International   Coffee   Organization
Organización Internacional del Café
Organização Internacional do Café
Organisation Internationale du Café

Executive Board
258th meeting
17 – 19 May 2005
London, England

Study of environmental issues relating to the coffee chain within a context of trade liberalisation, through a life-cycle approach

Background

1.   This document contains a summary of Terms of Reference presented by EDE Consulting to develop a study aimed at identifying both the positive and negative effects on the environment of all activities involved in the coffee life-cycle and providing a number of guidelines and recommendations for all those involved in the coffee chain who wish to apply this method of analysis.

2.   It may be noted that this study is defined within the context of the United Nations Environment Programme (UNEP)/ICO framework of studies on coffee, environment and international trade (EB-3723/99) and that the preliminary guidelines for this study were funded by the UNEP and presented to the Executive Board in May 2000 (document EB-3747/00).

Action

        The Board is requested <u>to consider</u> this project proposal and, if appropriate, <u>to recommend</u> it for approval by the Council.

Project Summary

Title of study:	Study of environmental issues relating to the coffee chain within a context of trade liberalisation, through a life-cycle approach
Duration:	Nine months
Location:	EDE Consulting duty station in Hamburg, Germany
Nature of the project:	To contribute to understanding the impact of production, processing, marketing and consumption that trading in coffee may have upon the environment. It will be conducted using the "life-cycle" approach to identify where in the coffee chain effects take place and how they can best be addressed.
Brief description:	The proposed study will develop analytical tools and reliable data with case studies to illustrate the current situation. It will help with the planning of national agricultural coffee policies, as well as project implementation in developing and enhancing the coffee sector, identifying both the positive and negative effects on the environment of all activities involved in the coffee life-cycle, and providing a number of guidelines and recommendations for all those involved in the coffee chain who wish to apply this method of analysis.
Total cost:	US$210,000
Mode of financing:	Grant
PEA:	EDE Consulting
Supervisory body:	International Coffee Organization
Estimated starting date:	N/A

Approach

The analysis will apply the four stages of the Life-Cycle Approach to the coffee chain: (a) definition of goal and scope, (b) process balance, (c) impact assessment, (d) interpretation.

Within the first stage of the Life-Cycle Assessment, goals and scope are determined describing briefly the process under consideration. The process balance comprises the establishment of a flow diagram for the life cycle of the product and the recording of input-output flows at the different stages of the life cycle. The impact assessment serves the purpose of identifying, quantifying and appraising the potential environmental effects within different categories of damages (e.g. extensive use of fertilisers, green house effect etc.). Within the scope of the interpretation different options are compared highlighting potentials for optimisation. With regard to coffee, the different stages in the coffee chain: farming, coffee processing, coffee trade and logistics, roasting and retail, consumption and waste disposal would have to be considered.

In the following, six modules are suggested that consider a basic overall analysis, the major categories of environmental impact and the creation of a model. Methodologically, the separation into modules helps to simplify the complexity of environmental impact in the case of coffee by concentrating on each module and integrating them afterwards into a more comprehensive presentation. In addition, in this way the study may be tailored to the specific focus the ICO would like to stress by exploring the different modules to varying extents.

Module 1 forms the basis by giving an overview and providing the methodological framework that subsequently will be detailed by the following 5 modules. The first module would basically consist of literature based research. Secondary Data shall be used to assess the environmental impacts of the different stages in the product chain. Within Modules 2 to 5, the analysis undertaken in the first module will be extended and the various effects will be quantified in greater detail on the basis of new data. Module 6 offers the opportunity to establish a model scheme that enriches final evaluation and serves as a flexible assessment tool.

During the preparation of the study exchange with scientific institutions being active in coffee and alternative crop related research will be established. The main stakeholders will be identified and involved in the assessment to get an unbiased picture.

Within the research for the first study, specific aspects of the second study shall be taken into consideration. The methodological approach as well as the data analysed with regard to coffee in the first study will serve as a basis for comparing coffee with other crops in the second study.

It might be interesting to consider that the results of the study would be handed over to selected national and/or international research institutions. They could use them within already existing research activities or redirect their own activities towards a follow-up and multiplication of the approach in different regions. This would ensure that a significant impact would be reached.

Module 1:   Guiding research and evaluation of state-of-the-art
**   regarding Life-Cycle – Analysis for coffee**

- Existing sources will be identified and analysed
- Scope and Aims of the different studies will be defined
- Existing sources will be screened regarding their relevance for the study
- Evaluation of existing sources (regarding data material, applicability to other regions etc.)
- Discussion of results on the basis of data obtained for different indicators including comparison of results from different sources (including recommendations for action).
- Identification of areas for research in the future

In the research undertaken within this module, aspects of the second study ("The Environmental Impact and Efficient Use of Natural Resources: A Comparative Analysis Between Coffee and other crops in the Agro-Industrial Sector") shall be considered in order to identify complementarities.

Costs: US$15,000

Module 2:   A Carbon Balance

The initial study made a macro estimate for global warming potential of coffee but this needs further attention. We need specific estimates of how much CO_2 is locked up in the most important production systems, considering:

Arabica (traditional and intensive)
- Robusta
- Shade trees
- Other main crops associated with coffee
- Other elements of coffee systems vegetation (forest remnants, soil cover)

And a breakdown of how much CO_2 is released through:

- Agricultural practices (fertilizer, fuel, soil clearance, soil, tillage, etc.)
- Post harvest processing
- Transport

- Roasting and packaging
- Consumption

For decision makers, we need a better understanding of how much difference it would make to CO_2 levels if, for instance, more shade trees were grown (see Module 6 on modelling below).

Output: a report detailing the existing data on coffee systems as carbon sinks and sources and how this is likely to change if, for instance, soluble coffee consumption rises and coffee shade declines.

Costs: **US$35,000**

Module 3:   Water Pollution

We require more comprehensive estimates of the main causes of water pollution:
- Post harvest processing
- Insecticide run-off
- Copper oxide run-off
- Fertilizer run-off
- Industrial processing

We also need a clearer exposition of the main effects of water pollution on the environment and public health, and a better appreciation of the costs of reducing water pollution, e.g.:
- Installation of water treatment facilities
- Adoption of eco-processing machines
- Down-stream water processing to remove pollutants (e.g. nitrogen)

Decision-makers need to know for example:

- What are the major risks to the environment caused by water pollution
- What are the costs of remedying them, e.g., which is easier to improve, on-farm post harvest processing by individual farmers or larger washing stations?

Module 2 should be able to formulate preliminary answers to such questions.

Output: a report reviewing coffee water pollution issues, detailing existing knowledge and information gaps. An economic analysis of costs of reducing water pollution levels due to post-harvest processing in developing countries.

Costs: **US$40,000**

Module 4: Biodiversity

Perhaps the most difficult module because it is hard to put a cost on ecosystem – e.g. how to value the cost of a population of migratory birds and how these would be affected by intensification. This element will present a balanced account of issues such as:

- current trends in valuing ecosystems
- the various costs and benefits of organic and shade coffees
- a list of endangered species supported by coffee, especially birds and mammals

It will also produce more detail (for three coffee production systems - agroforestry, traditional commercial and intensive) on:

- soil loss
- abundance and species richness
- effects on CITES listed endangered species

For decision makers, we need to be able to give a better picture of the merits of coffee in terms of the valuable species they nurture, as well as the major threats to biodiversity caused by different coffee production systems.

Output: report listing benefits and hazards of coffee production to biodiversity with indications of how to promote the former and minimise the latter.

Costs: US$40,000

Module 5: Global warming effects

Because there is increasing evidence of climatic change, any comprehensive study on coffee and the environment must include consideration of the global processes underway that are outside the coffee system. Thus over the next 30 years temperatures may well rise by 2°C, and rainfall patterns will alter, which will change distribution of coffee growing and with it quality, yields and farming practices. This will lead to changes in the variables mentioned in the rest of this document.

For this module, as a first step a major coffee-producing country (e.g. Brazil) will be studied as a case history. The climate of the current coffee areas in that country will be defined based on existing data. Using the Global Climate Model of the Hadley Centre[1], projections will be made for the 2020s, 2050s and 2080s for variables such as temperature, rainfall, evaporation,

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[1] *Part of the UK Meteorological Office, the module will be carried out in collaboration with them.*

solar radiation etc. Using available coffee agronomic and physiological data, the impact of the projected change in climate variables on coffee production will be calculated. General biomass predictions for these regions will also be made.

Output: a report projecting the effects of global warming on coffee production in a major coffee-producing country.

Costs:　　　　**US$45,000**

Module 6:　　**A Model**

Simple descriptions of the effects of the coffee chain on the environment are not enough. We need to answer questions such as:

- Consumption trends may increase CO_2 emissions (steaming and soluble coffee) but could these be offset by changes in coffee growing practice? Or would it be more cost effective, say, to improve efficiency in coffee brewing?

- Water pollution is a problem with coffee processing, various methods could reduce this if widely adopted but what would be the cost for changing and what impact would it have on other variables, e.g. more transporting of coffee cherries could have both positive and negative effects.

Accurate answers to these questions will take much detailed study to elaborate, as outlined in the modules above, but it is important to start making approximations very soon. The reason is that there may already be sufficient data available to make educated guesses about effects and the very action of trying to answer the questions would reveal gaps in knowledge, which need to be filled.

The best way to do this is by constructing a simple model using the variables regarded as the most important - through consultation, perhaps using a brainstorming workshop of experts. Once constructed it could then be 'run' for a range of values and parameters (e.g. to carry out a sensitivity analysis). If credible 'ball-park' outputs are obtained, this will allow us to make predictions which could then be tested through further data gathering and experimentation to feed back into the above modules. If improbable scenarios emerge it would force us to reconsider both the quality of the data used and the assumptions and concepts we have employed.

Output: a brainstorming workshop, a report and a simple model that can be operated from any Pentium PC.

Indicative cost:　　　**$35,000**

Time-Schedule

Module 1: Guiding research and evaluation of state-of-the-art regarding Life-Cycle-Analysis for coffee	6 weeks
Module 2. A Carbon Balance	6 weeks
Module 3: Water Pollution	6 weeks
Module 4: Biodiversity	6 weeks
Module 5: Global warming effects	6 weeks
Module 6: A model	4 weeks

Some modules can be developed in a parallel way in order to save time.

Overview of costs for the different modules

Module 1: Guiding research and evaluation of state-of-the art regarding Life-Cycle-Analysis for coffee	US$ 15,000
Module 2: A Carbon Balance	US$ 35,000
Module 3: Water Pollution	US$ 40,000
Module 4: Biodiversity	US$ 40,000
Module 5: Global warming effects	US$ 45,000
Module 6: A model	US$ 35,000
TOTAL	**US$ 210,000**