RESEARCH PROGRAM ON SUSTAINABILITY
IN AGRICULTURE (REPOSA)

Report No. 135
Field Report No. 175

TRANSPORTATION COSTS IN THE RIO ARANJUEZ AREA, COSTA RICA - Explication of determinants and its parameters of the transportation costs

August 1998

André J. Wouters

CENTRO AGRONOMICO TROPICAL DE
INVESTIGACION Y ENSEÑANZA (CATIE)

WAGENINGEN AGRICULTURAL
UNIVERSITY (WAU)

MINISTERIO DE AGRICULTURA Y
GANADERIA DE COSTA RICA (MAG)

THE REPOSA PROJECT

The Research Program on Sustainability in Agriculture (REPOSA) is a cooperation between Wageningen Agricultural University (WAU), the Center for Research and Education in Tropical Agriculture (CATIE), and the Costa Rican Ministry of Agriculture and Livestock (MAG). In addition, REPOSA has signed memoranda of understanding with numerous academic, governmental, international and non-governmental organizations in Costa Rica.

The overall objective of REPOSA is the development of an interdisciplinary methodology for land use evaluation at various levels of aggregation. The methodology, based on a modular approach to the integration of different models and data bases, is denominated *USTED* (*Uso Sostenible de Tierras En el Desarrollo*; Sustainable Land Use in Development).

REPOSA provides research and practical training facilities for students from WAU as well as from other Dutch and regional educational institutions.

REPOSA's research results are actively disseminated through scientific publications, internal reports, students' thesis, and presentations at national and international conferences and symposia. Demonstrations are conducted regularly to familiarize interested researchers and organizations from both within and outside Costa Rica with the *USTED* methodology.

REPOSA is financed entirely by WAU under its Sustainable Land Use in the Tropics program, sub-program Sustainable Land Use in Central America. It operates mainly out of Guápiles where it is located on the experimental station *Los Diamantes* of MAG.

EL PROYECTO REPOSA

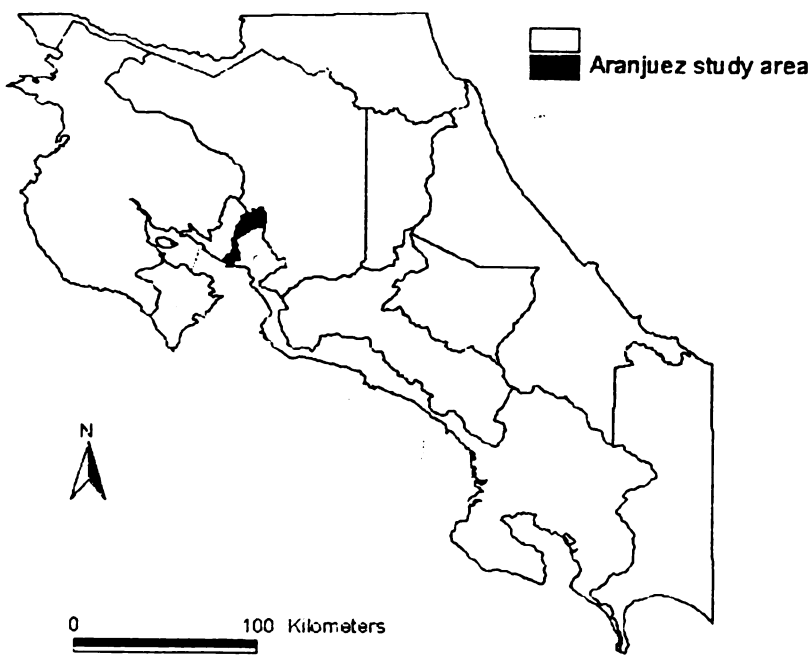
REPOSA (*Research Program on Sustainability in Agriculture*, o sea Programa de Investigación sobre la Sostenibilidad en la Agricultura) es una cooperación entre la Universidad Agrícola de Wageningen, Holanda (UAW), el Centro Agronómico Trópical de Investigación y Enseñanza (CATIE) y el Ministerio de Agricultura y Ganadería de Costa Rica (MAG). Además REPOSA ha firmado cartas de entendimiento con organizaciones académicas, gubernamentales, internacionales y non-gubernamentales en Costa Rica.

REPOSA ha desarollado una metodología cuantitativa para el análisis del uso sostenible de la tierra para apoyar la toma de decisiones a nivel regional. Esta metodología, llamada USTED (Uso Sostenible de Tierras En el Desarollo) involucra dimensiones económicas y ecológicas, incluyendo aspectos edafológicos y agronómicos.

REPOSA ofrece facilidades para investigaciones y enseñanza para estudiantes tanto de la UAW, como de otras institutiones educacionales holandesas y regionales.

REPOSA publica sus resultados en revistas científicas, tesis de grado, informes informales, y ponencias en conferencias y talleres. REPOSA regularmente organiza demostraciones para investigadores de Costa Rica y de otros países para familiarizarlos con la metodología USTED.

REPOSA es financiado por la UAW bajo su Programa del Uso Sostenible de la Tierra en los Areas Trópicos. La sede de REPOSA está ubicada en la Estación Experimental Los Diamantes del MAG en Guápiles.


Aranjuez study area
N
0
100 Kilometers

REPOSA

1. What is Reposa?

Reposa literally means 'Research Program On Sustainability in Agriculture'.

The REPOSA project is a colloboration with Wageningen Agricultural University (WAU), The Tropical Agronomy Research and Higher Education Center (CATIE) -Costa Rica and The Ministry of Agriculture and Livestock (MAG) - Costa Rica.

The REPOSA staff consists of three core staff members from the WAU, and one consultant. In addition, the program employs eight Costa Rican support staff (Anonymous, REPOSA-brochure). At this moment four Master- students (including myself) actively participate in the research, under supervision of the staff members.

REPOSA'S objective is to develop an interdisciplinary methodology for evaluating the profitability and sustainability of land use scenarios. This methodology is called SOLUS (Sustainable Option for Land Use). The main disciplines involved in REPOSA are soil science, agronomy, economics and marketing. With this methodology, policy makers will be able to evaluate alternative land use policy-options. The methodology is based on a linear programming technique. With this technique tradeoffs between different objectives can be analyzed. Among these variables are the income of the farmer which is the optimized variable with the restriction of the variables of sustainability. My part in this project will consist of gathering marketingdata. This means visiting farmers in a specific region in Costa Rica and collect data about costs of transport involved with selling their crops to the different market channels. My objective of study here is the obtain a better understanding of how data can be collected with the required amount reliability and validity of the answers. This will be the major concern of this practical time.

2. The Methodology; SOLUS in brief

The SOLUS methodology is defined by a number of sequential steps:

- data collection.
- scenario definition.
- analysis of the relationship between physical inputs and outputs for a specific crop. This relationship is put in quantitative terms.
- solving the optimisation problem (which means making the best trade off between the variables).
- presentation and interpretation of the results.

This methodology explicitly integrates socioeconomic with agronomic and edaphic factors. The technique of linear programming maximizes the income of the region under the conditions of the latter; agronomic and edaphic factors. Thus, my stage will be the first part of the SOLUS methodology. The exact objective of this research is: to obtain transportation costs in relation of its determinants. *The goal of this practical time is to explicate determinants of the transportation costs and furthermore their exact relationship to the final costs of transportation. This will be put, finally, in a regression equation with on one side the transportation costs and on the other side the determinants with their parameters.* The study area in which I will obtain data will be the Aranjuez area. More about this area in paragraph 5.

3. Objectives of this practical time

Before doing this practical time, I had almost finished my study of communication science at the University of Amsterdam, and moreover, two years of studying at the Wageningen Agricultural University. Here I studied marketing, business science in general and business logistics. Due to this interdisciplinary background I preferred to do my practical time in the same surrounding. The work which I have to do here at the project of REPOSA will use the knowledge obtained at the statistical classes during my study in Amsterdam. This is applied to a marketing problem in the agricultural field. My own aim is to extend a better understanding of data gathering and reliability and validity of the results obtained.

An other important objective of doing this practical time is to obtain 'experiences in the tropics'. You can experience how it really is, working in the tropics. This not only includes day-rhythm but also its matching culture. My actual experiences, I will further outline in paragraph 9, later in this report. Furthermore this practical time is an interesting test case for the Spanish vocabulary too. Data collection will take place in conversations with farmers (at their farm). One can imagine that farmers, like in any country, do not speak the most easy to understand idiom. But this should only be seen as a further obstacle to proper reliability and validity of the data. In paragraph 6.1 more about this topic. An other thing worth to learn is the difference in culture between the Netherlands and Costa Rica. In the latter, for example, appointments are not worth to be made. One should go to the field and do nothing more than hope that a respondent is there. In practice, this means that if a respondent is on its farm in 90% of all cases he is willing to talk as well. Another example could be standard of living. Things like those, which in the Netherlands might not play a role, may play a role here. One should be very aware of this.

One way to obtain this 'common sense' is to stay in Costa Rica for a while and even travel around before actually start working. Without any doubt this can not be obtained without sufficient knowledge of the Spanish language. Understanding of Costa Rica's culture is not only relevant for obtaining data, but also for the data itself; which questions should be asked and how to do this as reliable as possible. The outlining of the country Costa Rica will be the start of this report.

4. Costa Rica

4.1 Costa Rica in general

First, some basic statistics to introduce the Costa Rica in general and somewhat further up in this study the description of the area of Aranjuez in more detail. First some basic statistics for obtaining a first impression:

Number of inhabitants (x 1,000,000)	3.2
Population growth (% per year)	2.2
Total area (km)	51.100
Population density (inhabitants/ km)	59
Population in urban areas (%)	55.7
Literacy rate (%)	93
Life expectancy at birth (years)	76
Infant mortality rate (%)	1.39
Natality per 1,000 inhabitants	25.5
Mortality per 1,000 inhabitants	4.02
Gross domestic product (x 1,000,000 US $)	6,700
Growth rate GDP (average 1980-92, %)	3.3
Inflation rate (average 1980-92, %)	22.5
GDP per capita (US $)	1,960
Total labour force (x 1,000,000)	1.14
Unemployment rate	4.1

source: CNAA (1992), Indicadores Económicos y Estadísticas del Sector Agropecuario. Cámara Nacional de Agricultura y Agroindustria, San José.

Importance of agriculture leads from the following table (1996-figures, in percentage of GDP):

Industria	21.3
Agropecuario	18.7
Comercio	17.4
Transportes	10.6
Financiero	7.7
Gobierno Central	7.6
Bienes Inmeubles	5.9
Otros Servicios	4.3
Electricidad	3.3
Construccion	3.1

Source: SEPSA, febrero 1997, p.8

In 1992, Costa Rica's Gross Domestic Product (GDP) reached 6,7 billion US $, of which 15% was realized in the agricultural sector. The main of these agricultural products are bananas (492.000.000 US $), coffee (202.000.000 US $), pineapple (45.000.000 US $), meat 41.000.000 US $), fresh and frozen fish (39.000.000 US $), sugar (28.000.000 US $) and ornamental plants (29.000.000 US $) (CNAA, 1992). So far these basic macro-economic statistics.

The importance of agriculture can be outlined in terms of workforce situated in the agricultural sector:

1) Total number of inhabitants	3202.4
2) Rural population	1809.5
2/1	56.5%
3) Total workforce	1220.9
4) Agricultural workforce	259.1
4/3	21.2%
5) Employed population	1145.0
6) Agricultural working population	247.9
6/5	21.7%
7) Unemployed population	75.9
8) Agricultural unemployed population	11.2
7/8	14.8%

SEPSA, febrero 1997, p.8

In an interview with Sr. J.L. Hernandez Casante, Executive Director of AUPA, I have been talking about the agricultural situation in Costa Rica and more specific in the Aranjuez area. The AUPA is the training division of the UPA, Union Nacional de Pequeños y medianos Agriculturos, the biggest organization of small farmers in Costa Rica. From this interview several factors can be abstracted:

1. the general political direction of liberalization and the opening of borders
2. the Aranjuez area consists of many micro climates and poor road conditions
3. there is has been extensive erosion
4. the poor market structure in Costa Rica
5. knowledge of market information and communication about agricultural prices

One should remember that the UPA might have a biased opinion because of its political background. I will in the following successively discuss these points by the answers given by Mr. Hernandez and together with some background literature for providing a better understanding.

ad 1.
" The termination of the cold war at the end of the 1980's is a turning point in the twentieth century" (I. Cem, 10, 1997). Global balances are being reestablished. Although the new world order that many talk about has yet to be clearly defined, its basic components have more or less become visible; democracy, supremacy of law, respect for human rights and fundamental freedoms, adoption of liberal economic practices and peaceful settlements of disputes. Political changes also in Costa Rica should in my opinion be seen in this overall framework.

At Sunday the first of February, Miguel Angel Rodriguez, of the center-right opposition Partido Unidad Social Christiana won presidential elections. Miguel Angel stands for more free market-oriented politics and pledged to privatize state firms and cut governmental spending. 'Observers predict drastic economic and political changes. Costa Rica has a well protected economy and a good system of social security, which the government no longer can afford (Volkskrant, p.4, 2/2/98). This means to the agricultural markets that for example trade barriers will be removed. 'La Prensa Libre' stated (24/2/97, p.10) that Costa Rica's principal food, rice, beans and maize could be much cheaper imported than to produce it itself. One can imagine what removal of tradebarriers will mean to the farmers who produce these crops. One should know that Costa Rica, together with Panama, in the region are the most prosperous countries and therefore surrounding countries like Nicaragua can produce much cheaper.

ad 2.
In this area the climate is the most determining factor of the agricultural situation. Because this area, like most areas in Costa Rica, consist of many micro climates the result is, that the use of universal chemical

formulas and technical machines/ equipment is not possible. It may be self-evident that this has an significant impact on the efficiency of farming. Furthermore, daily temperatures of 30°C plus are very common. This is only one factor of poor agriculture in this area. Another factor is the poor quality of the roads and furthermore the inadequate means of transport. The opinion of Sr. Hernandez underlines that transport is to be characterized as being poor. For example, public transport is nothing more than two busses per day. Roads consists largely out of dirt roads only upon which the speedlimit will not access the 20 km. per hour.

ad 3.
In the area of Aranjuez one can see plain slopes of mountains. This is not only due to the heat, but also of the practice of poor farming. Cutting down natural forests promotes soil erosion. La prensa libre says about this phenomenom in the Aranjuez area (13-6-97): "71.8% mal utilizado debido a la erosion y perjuicio". Also in the south of the Aranjuez area there is intensive farming of coffee and sugar cane. Sugarcane is being grown on large many hectares. This results in a one sided land use. Taken together, this is not encouraging farming in the Aranjuez area.

4.2 The market structure in Costa Rica

ad 4 & 5.
The market structure in Costa Rica consists of four marketing channels. Marketing channels 'are sets of independent organizations involved in the process of making a product or service available to for the use or consumption' (Kotler, 1997, p.530). In Costa Rica these market channels are:

1. CENADA (national center for storage and distribution of food stuffs)
2. Ferias del agricultores (agricultural markets)
3. Intermediarios (intermediairs)
4. Empacador (exporter)
5. Organización (cooperation)
6. Subastas (cattle markets)

According to Kotler, (1997, p.531), marketing channels provides several different functions:

- information about potential and actual customers
- promotion for customer attraction
- negotiation in order to achieve the transfer of ownership
- ordering of the actual product
- financing of inventories
- risk taking in carrying out the channel work
- physical possession of storage and movement of the products

The functioning of one or more of these above presented functions should explain the reason for existence of marketing channels and its effectiveness of functioning. From here, one could on forehand predict what to expect while doing interviews. This knowledge is a first takeoff for drafting the interviews themselves. If, as we will see, the marketing channel CENADA plays an important role, more importance should be given to this marketing channel in the interview itself too. This could be, for example, be expressed in the writing-space about this marketing channel, while doing the research, or another question for underlying the questionnaires' reliability. For now, we will describe the marketing channels:

ad 1.
The CENADA (literaly Centro Nacional de Abastecimiento y Distribución de Alimentos) is the most important market channel for all fruits and vegetables (60 - 80%), (PIMA, 1992). At the CENADA,

wholesalers buy from rural traders (or farmers themselves) and sell to retailers. The market is in operation twice a week. Important is that the number of buyers and sellers exceed the number of wholesalers. In Mr. Hernandez' view, the actual producers do not have any power at all and that the wholesalers determine together the market prices. In economic terms one can speak of a oligopsonic market. Although revenues at the Ferias on the average are higher, the producer prefers to go to the CENADA. Looking at the functions given by Kotler one can conclude the producer prefers security of selling his products with a lower price above taking risk of not selling his products. Note: we are speaking about agricultural products which are perishable. Doing the questionnaire so it is logic to assume that also from the Aranjuez area most of its products will go the CENADA. According to Mr. Hernandez not selling the products to the CENADA can best be described as a lottery. More about this is described in the following points:

ad 2.
Agricultural markets, (Ferias del agricultores), are being held every now and then in the region of origin of the products. At these markets, farmers are able to sell directly to the final consumer. Also traders are present here, and they grow most of the time their own crops. These markets give the farmer the opportunity to sell his products at a higher price. However, there are not so many agricultural markets being held, and considering the list of functions, above presented by Kotler, another thing can be said too about the functioning of these agricultural markets. One of the functions of a marketing channel is ordering its products. If farmers themselves sell the products, the range of products will almost never exceed more than three products as we will see later in the results. The customer, however prefers an assortments which matches their wishes. For a full assortment the customer has to buy at several different sellers. Rice here, beans there, which can not all be bought at the same stable. Like in Holland, customers prefer to their shopping more conveniently in one shop only (the rise of the supermarket) having to pay en get the money for example only once. Furthermore, in my opinion, as the farmers all are coming from the same region, the products which are being offered are more or less the same. For the customer though, there will be a trade off between money saved and the assortment of available products.

ad 3.
Intermediaries, or in Spanish 'intermediarios', can best be described as rural traders. Farmers sell their crops to these intermediaries at their farm gate when the intermediaries come around. In this situation the farmer depends heavily on the trader, not only concerning price, but also on wether the traders come around at all. This dependability is strengthened by the perishability of the agricultural products. In the studyarea of the Aranjuez this weak point for the farmer is further enforced by the remoteness of the Aranjuez area. As said before, roads consist largely of dirt roads to which very few villages are connected. As an example, as I have used before, the public bus services consist of nothing more then two busses per day. For these reasons, if the farmer would have opportunity of other possibilities, besides the intermediary, the farmer is situated in a very weak position. Doing business does not guarantee the farmer either selling his products or, if so, selling it at a satisfying price. The perishability of the product will encourage the farmer selling his products at a lower price or/and accept unfavourable trading conditions, as offered by the trader.

ad 4.
Another market channel is selling the crops to exporters (in Spanish by 'empacadores', literally: packers). However, this is of little interest to the farmers of the Aranjuez. Facilitating export is very costly and the volumes of produce in the area of Aranjuez are not able to meet the costs of exporting. Furthermore, according to Jansen e.a. (1996, p.36), do exporters pay the farmers until the export order is completed. This can often take 'take three months or more'. As we will see later, in the chapter about the Aranjuez area, people are very poor and for me it is logic to assume that even the farmers from this area are able to sell to exporters, they have no capability of covering the time 'often three months or more' without payment. Whether farmers actually do or do not use this marketing channel will (hopefully) be stated by the research results, later in this report.

ad 5.
Cooperatives are found in sugarcane and coffee production. In the Aranjuez area there is a cooperative of 430 farmers which is called Coopemontes de Oro R.L. Founded in 1987, during the time that the coffee enterprises were exploiting the farmers by low prices and because of bad services these enterprises rendered. In the harvest of '95-'96, the cooperative produced 3.5Ton of coffee (Boer, H. den, 1997). In the Aranjuez area a lot of coffee can be found. Not only coffee is produced in cooperatives, but sugarcane is too. The most important cooperation is La Liga Agrícola Industrial de la Caña de Azúcar (Cortés, 1994, p.379). In the Aranjuez area there is only one producer which is situated in the low altitude-lands near the Pacific coast. In this (hot) area there can only sugarcane be found with villages located in these fields filled with employees of the sugarcane-producer.

ad 6.
The subasta, or the cattle market, must be seen quite separate from the five marketing channels from above, except for the third described marketing channel; the intermediary. The subasta and the intermediary are the only possibilities for cattle trading. Therefore, the Cenada, or ferias del agricultores are not of importance here. Which marketing channel will outperform the other, depends on how well they function (Kotler, 1997, p.531). In theory therefor should the subasta outperform the intermediaries for several reasons. First, at the subasta there is larger potential amount of buyers than with an intermediary only. Information about current prices are being given by the amount of people. If there was only one individual, an intermediary, then information about prices could only come from this source. Second, while having many selling and buyers together, the stored cattle promotes itself by just being there. This is much different compared with an intermediary, who first have put energy into going to the farmer. Spontaneous buying, for example, is excluded in this case. So far only advantages in favor of the subasta. However, an other function of the marketing channel disfavors the use of a subasta. This is the risk taking by evaporation of the cattle by waiting to be sold and investment by transporting (costs). The advantages must therefor outweigh the risks taken, selling the cattle at a subasta. This will only be the case if the farmer decides to trade a large amount of cattle. This will increase the chance of selling and as we will see in paragraph 8 decrease the cost of transport per animal. If there is only a small amount of cattle to be traded risks are to great going to the subasta, and therefor a small number of animals will be sold to the intermediary. In paragraph 7 we will look at the results and examine if this statement is also actually true.

5. The Aranjuez area

In this paragraph we will give a short description of the area, which have the function to set the tone for further exploring. The aranjuez area is named after an area which surrounds the river (rio) of Aranjuez. This river and its surroundings is situated in the south-west of Costa Rica in the county called Puntarenas. (See also the coverpage on which the area graphically is presented). To start with the first, and most important aspect of this area: "Puntarenas es hoy una de las provincias más deprimdas del país" (La Republica, 15-15-97). The relevance of Puntarenas of the Aranjuez area is that is the location of the subasta and also a location of the ferias del agricultor. If the people are poor there, it will by no doubt influence the trading of the farmers. Furthermore, the farmers themselves are more or less a part of the Puntarenas area too. From observation myself, the statement of being poor a region can in my opinion be underlined (although I have seen much poorer areas; Nicaragua).

In an interview with señor Hernandez Casante, it became clear that in Costa Rica was a classical form of the 'pig cycle'. Althoug farmers might be willing to produce their exist a situation of a lack of information which enables such thing as a pig cycle. Farmers do not know anything about future prices, instead all they know is about current prices. If those are high farmers tend to grow it the following season. They are living in a naive emperical reality, in what you see is what you get resulting in that everybody tends to do

the same thing. In fact this is even encouraged by the government which for example once encourage large number of farmers to grow mango and mango only. One can imagine what will happen to the margin of profit. To level out the pig-cycle is not possible with those perishable products, this can only be done for storable products like sugarcane and coffee. We can see that the phenomenom of the pig-cycle with these crops is therefore not applicable.

Already shortly described in paragraph 4.2, under point 2, transportation of products is very hard in the area of Aranjuez. One has to imagine roads which are to an ordinary luxury car inaccessible by the unumerous holes and other obstacles in the road. Any vehicle will have a very hard life in this area. It would therefore not be strange to have a very unreliable transport service. However, this seems not to be the case (see column 5, appendix 2). This is very remarkable in my opinion because in some villages there are only just a few, or in most cases not more than one transporter. There must be some really handy mechanics assisting the transporter.

6. The Research

The goal of this practical time, as said before in paragraph 2, is to explicate determinants of the transportation costs and furthermore their exact relationship to the final costs of transportation. This will be put, finally, in a mathematic linear equation with on one side the transportation costs and on the other side the determinants with their parameters. In short: 1) what are the determinants and 2) what is their exact relationship (expressed in their parameters) towards the costs of transportation.

So what could the detreminants of transportation be? One could think of that costs are determined by the product. The more expensive the product the more expensive the costs of transportation. Or the more marge of pofit, or maybe even the care which have to given to the product while transporting. Another possibility is that costs depend on geographical classification. This might be true for remoteness, or conditions of the road or the distance. Costs could also be determined by the type of the clients (the farmers). For example, if a farmer has a lot of power by having a continuous production which garantees the transporter of a every month ride, this may result in a different price to transport the crops. Also potential new clients may vary the costs of transportation. As we can see there are many different solutions to the problem of what really determines costs of transportation.

In Costa Rica there does not exist a possibility to simply call the ministry of agriculture, or some other institute which is able to give the exact figures. Controversially, this project is initiated by the ministry of Agriculture, the CATIE in cooperation with Reposa. The Aranjuez area must be seen as a pilot area, to give some indications of figures in other areas like the Guanacaste. For me it is not really clear however. Also the possibility to call people and just ask for their transportation costs is inadequate. People do not always fancy to answer and while respondents are scarce, this risk must be avoided. Therefore, the project has chosen to visit the area in person and talk to anybody who might know something about costs of transportation. In reality this means that the respondents is either a farmer or a transporter. Questionnaires will therefore be twofold: One farmer-tailored and the other transporter-tailored See appendix 3 for the questionnaires.

6.1 Justification of the Questionnaire

To get a first impression or at least a superficial transportation costs- feeling, it aws decided to just visit the region and only to look around without taking questionnaires. In fact during this orientation, we used some qualitative research techniques (Babbie, 1992, p.293). The interview with the respondents were unstructured while directing at the specific topic of costs of transportation and we lett the respondent do the most of the talking. While talking we made notes. During this visit several things became clear:

- the poverty of the people
- the poor state of the roads
- what kind of crops are being grown

Furthermore, while asking a 'open question' of what costs of transport depend on, to some transporters and farmers it became clear that:

- no difference is being made between different kind of crops in respect to transporting them. This means that tomatoes are transported together with for example beans and platanos. There should only be a distinction been made between cattle and non-cattle with respect to transportation costs. And even this distinction is made; it does not influence transportation costs because the same truck is used for all goods, both cattle and non-cattle. More important is that , as we will find out later, the transporter charges the same amount of money. This is for example also literally said in questionnaire respondent no. 17.
- transporters made a very reliable impression on me and this, as showed later in paragraph 8, was underlined by farmers and also by the fact that either a village only has one transporter or

transporter has his own stable group of clients. The transportation-market can therefore be characterized as being a very local business.

To obtain information about costs of transportation one has to know several things:

1. the identification of the routes in between there exist transport. (what is departure place A and what is destination place B where in between transport exists).
2. the cargo.
3. the prices/ costs and its related cargo.
4. if there are costs obtained, is it possible to transport; are the roads transitable.
5. the distance between two places; place of departure and place of arrival. This information is calculated out of GIS; and therefore is not a part of the questionnaires.

The following numbering correspond with the above numbering of the different items mentioned (places A and B; 1, cargo; 2 and 3 costs/ prices)

From above, the following questions are abstracted:

1. place of interview and origen and destination.
2. the quantity of products and its costs to transport from place A to B.
3. what does this cost, or how much is being charged for the transport?
4. is it possible to transport the whole year round? (no mechanical breakdowns, impossible roads to drive on etc.).

To ensure a certain level of reliability due to the language and possible shortcomings of accuracy of answers given, the following questions were added. Also here, the following numbering correspond with the above numbering of the different items mentioned (places A and B; 1, cargo; 2 and 3 costs/ prices):

1. to obtain an exhaustive lists of places of departure and destination places:
    1. when was the last time that something had to be transported?
    2. where to?
    3. and when was the last time that you have transported something to another place?
    4. do you also transport fertilizers?
    5. if yes at question 1.4: from where to where are these transported?
    6. do you also transport feed supplements for cattle?
    7. if yes at question 1.6: from where to where are these transported?

2. to obtain more reliability/ validity about the cargo that is being mentioned:
    1. what is the maximum cargo capacity of your (transporters') vehicle? (if it is mentioned that the truck always leaves full, the cargo will be the same amount/ weight as the capacity of the truck. This is being questioned in the following question. So if it said to full always we will take the maximum capacity as the weight of the cargo).
    2. is this always loaded full?
    3. do you always use the same vehicle/ transporter?

3. to obtain more price-figures:
    1. what do other transporters charge?
    2. what do you think in general of the transport here?
    3. is the price per trip or per load?
    4. further verification of 3: how much does it cost for only a few kilo's of product?
    5. extension to question 1.5: how much does this cost?
    6. extension to question 1.7: how much does this cost?

If we make a short review from now on, we can conclude that question 1: (what are the determinants) has been answered after the area has just been visited. The questionnaires were constructed right after this visit. The questions themselves determine what to find. To put it in words of prof. Van Cuilenburg e.a. (p.250 1984) "search and find". This means that you can only find what you are looking for. Therefor the decision what to look for is the main determinant of what you will find. In fact we are searching only because we want to find something (Kuypers, 1982, p.12) "The finding determines the searching". It is not just the filter in the beginning but in my opinion the biggest filter of selecting variables. The question rises what should happen if the variables only describes reality in a poor way? In this case one should ask himself therefore, of what other factors could transportation costs depend, other than amount of cargo, distances and a distinction of types of roads. I myself, could only come up with the power transporters have in a region. If they for example have a lot of power, because they are enjoying a monopoly, then this could be a factor of importance too. Their monopoly could have an impact on transportation costs, on top of the other three mentioned factors (amount of cargo, distances and a distinction of types of roads). Therefore I have added one more question:

How do you think transportation is being organized here?
- own mean of transport
- with transporters
- other

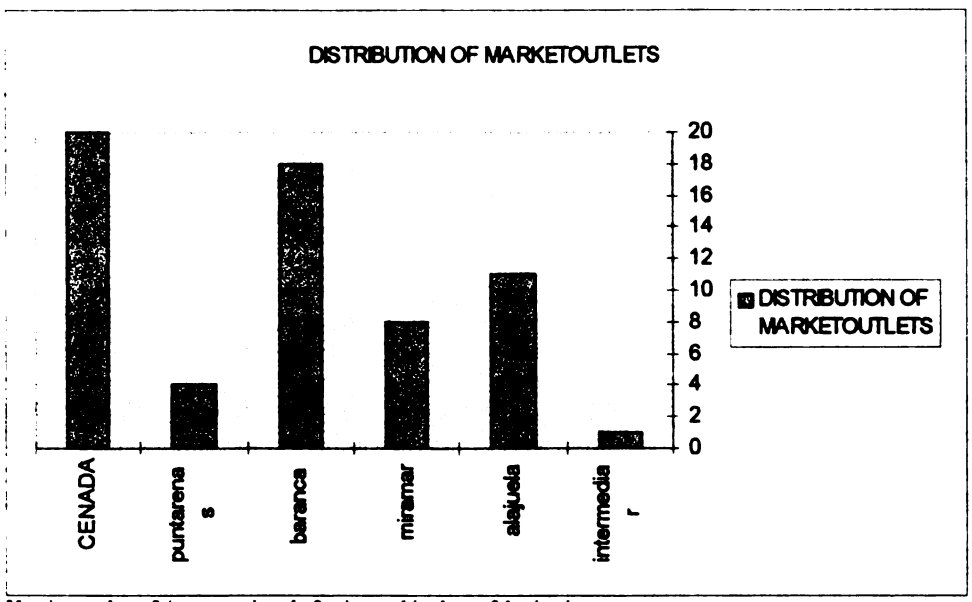
(answers will be in percentages)

Thus, by asking this question I will hope to find an explanation if some variance is not explained by the three factors. In my opinion (and I am hoping to find this) this unexplained variance could well be caused by transportation-market power of the transporters. One could also even argue that own means of transportation is less efficient and therefor more expensive. In the following paragraph we will see the results; if there is a relationship between market power and transportation costs at all, and if so, how is this relation.

7. Results

On the following page follows a complete overview of the obtained data (table2.sav). The meaning of the shortcut-written variables are to found in appendix 1.

Looking at table 2, and taking all columns together which shows figures about destination point of selling, it is easy to come to the following picture:



Y-axis: number of times mentioned of going to this place of destination
X-axis: all mentioned destination places

Suggestions made in paragraph 4.2 come true in the chart above. CENADA, is by no exception the biggest market outlet for crops and the subasta's (cattlemarkets) Baranca and Alajuela are the most important market outlets for cattle. In Puntarenas there is a supermarket situated, which are only four times mentioned that either a farmer goes there himself to sell his crops or a transporter who is transporting something for somebody. Miramar is a place to buy fertilizers and supplements only.

On the next pages (table1.sav) the following calculations are made. I will explain this by column:

1. costs per kilogram without consideration of distances made on either road 1 or 2. For example, the 40000/4500 from the former table (table2.sav) which shows the complete overview, in the cell ced_cen on page 1-1 gives 8.89. 40000 divided by 4500 gives 8.89. This can be found in table1.sav at case-number 26.
2. cargo capacity. (the reason of having the 26th number is that the table is ordened on the variable zdiffere. This will be described extensively, later in this paragraph. The same thing, dividing costs by kilograms is done for all cells out of table2.sav. 15000/1000 from table table2.sav is the one located at number 8 in the table1.sav table, 20000/1000 is number 38 etc. The second column is as said the corresponding cargo-capacity. The cargacapacity is taken as a measure for the cargo which is being transported in the case of full loaded truck. If this is not the case (only two cases), the costs are straightly devided by the cargo. I have taken the maximum capacity to increase my reliability. (For I have questionned the maximum capacity, if the truck was always fully loaded and what (in kilograms) was the cargo).
3. distance which have to be made on road type 1 (gravel)
4. distance which have to be made on road type 2 (asphalt)

From these four columns the following regression equation can be derived:

**** MULTIPLE REGRESSION ****

Dependent Variable.. COST_KG costs per kilogram in colo

Variable(s) Entered on Step Number
1.. ROAD2 distance on roadtype asphalt
2.. ROAD1 distance on road type gravel
3.. CARGOCAP capacity of the cargo in kg
N=60

Multiple R ,84313
R Square ,71086
Adjusted R Square ,69537
Standard Error 3,68856

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	1873,20720	624,40240
Residual	56	761,90822	13,60550

F = 45,89337 Signif F = ,0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
ROAD2	,087216	,012339	,517969	7,068	,0000
ROAD1	,342347	,078644	,371825	4,353	,0001
CARGOCAP	-,001658	3,0314E-04	-,475042	-5,470	,0000
(Constant)	3,966285	1,881386		2,108	,0395

Here we have made costs of transportatation dependent of cargo, distance made on road type 1 and distance made on road type 2. To be more specific:

transportation costs = 0,08 x distance made on road type 2 + 0,34 x distance made on road type 1 - 0,0017 x cargocapacity (all three are significant within a 95% confidence interval).

With 95% of confidence one can say that if one knows the amount of cargo, distance which have to made on road type 1 and road type 2, then cost of transport can be predicted. However, the found equation might be improved, because it has a R-square of 71%, which means that 29% of the variance is not being explained by the equation. Therefore we will try a logistic function and see if this has a better fit to the data. (we have to look at the R-square and not at the multiple R, because we have more than one independent variable).

The fifth, the sixth, the seventh and the eighth column in table table1.sav shows exactly the same data of column one to four, but now expressed in a logistic figure. If we run a linear regression on this data the following is found:

**** MULTIPLE REGRESSION ****

Dependent Variable.. LNCOSTS costs per km in LN

Variable(s) Entered on Step Number
1.. LNROAD2 distance road 2 in LN
2.. LNROAD1 distance road1 in LN
3.. LNCARGO capacity of cargo in LN
N=60

Multiple R ,91725
R Square ,84134
Adjusted R Square ,83142
Standard Error ,33981

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	29,39063	9,79688
Residual	48	5,54254	,11547

F = 84,84385 Signif F = ,0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
LNROAD2	,400480	,044480	,528530	9,004	,0000
LNROAD1	,491992	,086804	,369522	5,668	,0000
LNCARGO	-,634366	,078829	-,525456	-8,047	,0000
(Constant)	4,109910	,735577		5,587	,0000

First of all, this model gives a better fit to the obtained data: 84,1%.

LNtransportation costs = 0,40 x LNdistance made on road type 2 + 0,49 x LN distance made on road type 1 - 0,63 x LNcargocapacity (all three are significant within a 95% confidence interval).

Furthermore, we can derive the following conclusions from the SPSS-output:

- parameter coefficients are elasticities too. This only true for the double-log equition. An elasticity is an expression for the relatives of changes between two factors. If we change something with the independent variable, the question than is what will happen to the dependent variable. In the output we

have respectively 0.40 0.49 and - 0.63. This means that the amount of cargo has the strongest impact on the costs of transportation and in a negative way. One can say, it is therefore better to have a larger amount of products to sell at a more distant destination then a smaller amount at a more nearby destination. The order of impact of factors concerning costs of transportation is therefor the following: first cargo capacity, than the distance on road type 2 and than the distance on road type 1.

Nevertheless, although 84,1% of the variance is explained, 15,9% is left. Maybe we can explain this by the factor of market power of the transporter, or the inefficiency of own means of transport of the farmers themselves (described in paragraph 6.1).

If there exists a marketpower or an inefficiency of using own means of transport, then this should have its influence on transportation costs, independently from the other variables. The unexplained variance is made up of cases which are called outliers. Outliers are "cases with large residuals" (Norusis, 1986, p.353). To be more specific of what is a large residual I have chosen to define outliers as cases having more then 2 standardeviations (in absolute terms) to the mean. The mean in my case is mean difference between predicted and real data. If the difference between the predicted value and the real value is big, a large residual will be the result. This will result from the following calculation (Vocht, 1996, p.135):

$$\text{Zscore} = \frac{\text{fault (predicted - real frigure) - averge fault}}{\text{standard deviation of the fault}}$$

To figure this calculation out several steps have to be made:

1. calculate the predicted cost for every case. This means filling in the values in the found equation: LNtransportation costs = 0,40 x LNdistance made on road type 2 + 0,49 x LN distance made on road type 2 - 0,63 x LNcargocapacity. This is done in the ninth column of table1.sav with the SPSS compute-commando: predcos1 = 0,40 x LNroad2 + 0,49 x LN2 - 0,63LNcargo.
2. The outcome will be in a LNcost figure, so we have to convert this into a normal figure so we can compare this with the real found figures. Compute predcos2 = 2,718281828 to the power predcos1. The results are shown in the tenth column of table1.sav.
3. Then the difference can be calculated. Compute differen = predcos2 - cost_kg (the empirical found data). This is done in the eleventh column of table1.sav.
4. Because we can not make up decisions just looking at the real differences which one is being a 'real' outlier or not, we have to standardize all numbers, translating the outcome into a Zscore. This is done by abstracting all faults by the average fault and then dividing it by the standard deviation (see also formular written above). The average fault is the $\sum$ of all faults divided by the number of cases (104,31/52 = 2,0059) and the standeviation is 1,84:

Number of valid observations (listwise) = 52,00

Variable	Mean	Std Dev	Valid N	Label
DIFFEREN	2,01	1,84	52	dif expected and real in square root

---

5. The final step is to be found in the twelfth column of table1.sav. Here the outliers are calculated by deviding the defferences-column by the standard deviation of 1,84. All differences or faults concerning

predicting the right costs has to lie in the interval of 2,0058 +/- 2 x 1,84. If this is not the case, there is an outlier found (the outleir has a number greater than 2,00 times the standard deviation. This column I have ordered to have a first glance of the outliers. One can see that there are only four outliers (according to definition).

What causes those outliers? My suggestion is as said before the existence of a market power and/ or an inefficiency of using own means of transport by the farmers themselves. Other suggestions would be unreliable data provided by the respondents or failing to record the data accurately. Anyway lets see if marketpower and/ or an inefficiency of using own means of transport by the farmers themselves really has a significant influence on transport. To figure this out I will use the data out of columns 12 and 13 from table2.sav. Here rises the problem what is market power? If a transporter controls 80 or 90 percent of the market. To avoid this question I have made two different variables both with two dummy variables;

1. One with 10 percent or less having own means of transport (markpow1, column 13 in table1.sav)
   - no = not having marketpower
   - yes = having marketpower defined in terms of 'existing 10 percent of the farmers or less with own means of transport.
2. 20 percent or less having own means of transport (markpow2, column 14 in table1.sav). (1 means 'no' and 2 means 'yes', see also appendix 1).
   - no = not having marketpower
   - yes = having marketpower defined in terms of 'existing 10 percent of the farmers or less with own means of transport.

---

t-tests for independent samples of MARKPOW1marketpower with 10 percent and less with own means of transportation

Variable	Number of Cases	Mean	SD	SE of Mean
COST_KG costs per kilogram in colonnes				
no	32	6,5553	7,057	1,248
yes	28	7,6629	6,304	1,191

Mean Difference = -1,1075

Levene's Test for Equality of Variances: F= ,300 P= ,586

t-test for Equality of Means Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-,64	58	,527	1,738	(-4,588; 2,373)
Unequal	-,64	57,97	,523	1,725	(-4,561; 2,346)

t-tests for independent samples of MARKPOW2 marketpower with 20 or smaller with own means of transportation

Variable	Number of Cases	Mean	SD	SE of Mean
COST_KG costs per kilogram in colonnes				
no	24	5,8863	6,247	1,275
yes	36	7,8628	6,931	1,155

Mean Difference = -1,9765

Levene's Test for Equality of Variances: F= ,036 P= ,850

t-test for Equality of Means Variances	t-value	df	2-Tail Sig	SE of Diff	95% CI for Diff
Equal	-1,12	58	,265	1,757	(-5,495; 1,542)
Unequal	-1,15	52,85	,256	1,721	(-5,428; 1,475)

From these two Simple T tests we can conclude that there no differences in transportationcosts between the two groups (one with maket power 'yes' and without market power 'no'). Therefor, market power does not have an impact on costs of transportation. The same conclusion can be abstacted from the following regression:

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. LNCOSTS costs per km in LN

Block Number 1. Method: Enter LNCARGO LNROAD1 LNROAD2 MARKPOW1

Variable(s) Entered on Step Number
1.. MARKPOW1 marketpower with 10 percent and less wit
2.. LNROAD1 distance road1 in LN
3.. LNROAD2 distance road 2 in LN
4.. LNCARGO capacity of cargo in LN

Multiple R ,92012
R Square ,84662
Adjusted R Square ,83356
Standard Error ,33764

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	29,57505	7,39376
Residual	47	5,35811	,11400

F = 64,85620 Signif F = ,0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
MARKPOW1	,120157	,094471	,073083	1,272	,2097
LNROAD1	,500467	,086508	,375887	5,785	,0000
LNROAD2	,396411	,044312	,523160	8,946	,0000
LNCARGO	-,626174	,078591	-,518670	-7,968	,0000
(Constant)	3,853860	,758107		5,084	,0000

End Block Number 1 All requested variables entered.

From this regression we can see that Marketpower does not play a significant (significance more than the allowed 0,05) role on the costs of transportation. (marketpower 1 has been taken, because this variable is a more narrow defined than marketpower 2; power means controling at least 90% of the market while power in marketpower 2 is defined as at least 80%).

So, we have to be content with the found Lnequation. The 15,9% of the variance which has not been explained must be due to either inaquate registration of the answeres given by the respondents or false answers. Anyway, the following test shows how will the found equuation estimate the real costs:

-- Correlation Coefficients --

	COST_KG	PREDCOS2
COST_KG	1,0000	,9235
	(60)	(52)
	P= ,	P= ,000
PREDCOS2	,9235	1,0000
	(52)	(52)
	P= ,000	P= ,

(Coefficient / (Cases) / 2-tailed Significance)

Predcos2 predicts with 92,35% of all real costs well.

8. Conclusions

Here, we will refer to the objective of this research stated in paragraph 2: to obtain transportation costs in relation of its determinants. *The goal of this practical time is to explicate determinants of the transportation costs and furthermore their exact relationship to the final costs of transportation. This will be put, finally, in a mathematic linear equation with on one side the transportation costs and on the other side the determinants with their parameters.*

- The most general (framing)-conclusion of the Aranjuez is its poverty. The people are poor and the roads are in a poor state too.
- Theoretical suggestions made of the distribution of market outlets were confirmed by the empirical data. The CENADA is the most important market outlet to the farmers located in the Aranjuez area, and for cattle this is respectively the nearby Subasta Baranca and much further, near the capital of San José. All other market outlets mentioned and described in paragraph 4.2 like the agricultural markets, intermediaries, exporting do not play a role of any importance.
- In transportation and so in transportation costs, no difference is being made in either crops or cattle. Crops are being transported together, the main objective always is to fill up the truck to the maximum. Therefor, the costs are calculated in colones per kilogram, so for an animal the cost must be multiplied by 400 kilograms.
- The final equation of costs of transportation as dependent variable and cargo capacity of the truck, distance made on road type 1 and distance made on road type 2 as independent variables is: LNtransportation costs = 0,40 x LNdistance made on road type 2 + 0,49 x LN distance made on road type 2 - 0,63 x LNcargocapacity (all three are significant within a 95% confidence interval). This model gives a 84.1% fit of the empirical obtained data.
- The found parameters (0,40 0,49 and -0,63) are elasticities too. the cargocapacity has the highest impact on costs of transportation. In order of importance concerning costs of transportation is the following: first the cargo capacity, than the distance made on road type 2 and than the distance made on road type 1.
- Although 84,1% of variance is explained, 15,9% is not. In my opinion this could for example be due to the fact that there is an existence of market power by a transporter and/ or inefficiency of using own means of transportation. Comparing means of the costs of transportation between a market-power situation and a non market-power situation showed that there is not a significant difference between these two groups. Market power, therefor has no impacte on costs of transportation, (although most farmers fully depend on sometimes only one transporter in the whole region. The farmers themselves are namely poor and unable to afford a car of their own.
- While doing the questionnaires, we found out that transporters always work with the same clients. So farmers always stick to the same transporter. Almost never farmers changes from their transporter to another.

9. Postface. Personal experiences

In this paragraph I would like to make a small exposition of what I have learnt during this practical time and further experiences. My experiences can shortly be summarized as being good. Above all, Costa Rican people are very friendly which makes doing questionnaires easy, especially if there is sometimes a shortcomings in the language. The fact of being more or less unable to make fixed appointments is greatly offset by just coming around and people are willing to talk in about 90% of all cases.

Not only the language was especially in the beginning a 'problem', so was the temperature. In the Netherlands it is also sometimes warm but after a (short) while you can ease down with lower temperatures. My experience here is that I have adapted more or less to the heat after a week or two. Especially, after I came back from a trip to Nicaragua. There, the temperature is even higher then in Costa Rica. People over there even called San Jose cold! Now at the end of doing my practical time I begin to agree with this. Anyway, the experience of 'being in the tropics' for a while has been set.

Visiting Nicaragua and Honduras, meeting a lot of people has definitely encouraged my insight of Costa Rica. These mentioned countries are so much more poorer then Costa Rica that I have to come to the point that Costa Rica is well ahead of these countries and becoming a developed country. Much more aspects are better; busses are better organized, people look more decent, food is safe and the sanitary is much better too. However, everything has its costs, and so Costa Rica is in my opinion pretty expensive to stay in for a longer while, but well worth looking at the conveniences.

Once the data obtained, statistical procedures had to be chosen. It might look simple in this report, but a lot of trying of different methods of analysis where practiced formerly. This really enhanced my knowledge of the statistical possibilities in general and the SPSS computer program in particular. How should data be analyzed, how to convert data in for example two variables, creating a dummy variable and interpretation of the SPSS-output. I think it has been very nice to have made the questionnaire, taking the questionnaire to the respondents and also analyze it myself. Now, I will be able to have much more insight in all three steps and maybe in future I am better qualified to exert a better judgment about either my own research or somebody's else. This last point I find probably the most important of my whole practical time of which he opportunity was given by REPOSA. Therefore I would like to thank Mr. Hans Jansen and Mr. Aad van Tilburg, who actually gave me this opportunity.

BIBLIOTECA
IICA - CIDIA

10. Literature

Anonymous, REPOSA; Research Programme on Sustainability in Agriculture.

Babbie, E. (1992). The practice of Social Research. Wadsfort Inc.:Belmont California 94002

Billiet, J.B. (1993). Methoden van Sociaal-Wetenschappelijk Onderzoek: Ontwerp en Dataverzameling. Acco: Leuven/ Amersfoort

Boer, H. den (10/1997). Coffee Cultivation in the Wathershed of the river Aranjuez. Reposa: Guápiles.

CNAA (1992), Indicadores Económicos y Estadísticas del Sector Agropecuario. Cámara Nacional de Agricultura y Agroindustria, San José.

Cuilenburg, J.J., Scholten, O. & Noomen, L.v. (1992). Communicatiewetenschap. Muiderberg: Coutinho.

Cortés, G. (ed.) (1994). Atlas Agropecuario de Cost Rica. San Jose:Universidad Estatal a Distancia

http://agriforo.iica.ac.cr./cri/cnp

http://www.catie.ac.cr/~bibliot

http://www.fao.org

Jansen, H.G.P, e.a (1996). Agricultural Marketing in the Atlantic Zone of Costa Rica. CATIE:Turialba, C.R.

Kuipers, G. (1992). ABC van een onderzoeksopzet. Coutinho: Muiderberg.

Kotler, P. (1997). Marketing Management: Analysis, Planning, Implementation and Control. Prentice Hall: New Jersey.

La Prensa Libre, 24/2/97, p.10

Norusis, M.J. (1986). The SPSS guide to Data Analysis. Marketing Department SPSS Inc:Chicago.

PIMA (1992). Programa Integral de Mercado Agropecuario: Base de Datos de Mercado Mayorista CENADA. Programa Integral de Mercado Agropecuario: San José.

Secretería Ejecutiva de Planifacación Sectorial Agropecuaria (SEPSA). Bolletin Estandistico número 8 (feb 1997).

Vocht, A. de (1996). Basishandboek SPSS 6.1 voor windows. Bijleveld Press: Utrecht