____

Description: _____

11. Summarize principal institutional constraints affecting the product (repeat for each constraint):

Constraint #1: _____

Description of constraint: _____

Impact of constraint (how it affects product): _____

12. Other observations:

_____

_____

Annex 3-B Information on farmer organizations

1. Name of farmer organization: _____

2. Year founded: _____

3. Address/location: _____

4. Name(s) and position(s) of key person(s): _____

5. Number of active members (most recent year): _____

6. Type of products handled: _____

7. Product sales most recent year (tons and USD value): Year: _____

8. Types of service offered to members (for product being studied):

Type service	Yes	No	Comments
Credit	( )	( )	
Technical assistance	( )	( )	
Information	( )	( )	
Farm inputs	( )	( )	
Spraying	( )	( )	
Processing	( )	( )	
Marketing	( )	( )	
Storage	( )	( )	
Transport	( )	( )	
Other _____	( )	( )	

9. Identification of infrastructure/equipment/materials, etc. which may impact upon the product of interest:

Description of item	#Units	Location/other information

10. Briefly describe the relevant experiences of the farmer organization in the production, postharvest handling, marketing, processing, or distribution of the product of interest.

11. Identify and describe linkages/relationships with other organizations (public, private, bilateral, international, etc.)

a. Other farmer organizations: _____

b. Public sector institutions: _____

c. Support organizations: _____

d. Donor organizations: _____

e. Others (specify): _____

12. Identify and describe ongoing projects impacting the product:

Name of project	Begin date	End date	Cost	Source of USD

13. Identity and describe planned projects which will affect the product:

Name of project	Begin date	End date	Cost	Source of USD

14. Principal institutional constraints impacting product (repeat for each constraint):

Constraint #1: _____

Description of constraint: _____

Impact of constraint (how it affects product): _____

15. Principal operational constraints impacting product (repeat for each constraint):

Constraint #1: _____

Description of constraint: _____

Impact of constraint (how it affects product): _____

16. Observations:

_____

_____

Annex 3-C Inventory of development projects and activities affecting the agricultural value chain

1. Prepare a list of all projects and activities which may affect the product being studied.

2. For each project or activity, answer the following questions:

   a. Name of the project or activity: _____

   b. Beginning date: _____ Ending date: _____

   c. Sponsoring institution: _____

   d. Total cost: USD _____ Local currency _____

   e. Objectives: _____

   f. Status: ( ) ahead of schedule, ( ) on schedule, ( ) behind schedule

   g. Principal constraints affecting project: _____

   h. Expected impact on the product being studied: _____

3. For each project activity, identify the technical personnel associated with the product of interest.

Name	Area of expertise	Time to be in country

ANNEX 4

Simplified questions for each component of the agricultural value chain.

Source: Kitinoja And Kasmire 2002. Modified From La Gra 1990.

Components 1 - 7: Pre-production

1- **Importance of the crop.** What is the relative importance of the crop? Base your estimate of importance on available information, on number of producers, amount produced, area of production, and/or market value.

2- **Governmental policies.** Are there any laws, regulations, incentives or disincentives related to producing or marketing the crop? (e.g., existing price supports or controls, banned pesticides or residue limits).

3- **Relevant institutions.** Are there any organizations involved in projects related to production or marketing the crop? What are the objectives of the projects? How many people are participating?

4- **Facilitating services.** What services are available to producers and marketers (for example: credit, inputs, technical advice, subsidies)?

5- **Producer/shipper organizations.** Are there any producer or marketer organizations involved with the crop? What benefits or services do they provide to participants? At what cost?

6- **Environmental conditions.** Does the local climate, soils or other factors limit the quality of production? Are the cultivars produced appropriate for the location?

7- **Availability of planting materials.** Are seeds or planting materials of adequate quality? Can growers obtain adequate supplies when needed?

Components 8 - 11: Production

8- **Farmers' general cultural practices.** Do any farming practices in use have an effect on produce quality (irrigation, weed control, fertilization practices, field sanitation)?

9- **Pests and diseases.** Are there any insects, fungi, bacteria, weeds or other pests present that affect the quality of produce?

10- **Pre-harvest treatments.** What kinds of pre-harvest treatments might affect postharvest quality (such as use of pesticides, pruning practices, thinning)?

11- **Production costs.** Estimate the total cost of production (inputs, labor, rent, etc). What are the costs of any proposed alternative methods?

Components 12 - 21: Postharvest

12- **Harvest.** When and how is produce harvested? by whom? at what time of day? Why? What sort of containers are used? Is the produce harvested at the proper maturity for the intended market?

13- **Grading, sorting and inspection.** How is produce sorted? by whom? Does value (price) change as quality/size grades change? Do local, regional or national standards (voluntary or mandatory) exist for inspection? What happens to culled produce?

14- **Postharvest treatments.** What kinds of postharvest treatments are used? (Describe any curing practices, cleaning, trimming, hot water dips, etc.) Are treatments appropriate for the product?

15- **Packaging.** How is produce packed for transport and storage? What kind of packages are used? Are packages appropriate for the product? Can they be reused or recycled?

16- **Cooling.** When and how is produce cooled? To what temperature? Using which method(s)? Are methods appropriate for the product?

17- **Storage.** Where and for how long is produce stored? In what type of storage facility? Under what conditions (packaging, temperature, RH, physical setting, hygiene, inspections, etc.)?

18- **Transport.** How and for what distance is produce transported? In what type of vehicle? How many times is produce transported? How is produce loaded and unloaded?

19- **Delays/ waiting.** Are there any delays during handling? How long and under what conditions (temperature, RH, physical setting) does produce wait between steps?

20- **Other handling.** What other types of handling does the produce undergo? Is there sufficient labor available? Is the labor force well trained for proper handling from harvest through transport? Would alternative handling methods reduce losses? Would these methods require new workers or displace current workers?

21- **Agroprocessing.** How is produce processed (methods, processing steps) and to what kinds of products? How much value is added? Are sufficient facilities, equipment, fuel, packaging materials and labor available for processing? Is there consumer demand for processed products?

Components 22 - 26: Marketing

22- **Market intermediaries.** Who are the handlers of the crop between producers and consumers? How long do they have control of produce and how do they handle it? Who is responsible for losses /who suffers financially? Is produce handled on consignment; marketed via direct sales; moved through wholesalers?

23- **Market information.** Do handlers and marketers have access to current prices and volumes in order to plan their marketing strategies? How do they collect the information? Who does the recordkeeping? Is information accurate, reliable, timely, and useful to decision makers?

24- **Consumer demand.** Do consumers have specific preferences for produce sizes, flavors, colors, maturities, quality grades, packages types, package sizes or other characteristics? Are there any signs of unmet demand and/or over-supply? How do consumers react to the use of postharvest treatments (pesticides, irradiation, coatings, etc.) or certain packaging methods (plastic, styrofoam, recyclables)?

25- **Exports.** Is this product produced for export? What are the specific requirements for export (regulations of importing country with respect to grades, packaging, pest control, etc.)?

26- **Marketing costs.** Estimate the total marketing costs for the crop (inputs and labor for harvest, packaging, grading, transport, storage, processing, etc.). Do handlers/ marketers have access to credit? Are prevailing market interest rates at a level that allows the borrower to repay the loan and still make a profit? Is supporting infrastructure adequate (roads, marketing facilities, management skills of staff, communication systems such as telephone, fax, e-mail services)?

ANNEX 5

Summary of the postharvest system of mango in Uttar Pradesh, India.

Source: Kitinoja 2010.

ACTION	Who takes action?	What action is taken?	How is the action done?	When is the action done?	Why is the action done?	Where action taken?
Harvest	Trader/ contractor / agent	Fruits are plucked and put on ground	By netted harvester	In the morning 8-10 a.m.	Morning temperatures, 28°C – 35°C	On-farm
In-field collection	Hired labor	Fruits are gathered at one point	By hand	Immediately after plucking	For sorting, grading and packing	On-farm
On-farm packing	The contractor/ owner	Sorted and graded fruits are packed in containers (wooden & CFB boxes)	By hand	Immediately after sorting and grading	For safe transportation and to minimize damage	On-farm
On-farm transport	Trader/ contractor / agent	The containers are carried from the field to the collection point/directly to wholesale market	By tractor trailers and truck	As soon as the packing is completed - late afternoon	To transport the produce to the collection center	On-farm
Packing for local market	Packer	Sort those that are not meant for wholesale market	Manually: inferior quality of produce is packed in basket for sale in local market	Any time	Facilitate transport	On-farm
Transport to local market	Middlemen/ forwarding agent	Transport of produce	By tractor trailers and truck	Early evening	To sell the produce	Road
Auction sale	Commission agent	Auctioning	Sold to the highest bidder	Early morning	To get maximum profit	Wholesale market
Collection for retail	Retailer	Displays the produce well arranged on carts	Produce is arranged to attract the consumers who may purchase the produce by weight or by box	Early evening in uncovered retail market	To get maximum price	Retail outlets
Sale to consumer	Retail buyer	Allow buyers to select according to preference	There is some bargaining of price	In open retail market early evening to late night (11.00 p.m.)	Buyers preference to get the variety of their choice	Retail outlets

ANNEX 6

Worksheets for quantifying post harvest losses of leafy vegetables, fruits, roots, tubers and bulbs in agricultural value chains.

Source: PEF 2016.

Annex 6A. Worksheet for quantifying postharvest losses of leafy vegetables on farm level.

On farm data collection worksheet	Name of data collector:			
Leafy greens **Code: Farm** _____	Variety (if known _____) or describe color, shape, etc.			
Questions and observations	**At Harvest**		**Farm gate**	
Date				
Location of farm				
Size of farm				
Crops produced				
Season for leafy greens (range of harvesting dates on this farm)				
Name of destination market if known				
Distance to market if known	_____ km		Expected journey time _____ hours	
Sorting - selecting out that produce which will not be sent to the market	Was sorting done at harvest? Yes/No	If Yes, estimate waste (discarded) _____ % or left in the field _____ % Reason for sorting out:	Was sorting done before farm gate sale? Yes/No	If Yes, estimate waste (discarded): _____ % Reason for sorting out:
Size grading: is there any grading into different sizes on the farm?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected farm gate price:			Price offered _____ (by weight? by volume? by number of containers?) Price per kg: _____	

MEASUREMENTS	At Harvest	Farm gate (to be measured again if possible)
Sample size (select random samples)	count of 20 bunches	count of 20 bunches
Time from harvest	_____ hour	
Time of day		
Air temperature	_____ °C	_____°C
Relative humidity indicator	%RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	%RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C
Pulp temperature in °C (3 randomly selected bunches)		
Quality sort for defects, decay, damage (# out of count of 20) Ratings from 5 = Extreme defects, decay or damage; 3 = moderate; 1 = none	Number of rating 5 _____ Number of rating 3 _____ Number of rating 1 _____	Number of rating 5 _____ Number of rating 3 _____ Number of rating 1 _____
Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, etc.		
Describe defects found (take photos)		

	At Harvest	Farm gate (to be measured again if possible)
Number with decay symptoms ie: fungus, mildew, bacterial spots, etc.		
Describe decay found (take photos)		
Number damaged ie: bruises, cuts, mechanical injury, insect damage.		
Describe damages found (take photos)		
Maturity rating: 5 = large, more mature 3 = medium size 1= younger, very immature	Number large, more mature _____ Number medium size _____ Number young, very immature _____	Number large, more mature _____ Number medium size _____ Number young, very immature _____

Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection
Describe package or container: type, material, dimensions, cooling efficiency (take photos)		
Size and/ or weight of package or container		
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample	Weight at time of sale

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6B. Worksheet for quantifying postharvest losses of leafy vegetables at the wholesale market.

Wholesale data collection worksheet	**Name of data collector:**			
Leafy greens	Variety (if known _____) or describe color, shape, etc.			
Code: Farm _____				
Questions and observations	**On arrival**		**At the time of sale**	
Date				
Name of market				
Location of market				
Season for leafy greens (range of sales dates at this market)				
Distance from farm if known	_____ km			
Sorting - selecting out that produce which will not be resold	Was sorting done before delivery? Yes/No	If Yes, estimate waste (discarded) _____% Reason for sorting out:	Was sorting done before sale? Yes/No	If Yes, estimate waste (discarded): _____ % Reason for sorting out:
Size grading: is there any grading into different sizes at the market?	If Yes, estimate % in each category: Large _____% ; Medium _____% ; Small _____%		If Yes, estimate % in each category: Large _____% ; Medium _____% ; Small _____%	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected wholesale price			Price range _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**At the time of sale**	
Sample size (select random samples)	count of 20		one package (_____ = total number)	
Time from harvest if known				
Time of day				
Air temperature	_____ °C		_____°C	
Relative humidity indicator	%RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C		%RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	

Pulp temperature in °C (3 randomly selected bunches)						

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
				Number of rating 5 _____
				Number of rating 3 _____
				Number of rating 1 _____		

Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, etc.						
Describe defects found (take photos)						
	On arrival			**At the time of sale**		
Number with decay symptoms ie: fungus, mildew, bacterial spots, etc.						
Describe decay found (take photos)						
Number damaged ie: bruises, cuts, mechanical injury, insect damage.						
Describe damages found (take photos)						
Maturity rating: 5 = large, more mature 3 = medium size 1 = younger, very immature	Number large, more mature _____ Number medium size _____ Number young, very immature _____			Number large, more mature _____ Number medium size _____ Number young, very immature _____		
Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection			____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection		
Describe package or container: type, material, dimensions, cooling efficiency (take photos)						
Size and/ or weight of package or container						
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample			Weight at time of sale		

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6C. Worksheet for quantifying postharvest losses of leafy vegetables at the retail market.

Retail data collection worksheet	**Name of data collector:**			
Leafy greens	Variety (if known _____) or describe color, shape, etc.			
Code: Retail _____				
Questions and observations	**On arrival**		**6 to 8 hours later**	
Date				
Name of market				
Location of market				
Season for leafy greens (range of sales dates at this market)				
Distance from wholesale market	_____ km			
Sorting - selecting out that produce which will not be resold	Was sorting done before purchase? Yes/No	If Yes, estimate waste (discarded) _____ % Reason for sorting out:	Was sorting done before sale? Yes/No	If Yes, estimate waste (discarded): _____% Reason for sorting out:
Size grading: is there any grading into different sizes at the market?	If Yes, estimate % in each category: Large _____% ; Medium _____% ; Small _____%		If Yes, estimate % in each category: Large _____% ; Medium _____% ; Small _____%	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected retail price:			Price range _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**6 to 8 hours later**	
Sample size (select random samples)	count of 20 bunches		count of 20 bunches	
Time from harvest if known				
Time of day				
Air temperature	_____ °C		_____°C	
Relative humidity indicator	%RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C		%RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	

Pulp temperature in °C (3 randomly selected bunches)						

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
				Number of rating 5 _____
				Number of rating 3 _____
				Number of rating 1 _____		

Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, etc.						
Describe defects found (take photos)						
	On arrival			**6 to 8 hours later**		
Number with decay symptoms ie: fungus, mildew, bacterial spots, etc.						
Describe decay found (take photos)						
Number damaged ie: bruises, cuts, mechanical injury, insect damage.						
Describe damages found (take photos)						
Maturity rating: 5 = large, more mature 3 = medium size 1= younger, very immature	Number large, more mature _____ Number medium size _____ Number young, very immature _____			Number large, more mature _____ Number medium size _____ Number young, very immature _____		
Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection			____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection		
Describe package or container: type, material, dimensions, cooling efficiency (take photos)						
Size and/ or weight of package or container						
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample			Weight 6 to 8 hours later		

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6D. Worksheet for quantifying postharvest losses of fruits on farm level.

On farm data collection worksheet	**Name of data collector:**			
Fruit (NAME)	Variety (if known _____) or describe color, shape, etc.			
Code Farm_____				
Questions and observations	**At Harvest**		**Farm gate**	
Date				
Location of farm				
Size of farm				
Crops produced				
Season for _____ (range of harvesting dates on this farm)				
Name of destination market if known				
Distance from wholesale market	_____ km		Expected journey time _____ hours	
Sorting - selecting out that produce which will not be sent to the market	Was sorting done at harvest? Yes/No	If Yes, estimate waste (discarded) _____% or left on the tree _____% Reason for sorting out:	Was sorting done before farm gate sale? Yes/ No	If Yes, estimate waste (discarded): _____% Reason for sorting out:
Ripening - is ripening done before sale?			If yes, estimate weight loss: _____ %	
Size grading: is there any grading into different sizes on the farm?	If Yes, estimate % in each category: Large _____% ; Medium _____% ; Small _____%		If Yes, estimate % in each category: Large _____% ; Medium _____% ; Small _____%	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected farm gate price:			Price offered _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**At Harvest**		**Farm gate (to be measured again if possible)**	
Sample size (select random samples)	count of 20		count of 20	
Time from harvest	_____ hour			
Time of day				
Air temperature	_____ °C		_____°C	

Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C
Pulp temperature in °C (3 randomly selected bunches)		
Quality sort for defects, decay, damage (# out of count of 20) Ratings from 5 = Extreme defects, decay or damage; 3 = moderate; 1 = none	Number of rating 5 _____ Number of rating 3 _____ Number of rating 1 _____	Number of rating 5 _____ Number of rating 3 _____ Number of rating 1 _____
Number with obvious defects ie: cracks, sunburn, misshapen, etc.		
	Harvest	**Farm gate (to be measured again if possible)**
Describe defects found (take photos)		
Number with decay symptoms		
Describe decay found (take photos)		
Number damaged ie: bruises, cuts, mechanical injury, sap burn, insect damage.		
Describe damages found (take photos)		
Ripeness rating: 5 = external full color*, full ripe 4 = 3/4 color 3 = 1/2 color 2 = 1/4 color 1= green	Number full color _____ Number 3/4 ____ Numbe 1/2 ____ Number 1/4 ____ green ____	Number full color _____ Number 3/4 ____ Numbe 1/2 ____ Number 1/4 ____ green ____
SSC % (Brix) (measure 3 randomly selected fruits with refractometer)		
Rate Firmness (measure 3 randomly selected fruits with Effigi pressure tester) tip size 8mm		
Rate package protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection
Describe package or container: type, material, dimensions, cooling efficiency, etc. (take photos)		
Size and/ or weight of package or container		
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample	Weight at time of sale

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6E. Worksheet for quantifying postharvest losses of fruits at the wholesale market.

Wholesale data collection worksheet	**Name of data collector:**			
Fruit (NAME)	Variety (if known _____) or describe color, shape, etc.			
Code: Wholesale____				
Questions and observations	**On arrival**		**At time of sale**	
Date				
Name of market				
Location of market				
Season for _____ (range of dates of sales at this market)				
Name of destination market if known				
Distance from wholesale market	_____ km		Expected journey time _____ hours	
Sorting - selecting out that produce which will not be resold	Was sorting done before delivery? Yes/No	If Yes, estimate waste (discarded) _____% Reason for sorting out:	Was sorting done before sale? Yes/ No	If Yes, estimate waste (discarded): _____% Reason for sorting out:
Size grading: is there any grading into different sizes at the market?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected wholesale price:			Price offered _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**At time of sale (to be measured again if possible)**	
Sample size (select random samples)	count of 20		one package (_____ = total number)	
Time from harvest (if known)				
Time of day				
Air temperature	_____ °C		_____°C	

Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C
Pulp temperature in °C (3 randomly selected bunches)		

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
		Number of rating 5 _____
		Number of rating 3 _____
		Number of rating 1 _____

Number with obvious defects ie: cracks, sunburn, misshapen, etc.		
Describe defects found (take photos)		
	On arrival	**At time of sale**
Number with decay symptoms ie: fungus, bacterial rots, etc.		
Describe decay found (take photos)		
Number damaged ie: bruises, cuts, mechanical injury, sap burn, insect damage.		
Describe damages found (take photos)		
Ripeness rating: 5 = external full color*, full ripe 4 = 3/4 color 3 = 1/2 color 2 = 1/4 color 1= green	Number full color _____ Number 3/4 ____ Number 1/2 ____ Number 1/4 ____ green ____	Number full color _____ Number 3/4 ____ Number 1/2 ____ Number 1/4 ____ green ____
SSC % (Brix) (measure 3 randomly selected fruits with refractometer)		
Rate Firmness (measure 3 randomly selected fruits with Effigi pressure tester) tip size 8mm		
Rate package protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection
Describe package or container: type, material, dimensions, cooling efficiency, etc. (take photos)		
Size and/ or weight of package or container		
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample	Weight at time of sale

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6F. Worksheet for quantifying post harvest losses of fruits at the retail market.

Retail data collection worksheet	**Name of data collector:**			
Fruit (NAME)	Variety (if known _____) or describe color, shape, etc.			
Code: Retail _____				
Questions and observations	**On arrival**		**6 to 8 hours after arrival**	
Date				
Name of market				
Location of market				
Season for mangoes (range of dates of sales at this market)				
Distance from wholesale market	_____ km			
Sorting - selecting out that produce which will not be resold	Was sorting done before delivery? Yes/No	If Yes, estimate waste (discarded) _____% Reason for sorting out:	Was sorting done before sale? Yes/ No	If Yes, estimate waste (discarded): _____ % Reason for sorting out:
Size grading: is there any grading into different sizes at the market?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected wholesale price:			Price offered _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**6 to 8 hours after arrival**	
Sample size (select random samples)	count of 20		count of 20	
Time from harvest (if known)				
Time of day				
Air temperature	_____ °C		_____°C	
Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C		% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	

Pulp temperature in °C (3 randomly selected bunches)						

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
				Number of rating 5 _____
				Number of rating 3 _____
				Number of rating 1 _____		

Number with obvious defects ie: cracks, sunburn, misshapen, etc.						
Describe defects found (take photos)						
	On arrival			**6 to 8 hours after arrival**		
Number with decay symptoms ie: fungus, bacterial rots, etc.						
Describe decay found (take photos)						
Number damaged ie: bruises, cuts, mechanical injury, sap burn, insect damage.						
Describe damages found (take photos)						
Ripeness rating: 5= external full color*, full ripe 4= 3/4 color 3= 1/2 color 2= 1/4 color 1=green	Number full color _____ Number 3/4 ____ Number 1/2 ____ Number 1/4 ____ green ____			Number full color _____ Number 3/4 ____ Number 1/2 ____ Number 1/4 ____ green ____		
SSC % (Brix) (measure 3 randomly selected fruits with refractometer)						
Rate Firmness (measure 3 randomly selected fruits with Effigi pressure tester) tip size 8mm						
Rate package protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection			____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection		
Describe package or container: type, material, dimensions, cooling efficiency, etc. (take photos)						
Size and/ or weight of package or container						
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample			6 to 8 hours after arrival		

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6G. Worksheet for quantifying postharvest losses of roots, tubers and bulbs on farm level.

On farm data collection worksheet	**Name of data collector:**			
Root, tuber or bulb	Variety (if known _____) or describe color, shape, etc.			
Code: Farm _____				
Questions and observations	**At Harvest**		**Farm gate**	
Date				
Location of farm				
Size of farm				
Crops produced				
Season for _____ (range of harvesting dates on this farm)				
Name of destination market if known				
Distance to market if known	_____ km		Expected journey time _____ hours	
Sorting - selecting out that produce which will not be sent to the market	Was sorting done at harvest? Yes/No	If Yes, estimate waste (discarded) _____ % Reason for sorting out:	Was sorting done before farm gate sale? Yes/ No	If Yes, estimate waste (discarded): _____% Reason for sorting out:
Was curing done on the farm?			If yes, estimate weight loss: _____ %	
Size grading: is there any grading into different sizes on the farm?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected farm gate price:			Price offered _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**At Harvest**		**Farm gate (to be measured again if possible)**	
Sample size (select random samples)	count of 20		count of 20	
Time from harvest	_____ hour			
Time of day				

Air temperature	_____ °C	_____°C
Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C
Pulp temperature in °C (3 randomly selected bunches)		

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
		Number of rating 5 _____
		Number of rating 3 _____
		Number of rating 1 _____

Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, darkening, etc.		
Describe defects found (take photos)		
	Harvest	**Farm gate (to be measured again if possible)**
Number with decay symptoms ie: fungus, mildew, bacterial spots, rot, etc.		
Describe decay found (take photos)		
Number damaged ie: bruises, cuts, mechanical injury, insect damage.		
Describe damages found (take photos)		
Quality rating: 5 = large 3 = medium size 1= small	Number large size _____ Number medium size _____ Number small _____	Number large size _____ Number medium size _____ Number small _____
Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection
Describe package or container: type, material, dimensions, cooling efficiency (take photos)		
Size and/ or weight of package or container		
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample	Weight at time of sale

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6H. Worksheet for quantifying postharvest losses of roots, tubers, or bulbs during storage.

Storage data collection worksheet	**Name of data collector:**			
Root, tuber or bulb	Variety (if known _____) or describe color, shape, etc.			
Code: Storage _____				
Questions and observations	**On arrival**		**At the time of sale**	
Date				
Name of village				
Location of storage				
Season for _____ (range of dates in storage)				
Distance from farm if known	_____ km			
Sorting - selecting out that produce which will not be resold	Was sorting done before storage? Yes/No	If Yes, estimate waste (discarded) _____% Reason for sorting out:	Was sorting done before sale? Yes/ No	If Yes, estimate waste (discarded): _____% Reason for sorting out:
Was curing done before storage?			If yes, estimate weight loss: _____%	
Size grading: is there any grading into different sizes on the farm?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected price:			Price range _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**At the time of sale**	
Sample size (select random samples)	count of 20		count of 20	
Time from harvest if known				
Time of day				
Air temperature	_____ °C		_____°C	
Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C		% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	

Pulp temperature in °C (3 randomly selected bunches)						

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
				Number of rating 5 _____
				Number of rating 3 _____
				Number of rating 1 _____		

Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, darkening, etc.						
Describe defects found (take photos)						
	On arrival			**At the time of sale**		
Number with decay symptoms ie: fungus, mildew, bacterial spots, rot, etc.						
Describe decay found (take photos)						
Number damaged ie: bruises, cuts, mechanical injury, insect damage.						
Describe damages found (take photos)						
Quality rating: 5 = large 3 = medium size 1= small	Number large size _____ Number medium size _____ Number small _____			Number large size _____ Number medium size _____ Number small _____		
Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection			____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection		
Describe package or container: type, material, dimensions, cooling efficiency (take photos)						
Size and/ or weight of package or container						
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample			Weight at time of sale		

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6l. Worksheet for quantifying postharvest losses of roots, tubers and bulbs at the wholesale market.

Wholesale data collection worksheet	**Name of data collector:**			
Root, tuber or bulb	Variety (if known _____) or describe color, shape, etc.			
Code: Farm _____				
Questions and observations	**On arrival**		**At the time of sale**	
Date				
Name of market				
Location of market				
Season for _____ (range of sales dates in this market)				
Distance from farm if known	_____ km			
Sorting - selecting out that produce which will not be resold	Was sorting done before delivery? Yes/No	If Yes, estimate waste (discarded) _____ % Reason for sorting out:	Was sorting done before sale? Yes/ No	If Yes, estimate waste (discarded): _____ % Reason for sorting out:
Was curing done at this market?			If yes, estimate weight loss: _____ %	
Size grading: is there any grading into different sizes on the farm?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected wholesale price:			Price offered _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**At the time of sale**	
Sample size (select random samples)	count of 20		one package (_____ = total number)	
Time from harvest if known				
Time of day				
Air temperature	_____ °C		_____°C	

Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C
Pulp temperature in °C (3 randomly selected bunches)		

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5= Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
		Number of rating 5 _____
		Number of rating 3 _____
		Number of rating 1 _____

Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, darkening, etc.		
Describe defects found (take photos)		
	On arrival	**At the time of sale**
Number with decay symptoms ie: fungus, mildew, bacterial spots, rot, etc.		
Describe decay found (take photos)		
Number damaged ie: bruises, cuts, mechanical injury, insect damage.		
Describe damages found (take photos)		
Quality rating: 5 = large 3 = medium size 1= small	Number large size _____ Number medium size _____ Number small _____	Number large size _____ Number medium size _____ Number small _____
Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection
Describe package or container: type, material, dimensions, cooling efficiency (take photos)		
Size and/ or weight of package or container		
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample	Weight at time of sale

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

Annex 6J. Worksheet for quantifying postharvest losses of roots, tubers or bulbs at the retail market.

Retail data collection worksheet	**Name of data collector:**			
Root, tuber or bulb	Variety (if known _____) or describe color, shape, etc.			
Code: Farm _____				
Questions and observations	**On arrival**		**6 to 8 hours later**	
Date				
Name of market				
Location of market				
Season for potatoes (range of sales dates in this market)				
Distance from farm if known	_____ km			
Sorting - selecting out that produce which will not be resold	Was sorting done before delivery? Yes/No	If Yes, estimate waste (discarded) _____ % Reason for sorting out:	Was sorting done before sale? Yes/ No	If Yes, estimate waste (discarded): _____ % Reason for sorting out:
Was curing done at this market?			If yes, estimate weight loss: _____ %	
Size grading: is there any grading into different sizes on the farm?	If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %		If Yes, estimate % in each category: Large _____ % ; Medium _____ % ; Small _____ %	
Does price offered vary by quality grade?	Describe grading criteria:		If Yes, what is the price offered for each quality grade? Highest _____ ; Middle _____ ; Lowest _____	
Expected retail price:			Price range _____ (by weight? by volume? by number of containers?) Price per kg: _____	
MEASUREMENTS	**On arrival**		**6 to 8 hours later**	
Sample size (select random samples)	count of 20		count of 20	
Time from harvest if known				
Time of day				
Air temperature	_____ °C		_____°C	

Relative humidity indicator	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C	% RH: _____ Wet bulb T: _____ °C Dry bulb T : _____ °C
Pulp temperature in °C (3 randomly selected bunches)		

Quality sort for defects, decay, damage
(# out of count of 20) Ratings from
5 = Extreme defects, decay or damage;
3 = moderate; 1 = none
	Number of rating 5 _____
	Number of rating 3 _____
	Number of rating 1 _____
		Number of rating 5 _____
		Number of rating 3 _____
		Number of rating 1 _____

Number with obvious defects ie: cracks, sunburn, misshapen, shrivel, over-mature, darkening, etc.		
Describe defects found (take photos)		
	On arrival	**6 to 8 hours later**
Number with decay symptoms ie: fungus, mildew, bacterial spots, rot, etc.		
Describe decay found (take photos)		
Number damaged ie: bruises, cuts, mechanical injury, insect damage.		
Describe damages found (take photos)		
Quality rating: 5 = large 3 = medium size 1= small	Number large size _____ Number medium size _____ Number small _____	Number large size _____ Number medium size _____ Number small _____
Rate package protection (mark one with an X)	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection	____ 5 = very strong, protective ____ 4 = strong, moderately protective ____ 3 = somewhat strong, protective ____ 2 = weak, not very protective ____ 1 = no pack or very weak, no protection
Describe package or container: type, material, dimensions, cooling efficiency (take photos)		
Size and/ or weight of package or container		
Weight loss on farm (set aside an initial random sample, weigh it again at time of sale)	Initial weight of sample	Weight at 6 to 8 hours later

% are calculated by #/20 or weight/total weight of sample or count/total count of sample.

ANNEX 7

Postharvest cost-benefit worksheet.

Source: Kitinoja 2016.

Assume harvest 1000 kg _____ Crop _____ Country/Region _____

Use your local currency _____ = USD 1

Type Information	Current/ Traditional Practice	New / Improved Practice
Description of action taken		
Disadvantage		
Costs		
Expected benefits		
% losses		
Amount for sale		
Value/kg (average price)		
Total market value		
Market value minus costs		
Relative profit for the season		
ROI How many loads does it require to reach 100% Return on Investment?		

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