# AGROFOREST MARKETING METHODOLOGY

*Peter Calkins, CRÉA*

*Laval University, Canada*

## ABSTRACT

*Rapid deforestation on a global level occurs both because standard measures of development ignore environmental costs and because markets for nonwood agroforest products and services are un(der)developed. This paper first categories agroforestry visually into 28 types and determines which have been studied by which disciplines. A detailed inventory shows that living fences, forest farming, mushroom and sap production, game hunting, wild life observation, ecotourism and landscape enhancement have been all but ignored in the literature. Furthermore, while socioeconomic analyses of agroforest systems have increased over the past seven years, only one-sixth of socioeconomic articles even mention marketing. The paper then develops piece-by-piece an integrated methodology for evaluating past studies and planning future projects in agroforest marketing. Such a framework could ensure that nothing important is left out, and promote exchange and comparison of research results across sites. It also reveals that, to date, the unique methods of marketing research into marketing channels (flowcharts, efficiency scores, structure-conduct-performance analyses, SWOT diagrams) and consumer behavior (focus-groups, contingent valuation, total quality analysis) are almost totally absent from the literature. Effective social marketing and sustainable agroforest development in the future must therefore rely upon fuller use of the methodological toolkit in social sciences.*

*Key words:* agroforestry, marketing, methodology, social marketing, sustainability.

## Introduction

Rapid deforestation in developing countries – whether Nepal, Vietnam or Brazil – results from imbalances within and among the environmental, technological, social, cultural, political, and economic dimensions of the agroforest marketing system. Such disequilibria have led to large and rising losses of forest-cover, soil stability, air and water quality, income, and even the entire sociocultural contract of communities living in or near the forest. Since these communities are often composed of economically disadvantaged ethnic minorities, a vicious circle of forest degradation and immiseration may easily ensue.

A second reason for agroforest disequilibrium and non-sustainability is insufficient market demand, or even the total absence of markets[1], not only for *wood products* (lumber, bark, firewood, shingles) but especially *nonwood products* (fruits, flowers, medicinal herbs, mushrooms, sap and syrup) or *nonwood services* (hunting, landscape beauty, ecotourism, carbon offsets, erosion control, watershed protection) producible in many agroforestry

[1] Technically, these conditions are termeed "market failure" by economists.

systems. People are often simply unaware of what they might sell, and to whom. Sustainable development therefore requires effective transdisciplinary research between agroforest engineers and marketing experts to identify marketable wood and nonwood products and services and to balance market supply and demand for non-wood forest products and services at rising levels over time. Only then will the present value of continuous harvest or alternative farming of forestlands outweight the present value of cutting them down today.

Given the urgency of such issues, this paper will seek to achieve five objectives:

a) to paint a systemic picture of the agroforestry marketing system as an object of sustainable development,

b) to propose an integrated methodology for recommending improvements in that system,

c) to pinpoint future knowledge needs by type of agroforest system and methodological technique,

d) to illustrate with three case studies how to identify the policies, institutions and influencable factors of agroforest market systems that can be most effectively applied in projects and policies, and finally

e) to argue that the framework so presented is useful not only for individual researchers and agroforest practitioners from a wide range of disciplines, but also for clear exchange of research findings among groups of researchers.

**What is agro-forestry?**

Dual forms

Definitions of agroforestry abound, but the clearest definition is an aerial fly-by of a biodiverse landscape shaped like the leaves of a Pacific dogwood tree (Figure 1).

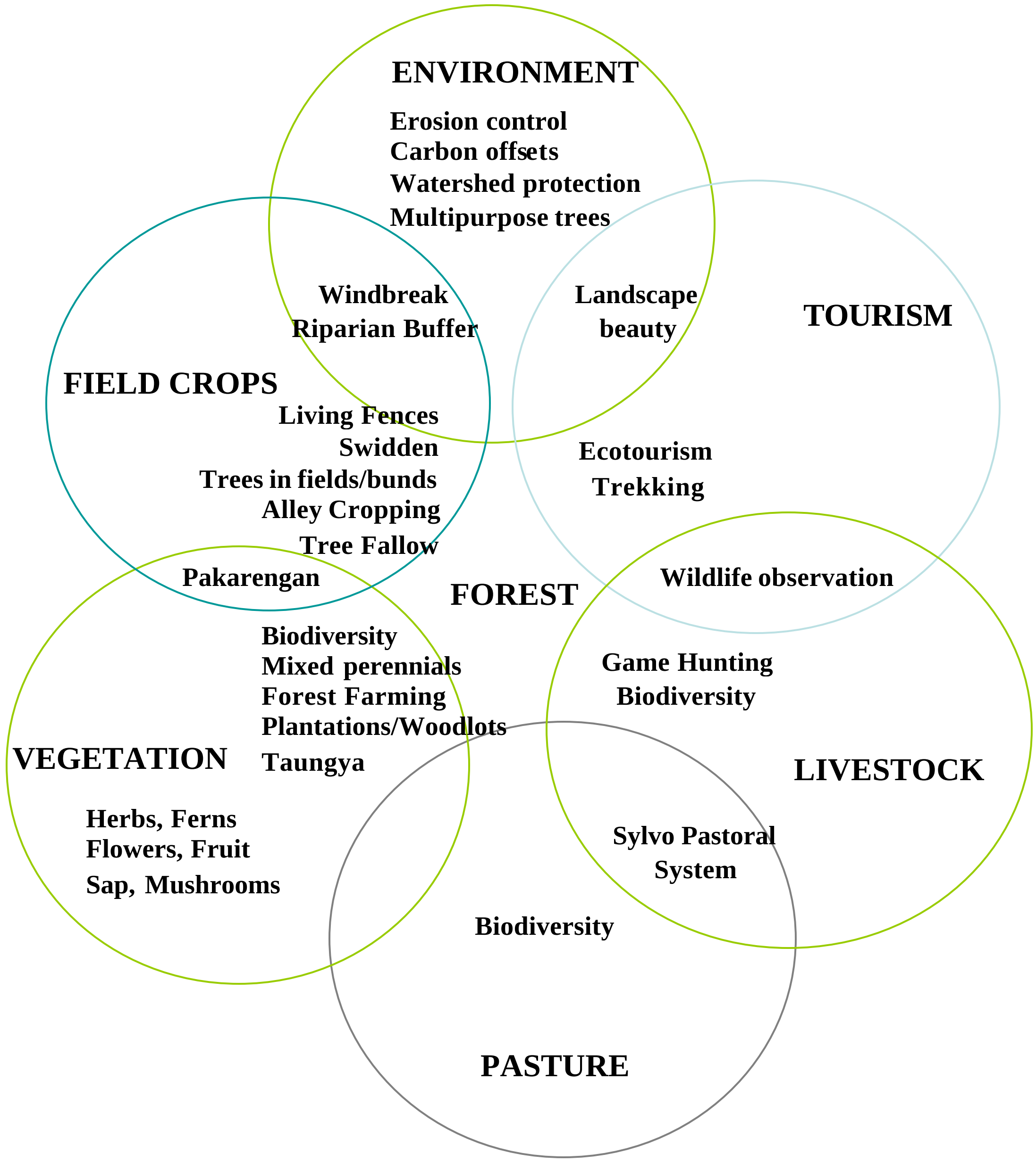


**Figure 1. 28 agroforestry systems**

Beneath our helicopter, forests appear as the center of a six-leafed cluster. Combining the forest center with each of these leaves – environment, field crops, vegetation, pasture, livestock and tourism -- creates the six simplest, binary forms of agroforestry. To give some examples, forests combined with the *environment* give, among other possibilities, erosion control; forests combined with *field crops* give living fences; forests combined with *vegetation* give forest farming, forests combined with *pasture* give greater biodiversity; forests combined with *livestock* give game hunting; and forests combined with *tourism* give ecotourism.

Trinal and higher forms

But each pair of leaves partially overlap to form more complex agroforest systems. For example, forests combined with the *environment* and *field crops* lead to, among other things, riparian buffers; forests combined with *field crops* and *vegetation* give home gardens, of which the most famous expression is the multilayered Indonesian *pekarangan*. Forests combined with *livestock* and *pasture* give silvopastoral systems, forests combined with *livestock* and *tourism* give wildlife observation, and forests combined with *tourism* and *the environment* result in landscape beauty. Agroforestry mimics nature itself in its stunning diversity.

Relative importance in studies to date

Which of the 28 agroforestry forms shown in the aerial view of Figure 1 have been most studied by agroforestry research in the past? Mercer and Miller (1998, Table 1) indicate that 2% of socioeconomic articles in *Agroforestry Science* between 1982 and 1996 treated erosion control, 9% multipurpose trees, 6% swidden agriculture, 12% trees in fields or bunds, 9% alley cropping, 7% home gardens, 5% mixed perennials, 6% woodlots, 5% taungya, 3% nontimber forest products (NTFP) and 10% silvopastoral systems.

We updated that research from both the journal *Agroforestry Science* and from all literature[2] in agroforestry for 1997-2004 (last two columns, Table 1). Three trends stand out. First it would seem that more attention is now being paid to erosion control, carbon sequestering, windbreaks and riparian buffers as major benefits of agroforest systems. Second, trees in bunds and fields, and home gardens have fallen in importance; while forest farming of herbs, ferns, flowers and fruit may be receiving more attention. Third, wildlife observation and hunting seem to be drawing increasing, if still low, attention.

Of course, comparing literature by key words and synonyms is fraught with difficulty, but this kind of comparison is important and should continue to be made. Already, we note key priorities for future agroforest market research: living fences, forest farming, mushroom and sap production, game hunting, wildlife observation, ecotourism and landscape enhancement have received little or no treatment in any column of Table 1! *These areas require more systematic study as a means to increasing the extent and diversity of sustainable agroforestry market systems.*

[2] This was done electronically using a pooled data base composed of *CAB, Econlit, Ageline, Francis, Sociological Abstracts,* and *Social Science Abstracts* for the period 1997-2004.

| **Type of agroforestry system** | Agroforestry systems, 1982-1996 | Agroforestry systems, 1997-2004 | All literature, 1997-2004 |
|---|---|---|---|
| **Forest plus environment** | | | |
| *Erosion control* | 2% | 6.4% | 8.3% |
| *Carbon effects* | | 4.1% | 1.0% |
| *Watershed protection* | | 1.2% | 1.1% |
| *Multipurpose trees* | 9% | 4.7% | 2.3% |
| **Forest plus environment plus field crops** | | | |
| *Windbreak* | | 1.8% | 1.3% |
| *Riparian buffer* | | 3.5% | 0.1% |
| **Forest plus field crops** | | | |
| *Living fences* | | | 0.05% |
| *Swidden /slash-and-burn* | 6% | 9.4% | 2.0% |
| *Trees in fields/bunds* | 12% | 0.6% | 0.3% |
| *Alley cropping* | 9% | 14.0% | 7.7% |
| *Tree fallow* | | 3.5% | 0.08% |
| **Forest plus field crops plus vegetation** | | | |
| *Pekarangan and home gardens* | 7% | 1.8% | 1.4% |
| **Forest plus vegetation** | | | |
| *Biodiversity* | | 8.2% | 5.0% |
| *Mixed perennials* | 5% | | 0.03% |
| *Forest farming* | | 0.6% | 0.5% |
| *Plantations / woodlots* | 6% | 11.1% | 2.0% |
| *Taungya* | 5% | | 0.4% |
| *Herbs* | | 11.1% | 10.7% |
| *Ferns* | | 2.3% | 0.3% |
| *Flowers* | 3% | 1.2% | 1.3% |
| *Fruit* | | 16.4% | 5.9% |
| *Sap and syrup* | | | 0.5% |
| *Mushrooms* | | | 0.2% |
| **Forest plus livestock plus pasture** | | | |
| *Silvopasture* | 10% | 8.2% | 4.6% |
| **Forest plus livestock** | | | |
| *Game hunting* | | | 0.4% |
| **Forest plus livestock plus tourism** | | | |
| *Wildlife observation* | | 0.6% | 0.7% |
| **Forest plus tourism** | | | |
| *Ecotourism* | | | 0.7% |
| **Forest plus tourism plus environment** | | | |
| *Landscape beauty* | | | 0.01% |
| **Other and various** | 9% | n.a. | n.a. |
| **Non specifieed** | 17% | n.a. | n.a. |
| ***Total articles*** | 517 | 534 | 10,963 |
| ***Total socioeconomic in total articles*** | 21.9% | 32.0% | 67.2% |
| ***Total economic in socioeconomic articles*** | 53.1% | 75.4% | 37.4% |
| ***Total marketing*** | n.a. | 17.5% | 6.3% |
| ***Total sociological*** | 10.6% | 20.5% | 4.1% |
| ***Total anthro*** | 8.0% | 2.3% | 6.5% |
| ***Total political science*** | 7.1% | 1.8% | 1.9% |

**Table 1: Evolution of types of agroforestry studied, 1982 - 2004**

**Improving the supply side of agroforestry marketing systems**

Technologies

The job of agroforest engineers includes not only drawing upon the current synergies inherent in these 28 agroforestry systems, but also exploring how new biological material, chemical protection, mechanical treatment, or enhanced physical layout could increase the biological activity and environmental benefits of such systems (Figure 2). A full seventy-eight percent of the total 517 articles in *Agroforestry Systems* between 1982 and 1996 treated such biological and technical dimensions of current and envisageable systems, leaving only 22% (113 articles) to deal with their socioeconomic repercussions.

Since 1996, the proportion of socioeconomic articles, broadly defined, has increased markedly (bottom, Table 1). Our calculations show that 32 percent (171 of 534 *Agroforestry Systems* articles over the past 7 years) included a socioeconomic dimension[3] a major increase over the period 1982-96. Still, only 129 (24%) of all articles in the past seven years dealt with economics[4], and a mere 30 articles (5.6%) actually mentioned the words "market", "buy" or "sell"! And while the general literature now shows a remarkable two-thirds proportion of socioeconomic articles (last column, Table 1), the proportion of socioeconomic articles in anthropology and especially political sciences seems to have declined.

Assets

Adoption of agroforest technology implies that humans must invest their time and assets into agroforest management. In addition to labor, people bring land, water, capital, management skills and spirit (ethics, esthetics) to the maintenance of sustainble agroforest systems (Figure 3). These assets are often imperfect in disadvantaged agroforest contexts, however: land may be of poor soil type, steep slope, or broken into dispersed fragments. Water and capital are frequently lacking. Irrigation, credit, and training-extension-participation programs therefore become necessary to implement the best practice technologies identified by agroforest scientists and engineers. These problems are so frequent that a full 21% of the 113 socioeconomic articles in *Agroforestry Science* in 1982-1996 were devoted to project development!

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[3] Defined as any article that discusses the following key words: *sociology, anthropology, politics, cooperation, household, service, adoption; economics, income, credit, capital, tourism; markets, sell, buy, price, or valuation.*

[4] Defined as any article including the terms *economics, income, credit, capital, tourism; markets, sell, buy, price, or valuation.*

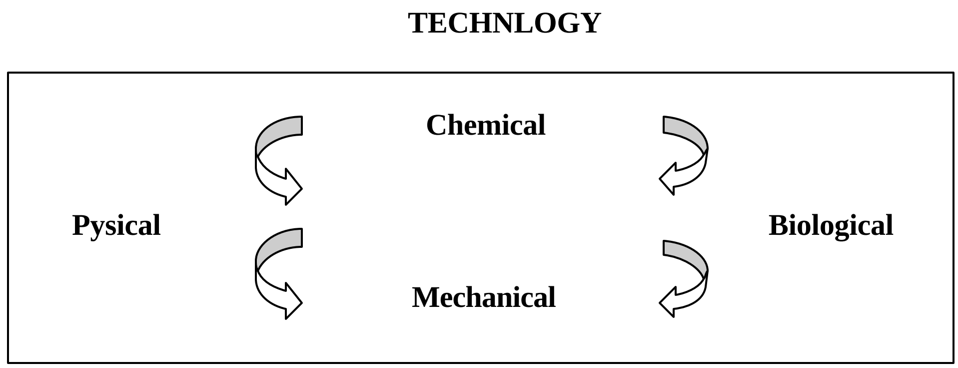


**Figure 2: The improvements that technology can bring to agroforest production systems**

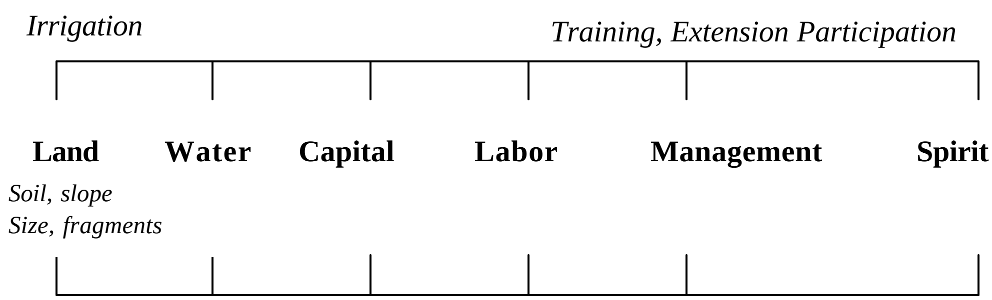


**Figure 3: The Assets agroforest households bring to production and marketing**

<u>Household and community</u>

To best design agroforest marketing projects, we must study households, communities, their strengths and constraints (Figure 4). Even within the same ecosystem, agroforest households differ markedly with respect to the number, age, and gender of members; who makes decisions based on what education and experience; and what socioeconomic status (based on caste or ethnic group and income). It is increasingly recognized in the literature that households have traditional knowledge, a valuable asset for poor countries in the emerging global knowledge economy. Exploring these internal dimensions of the household are the domain of agroforest sociologists.

External social dimensions also condition the ability of the household to adopt and management best agroforestry practices. Community norms, structure, beliefs, land ownership or usufruit are studied by agroforest anthropologists. Meanwhile, agroforest policy analysts explore to what extent basic political stability or specific government institutions could promote sustainable agroforest market development. That is why the decline in anthropological and political science studies noted in Table 1 is so alarming.

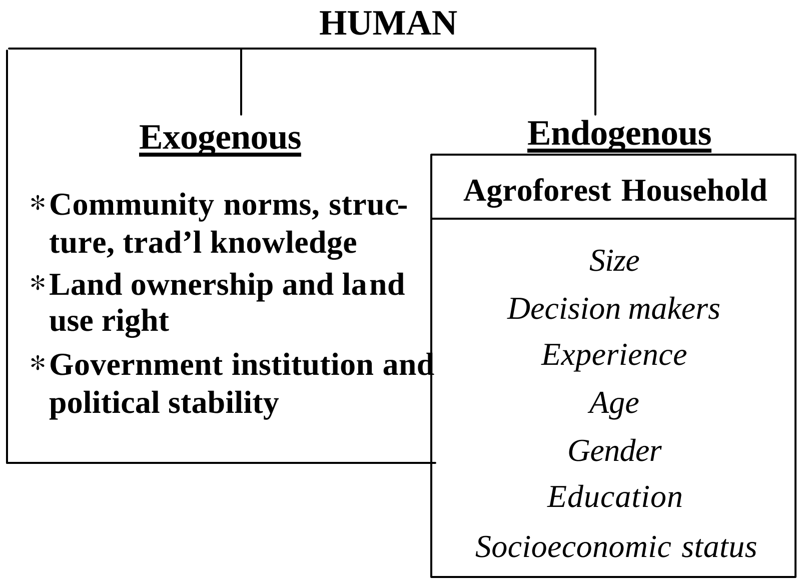


**Figure 4: The social characteristics and anthropological-political context of agroforest households**

**The methods of agroforest socioeconomics**

The whole brain

Such future studies must of course be internally rigorous and comparable with each other. So what methodologies would be best to arrive at scientifically valid, socially optimal, and policy-pertinent conclusions for the agroforest market system (Figure 5). Four responses overlap to answer this strategic question. The first is that we must harness the capacity for *quantification and modeling* of the left brain with the talent for *story-telling and synthesis* of the right brain. Figure 6 presents a continuum of 32 frequently-used data collection and analysis methods in socoeconomics and marketing. They range from stochastic programming in the deep left brain to literature reviews in the deep right brain, and pass through budgets and focus groups in the middle.

While, theoretically, all of these techniques offer powerful analytical tools, we may note that *Agroforestry Systems* articles from 1982-96 (Table 2) exploited little of the richness of left-brain techniques. Indeed, only 3% of articles used linear programming or other optimisation techniques, 4% bioeconometric simulation, 3% factorial analysis and modeling, 3% econometrics, and 5% mean-standard deviation analysis. The vast majority of quantified studies used cost benefit analysis (25% of all 113 articles) or budgeting and farmer-station comparisons (16%). Not surprisingly, then, experts reviewing the period 1982 through 1996, though content with the rise of left-brain economic analysis (21%), called for still better economic models and analytical methods (14%). The same problem affected qualitative studies. Although 41% of the 113 articles used qualitative techniques, half (21%) were based on literature reviews, with another 4% devoted to case studies, leaving only 12 articles in 15 years for other descriptive approaches. It is not surprising that the experts pointed to the need for future qualitative studies of constraints to adoption (19%), land use rights (6%), and participatory research (4%).

The last two columns of Table 2 depict the techniques used during the last 7 years. Optimisation, regression and notably simulation techniques seem to have increased, largely displacing cost-benefit, net present value, and budget analyses on the quantitative side and literature reviews on the qualitative side. Still, very few of the innovative market-research techniques that will be necessary to sustainable agroforest market development have been tapped. We will describe some of these in the following section of this paper.

*Coops, group marketing

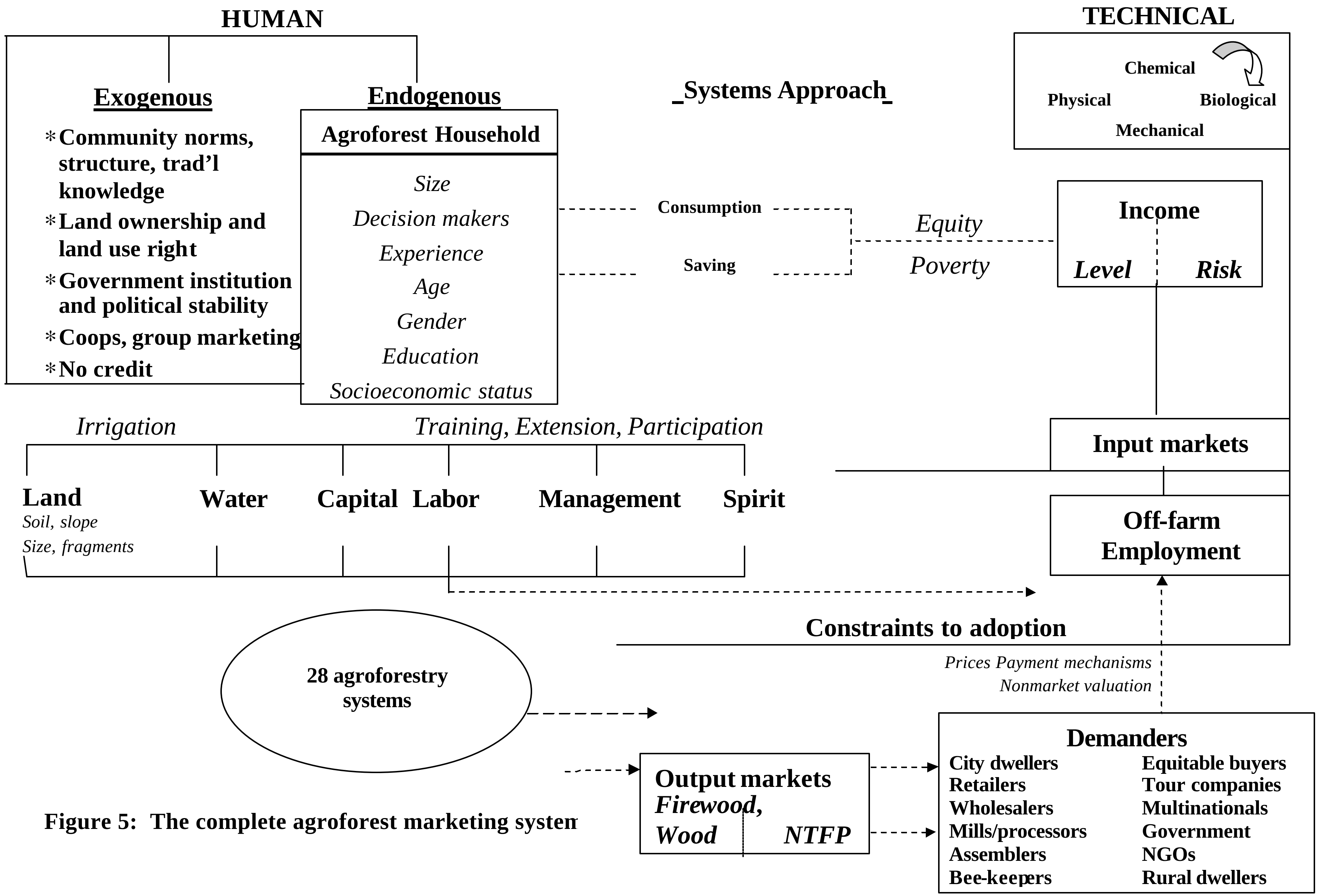


**Figure 5: The complete agroforest marketing system**

**LEFT BRAIN**

**Optimisation**

***Stochastic program***

***Linear program***

***Stochastic dominance***

***Bayesian/decision tree***

**Simulation**

***Bioeconometric/GIS simul'n***

**Statistical explanation**

***Factorial/discriminant anal***

***Regression/econometric***

***Sensitivity analysis***

***Mean/standard dev'n***

***Contingency table***

***Quantitative surveys***

**Quantified description**

***Station-farmer gap***

***Market effic.($/km, $/kg)***

***Cost-Benefit/NPV***

***Structure-conduct-perform***

***Budgets/marketing margin***

*Credit

**Qualitative prescription**

***Total quality analysis***

***Product system life***

***Hedonics, contingent val'n***

***4 P's analysis***

***Advertising/cons. survey***

***(Telephone, exit) interview***

***Participatory observation***

***(Focus) group interview***

**Pictorial description**

***Analytic grid/radar chart***

***Quadrant or SWOT anal.***

***Market channel flowchart***

***Scales or histograms***

**Verbal description**

***Qualitative survey***

***Case studies***

***Verbal/historical descr.***

***Literature review***

**RIGHT BRAIN**

**Figure 6: Left- to right - brain research methods in agroforest marketing**

| *LEFT BRAIN* | Agroforestry systems, 1982-1996 | Agroforestry systems, 1997-2004 | All literature,1997-2004 |
|---|---|---|---|
| **Optimisation** | | **5.8%** | **1.3%** |
| *Stochastic program* | | | |
| *Linear program* | 3% | 1.7% | 0.3% |
| *Stochastic dominance* | | 0.6% | 0.1% |
| *Bayesian/decision tree* | | | 0.0% |
| **Simulation** | | **6.4%** | **1.7%** |
| *Bioeconometric/GIS simul'n* | 4% | 2.3% | 0.8% |
| *Modeling* | | 15.7% | 5.2% |
| **Statistical explanation** | | **6.4%** | **5.1%** |
| *Factorial/discriminant analysis* | 3% | 1.2% | 0.5% |
| *Regression/econometric* | 3% | 5.2% | 1.8% |
| *Sensitivity analysis* | | 2.9% | 0.2% |
| *Mean/standard dev'n* | 5% | 0.6% | 0.1% |
| *Contingency table* | | 0.6% | 0.0% |
| *Quantitative surveys* | | 11.6% | 4.5% |
| **Quantified description** | | **17.4%** | **1.1%** |
| *Cost-Benefit/NPV* | 25% | 4.1% | 0.8% |
| *Market effic.($/km, $/kg)* | | | 0.1% |
| *Structure-conduct-perform* | | | |
| *Station-farmer gap* | 16% | 1.2% | 1.1% |
| *Budgets/marketing margin* | | 1.2% | 0.6% |
| **Qualitative prescription** | | **1.2%** | **0.6%** |
| *Total quality analysis* | | | 0.03% |
| *Product system life* | | | |
| *Hedonics, contingent val'n* | | | 0.15% |
| *4 P's analysis* | | | |
| *Advertising/cons. survey* | | 0.6% | 0.24% |
| *(Telephone, exit) interview* | | | 0.1% |
| *Participatory observation* | | | 0.4% |
| *(Focus) group interview* | 16% | 0.6% | 0.1% |
| *Pictorial description* | | 1.7% | 0.6% |
| *Analytic grid/radar chart* | | | |
| *Quadrant or SWOT anal.* | | | 0.0% |
| *Market channel flowchart* | | | |
| *Scales or histograms* | | | |
| **Verbal description** | | **4.1%** | **9.7%** |
| *Qualitative survey* | | 9.3% | 2.7% |
| *Case studies* | 4% | 5.8% | 5.3% |
| *Literature review* | 21% | 0.6% | 0.2% |
| ***RIGHT BRAIN*** | | | |

**<u>Table2:</u> Evolution of data colection and analysis techniques 1982-2004.**

The progression of knowledge

The second response to our question is that careful research must always advance in order through three stages: *positive* description, *normative* improvement, and *pragmatic* prescription. If we are not positively certain about the existing state of the system, then we will not know how to improve it; if we do not know how to improve it, then we cannot recommend better projects, programs or policies. We must resist the temptation to give a policy recommendation if we do not have all the information at hand.

Triangulation

The third answer is that no one analytical technique can be trusted to give unequivocal results. For any given study, we therefore try to combine at least three approaches from the 32 listed in Figure 6 to "triangulate"[5] to the truth. If we arrive at compatible answers to the same questions from three or more techniques, we will be significantly more confident of our results. For example, we could triangulate a) *focus-group discussions* with villagers of their perceptions of key constraints to adoption with b) *econometric analysis* of the most significant determinants of non-adoption, c) case studies of adopters and non-adopters, and d) *t*-tests for significantly different mean levels of those same factors. If these four techniques all pointed to the same factors, we could go about proposing practical solutions for eliminating the barriers to adopting better agroforest production and marketing activities.

Sharing results

The fourth answer is that no single agroforest developer can possibly apply all these techniques in all contexts. The sharing of research results from a common methodological framework for current and future research becomes essential for increasing the environmental, economic and social benefits of agroforestry market development. The experts (Mercer and Miller, 1998) have called for comparative cross-site studies (4%) based on better data sets (3%) and a systems approach in the future.

[5]It is entirely appropriate that this term, derived from the physical surveying of forests, should also apply to the socioeconomics of agroforestry!

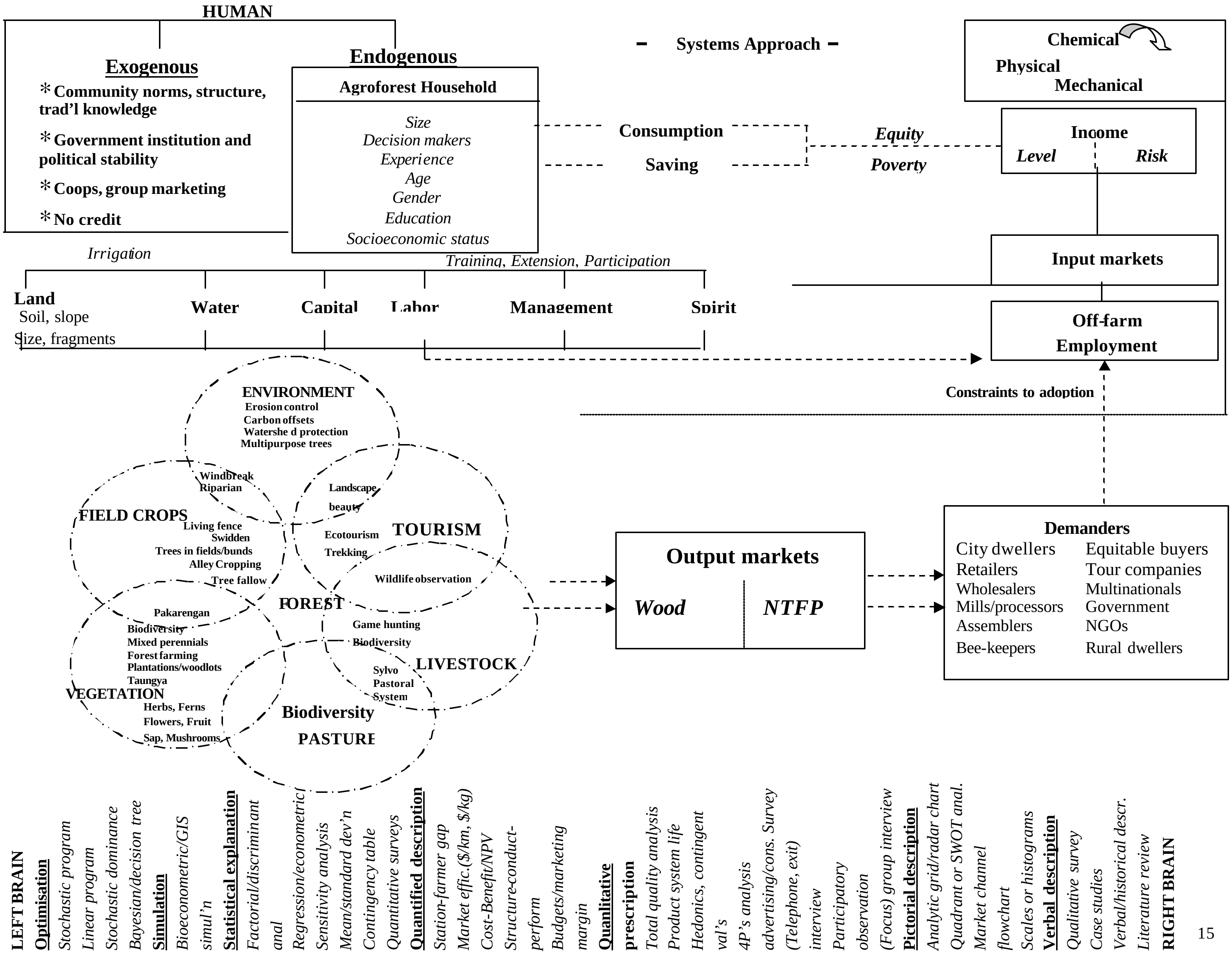


**Figure 7: Agroforest marketing methodologies**

**An integrated methodology for agroforest marketing**

Based on the above, we are now in a position to propose an integrated methodology for future studies of agroforest product marketing. Figure 7, while complex at first view, is simply the sum of the previous six figures of this paper. It offers on a single, photocopiable page a method for completely describing a *past* study's agroforest technologies, technical improvements, resource inputs, household and community characteristics, development impacts, market development, data collection and analytical techniques. In a similar way, it can be used to plan and communicate a *future* research or development project in agroforestry with funding agencies, government planners, agroforest housholds, and researchers in other countries or ecosystems. In that sense, it becomes a visual checklist, a graphic reminder of what we are including and leaving out of a given project, and why.

Using Figure 7 for project planning involves eight steps:

1. Choose from Figure 1 and inscribe on Figure 7 the most promising existing <u>and future</u> agroforest products and services for market. We sometimes forget that currently absent products (e.g. mushrooms or living fences) or services (e.g. ecotourism or carbon offsets) may eventually become part of optimal agroforest market development.
2. Explore from Figure 2 and inscribe on Figure 7 what chemical, biological, mechanical and physical technologies for creating those marketable products and services are the most promising for active comparison.
3. Identify from Figure 3 and inscribe on Figure 7 the most specific assets (e.g. hillsides, run-off water, planting-season capital, cooperative labor, female management, cooperative spirit) to make sure that input markets for such assets -- including the off-farm market for labor and the credit market for capital – are included in the study.
4. Choose from Figure 4 and write on Figure 7 the key household, community, and policy characteristics that may contribute to or impede improvement of the target agroforestry products and services.
5. Write on Figure 7 the specific target *wood products* (such as lumber, bark, and firerwood), *non-timber forest products* (such as fruit, flowers, herbs, mushrooms, sap), and *services* (such as hunting, beauty, ecotourism and environmental benefits) to be promoted for market. For each of these products and services, market conditions will have to be explored, including in some cases non-market valuation (to be payable by government) in order to complete benefit cost analyses.
6. Choose the current and potential demanders for these products (some of which are suggested in Figure 5), as well as the informational and promotion strategies to be compared for each type.[6]
7. Select from Figure 6 and circle on Figure 7 at least three analytical techniques to describe, optimize or prescribe, depending on the state of current knowledge of the specific agroforestry system in the specific ecological zone under study.
8. Perform the study and generate recommendations.

[6] Often, steps 6 and 7 are best performed simultaneously.

To illustrate this process in detail, we now ask the reader to analyze three very different past case studies, which, when taken together, confirm the enormous potential for careful, complementary agroforestry market research in the future.

**Case number 1: Positive description of agroforest markets in Bélize**

Agroforestry system evaluated

Levasseur and Olivier (2000) described the current development of cacao and home gardens in San Juan, Bélize and noted the constraints to further expansion of these systems. Their study is visually summarized in Figure 8. Cacao can be grown under shade trees. Home gardens include medicinal plants, guava, avocado, ormamentals, mango, pimento, firewood, tomatoes, cucumbers, cabbage and small livestock (pigs and poultry).

Technical and asset constraints

There are many households with no land ownership. Most people are poor and must struggle to consume some 420 grams of maize per person per day. Therefore, the cacao and home gardens are in competition with a corn-rice-beans association on slash-and-burn land.

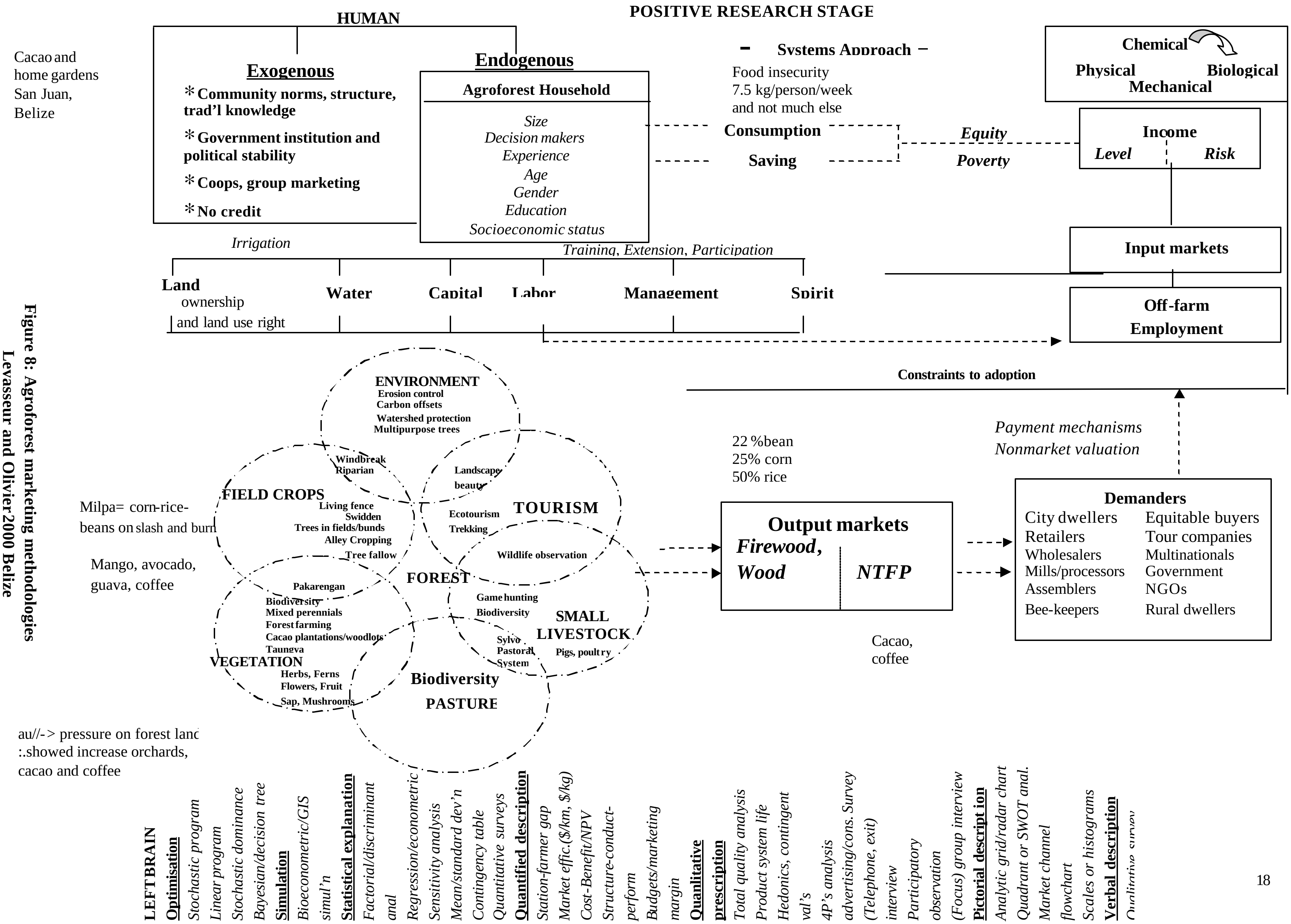


**Figure 8: Agroforest marketing methodologies**
**Levasseur and Olivier 2000 Belize**

Socio-cultural constraints

65% of the people in the area are Maya with no political participation. Furthermore, a gender division of labor means that only men can construct and fertilize home gardens and sell firewood, while women are confined to managing the household.

Economic constraints

Only six percent of people have a full-time job. To assure an adequate income, they sell 25% of their corn, 50% of their rice and 22% of their beans. The Toledo Cacao Growers Association has attempted to relieve these constraints somewhat by helping to promote and market the cacao.

Data collection and analytical techniques

This is a good example of *qualitative research* through a *systems approach* linking cultural, agricultural and sociological perspectives. Knowledge was collected through both participatory observation (living with the people) and through simple qualitative surveys. Analysis was based upon careful reporting of the literature and the use of simple averages, with no measure of variability of tests of statistical significance.

Market development conclusions

The percentage of land area under orchards, cacao and coffee destined for market should be increased in order to counter increasing slash and burn to make way for the corn-rice-bean association.

**Case number 2: Normative optimization of agroforest markets in Indonesia**

Agroforestry system evaluated

Nieuwenhyse *et al* (2000) simulated and then optimized teak and melina agroforestry in a managed natural forest in the Atlantic lowlands of Costa Rica. Figure 9 illustrates the essential features of this resarch. The *melina* and teak plantations have the potential of augmenting area under natural forest. As in Bélize, there were extensive home gardens composed of banana, plaintain, palm heart, and pineapple. Field crops were maize, cassava and black beans. There was pasture land for beef breeding, but feedlots also competed with humans for corn.

Technical and asset constraints

The main asset constraint was biophysical: land and water conditions meant that 22% of the land was unsuitable for agricultural cultivation.

Socio-cultural and economic constraints

None were noted.

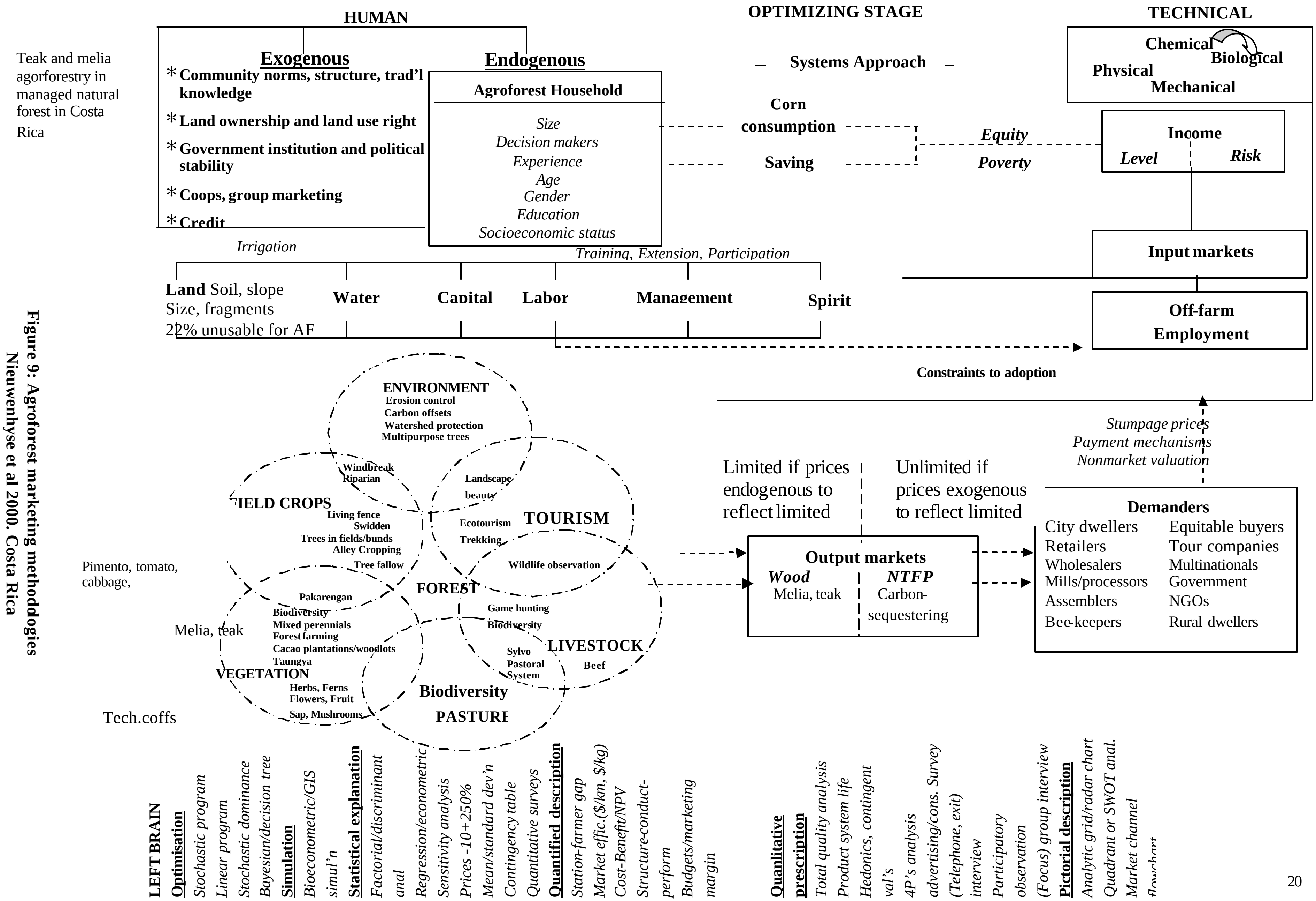


**Figure 9: Agroforest marketing methodologies**
Nieuwenhyse et al 2000. Costa Rica

Data collection and analytical techniques

This is a good example of *quantitative resesarch* through a *systems approach* linking geographic, technical, and economic perspectives. Knowledge was collected through *GIS surveys* (to obtain technical coefficients on yields, costs, and labor use) and market surveys (to discover prices). A *linear programming* model was constructed to incorporate these data and then optimized under two sets of market assumptions: a) limited demand with locally-determined prices, vs b) unlimited demand through exports with internationally-determined prices. *Sensitivity analysis* varied the prices received for teak and melina from 90% to 350% of current prices. The impacts of key parameters on all crops were presented in *line graphs*.

Market development conclusions

Natural forest management was not an attractive land-use option under any scenario: under restricted market demand, wood prices would have to increase 3.4 times before any pasture would be converted into natural forest. Similarly, *melina* and teak plantations would also be replaced by pasture-based cattle ranching under the *restricted* market situation. But when international markets for teak and melina are *unrestricted*, and labor wage is high, there is a strong push to plant teak and melina. Particularly if markets for carbon-sequestering could be developed, the incentives to produce *melina*, teak, and perhaps even natural forest for market could be greatly enhanced.

## Case Number 3: Pragmatic recommendations for forest markets in Cameroon

Agroforestry system evaluated

Nelson *et al* (1998, Figure 10) evaluate the costs, benefits and net present value of hedgerow intercropping with the shrub legume *Gliricidia* as a nitrogen-fixing agroforest alternative to hedgerow intercropping with either natural vegetation or Napier grass strips in the Philippines. Currently many farmers either grow continuous maize or a corn-corn-grass-grass rotation because of high maize prices. In addition, there is the potential for fruit and coconut plantations in the future if trade protection of maize falls.

Technical and asset constraints

Erosion has already reduced soil depth considerably so intercropping of some kind is desirable. *Gliricidia* hedgerows can sustain maize yields at higher levels than any other land use. Labor requirements differ significantly by crop association, with the highest demand being by far for gliricidia hedgerows.

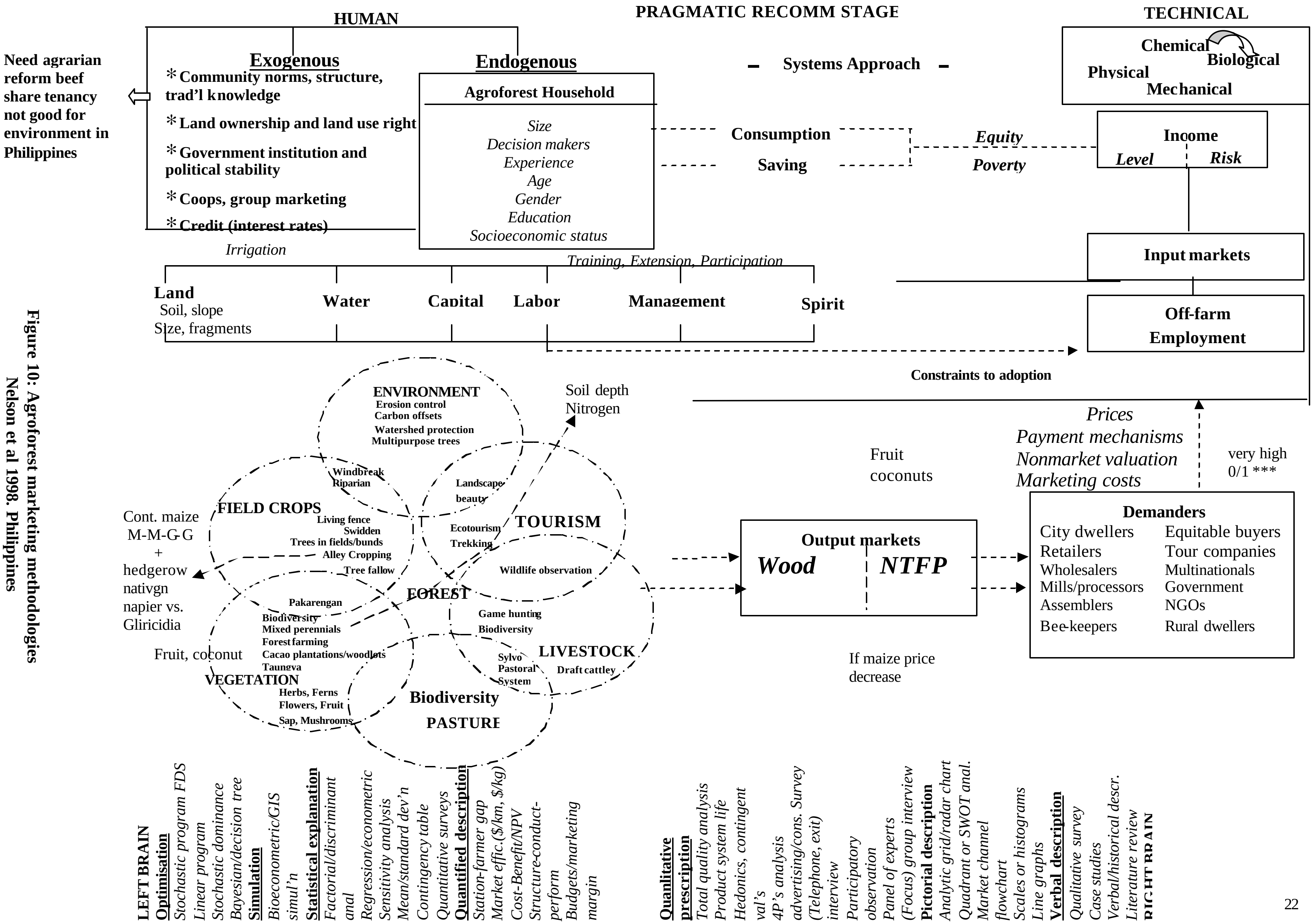


**Figure 10: Agroforest marketing methodologies**
**Nelson et al 1998. Philippines**

Socio-cultural constraints

Poor farmers have relatively abundant labor but little land tenure security, which reduces their incentive to be stewards of the soil. Agrarian reform is therefore required to reduce share tenancy.

Economic constraints

Credit is lent to farmers at an interest rate of 25% by traders, and 10% from governments through cooperatives. There is disguised unemployment, which means that the opportunity cost of labor is only 2/3 of the market wage.

Data collection and analytical techniques

This is a good example of *pragmatic research* designed to generate recommendations.

Knowledge was collected through study of the historical probability distribution of maize prices and yields and through surveys of six key informants (to obtain production budgets) Analysis was done through diagrams, budgets, cost-benefit anlaysis, sensitivity analysis (of interest rates on credit and on level of trade protection and marketing costs), and stochastic dominance, in that order. In the sensitivity analyses a reduction of 50% in the current level of marketing costs was assumed to reflect possible future infrastructure improvements. Similarly, reduction of all interest rates to 10% was used to simulate possible improvements in credit institutions. Share tenancy was also compared with ownership. The probability of negative net returns was evaluated under all scenarios.

Market development conclusions

The *level of trade protection* for maize is the single most significant determinant of the currently low marketability of fruit and coconut. Such protection dwarfs the impact of marketing costs as such, which could fall by 50%, through infrastructure improvement, without having any significant impact. Rather, agrarian reform to eliminate share cropping, rural finance to reduce interest rates, and accurate commodity pricing (by removing maize subsidies) could induce more farmers to adopt and maintain hedgerow intercropping.

## Conclusion

This exploration of agroforest resesarch methodologies leads us to two major conclusions. First, there has been a slight shift over the past seven years to more socioeconomic, economic and market-oriented studies of the agroforestry system as an object of study. But *very little has been done to use the powerful tools of market research as such.* Measures of marketing efficiency, market channel flowcharts, structure-conduct-performance, marketing margin histograms, consumer and advertising surveys, strength-weakness-opportunity-threat (SWOT) diagrams, total quality analysis, product life system, hedonic and contingent valuation remain all but unapplied in the study of agroforest input and output markets. There is an urgent need to increase the number and quality of such studies.

Secondly, as a step in that direction, we have built up piece by piece an integrated one-page worksheet for the application of agroforest marketing methodology (Figure 8). While that worksheet remains preliminary and far from complete, the applications described in this paper already show the *feasibility and desirability of sharing a common research framework* among disciplines, countries, schools of thought; and among researchers, agroforest practioners and government. Scarce research and development funding stands to be used more inefficiently if research and development efforts are coordinated so as to maximize internal completeness and external comparability.

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