29th INTERNATIONAL COURSE ON FOOD AND NUTRITION

Food and nutrition security: caring for women and children

Module on household food security in rural areas

Food processing, storage and safety

Facilitator: S. Essers

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FOOD STORAGE, PROCESSING AND SAFETY ASPECTS OF FOOD SECURITY: PROBLEMS AND OPPORTUNITIES

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Introduction

Processing of food adds value to it, and as such may create income and employment for people. Selling vegetable oil or gari instead of the oilseed or cassava - as an example - may increase the income of farmers considerably.
Food consumption patterns and habits have significantly changed in many societies over the past decades, leading to a higher demand for processed or readily prepared foods. The discrepancy of the dependency of imported processed food products in urban areas while often the raw material is present in sufficient quantity in the country itself, demonstrates a gap and an opportunity for food processing. This would not only offer jobs and income to the ones directly involved, but the local products could substitute otherwise imported products and thus save on foreign exchange, which might be used to increase development, well-being and food security in other ways.
Food processing has been the domain of women in many societies. Processing and preparing foods for sale can earn them the money they need to cater to the basic needs of their families and themselves.
Besides income-related aspects, local or national food processing, contributes to an increased availability of a diversified food basket which may have improved quality and safety. Immediate processing within the locality helps to reduce post-harvest losses, enhances by-product development and consequently is an important step forward towards increasing food availability and achieving greater food security all year round.
As the added value provided by processing may increase the demand for raw materials, and with it the price, processing may have a triggering effect towards the agricultural production. Strengthening the sector of food processing is therefore an important and powerful strategy for enhancing food security and development.

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FOOD SAFETY ASPECTS OF FOOD SECURITY

Food security harbours aspects of food quality, related to health. Food should be safe and satisfy relevant nutritional and/or socio-cultural needs, while being acceptable culturally and organoleptically (taste, smell, consistency etc.).
Safe food can be considered as food in which any potential toxic constituent or microbial contamination is in such a low concentration that -with the regular or expected use of the food including processing, preparation, share in the diet and taking into account possible neutralizing food factors- no significant adverse health effects are to be expected in the short and long run. These health effects must be considered relative to other common health expectations and risks.
The most relevant threats to food safety come from natural plant toxins, microorganisms, contaminants and parasites (see box 1).

Food insecurity increases the risk of impaired food safety

The relations between food insecurity or shortage and food unsafety can be:

* **Changing food basket**
  Choosing items for food otherwise considered as unedible. Precautions to consider

something as being edible or not are relaxed. This may lead to consumption of hardly digestible materials (banana tree stems, stalks of okra plants, grasses, tree bark) or even toxic plants (In Memba district, Mozambique 1982, after a severe famine, it appeared that 80 wild plant products, although usually not considered edible, had been consumed by the desperate population; some were toxic, others caused fatal internal bleeding). In the Darfur famine, Sudan 1991, people searched for wild berries in the forest. Those had to be soaked for one week, discarding the precious water regularly, to remove the toxins. Shares of food components in the diet may be changed. Consumption of the slightly poisonous grass pea (Lathyrus sativa) during famines in India and the horn of Africa has led to massive permanent paralysis, known as lathyrism, by a shift in its share from usually less than 6% to over 50% in the diet.

* **Accepting lower quality standards**
  Lower quality standards are accepted which may lead to consumption of spoiled foods (e.g. meat, moulded cereals). Food, donated by relatives, friends or neighbours cannot easily be refused especially under such conditions, even if its safety is apparently doubtful.

* **Deviation from usual processing, storage and preparation practices**
  Especially when food, time or processing devices are scarce, traditional food processing practices are being short-cut or omitted, as they are too time consuming for a starving person or they require too many assets like water in a drought area or firewood. A lack of firewood may implicate insufficient heating of food and survival and outgrowth of pathogenic or toxin-forming microorganisms. Also, as kitchen assets like pestle and mortar, grinding stones and pots and pans may have been sold or bartered for food, proper processing and preparation may be impaired. This, especially combined with the choice of "unedible" food items enhances unsafety.
  In Mozambique, 1981, food shortage caused by a drought that had led to the vanishing of all food crops except for a drought tolerant toxic cassava variety, led to a drastic short-cutting of the usual lengthy sun-drying and storage of the bitter roots, which would take two months at least. (The famine also caused the consumption of the -even more poisonous- root peels.) This staggered the uptake of cassava toxin, which caused acute poisonings and permanent paralysis of over 1000 rural consumers.
  Food insecurity in a region may go hand in hand with withholding food stocks for slowing down the depletion of food reserves or for commercial reasons. This may easily lead to spoilage and mycotoxin contamination from mould, or otherwise to the application of excess pesticides in storage places to reduce food losses.

Relief food

Victims of famines usually have no choice but to accept, even e.g. if the grain is moulded. Pesticide-treated cereals meant for sowing, may be consumed if not delivered together with enough food.
Food aid should be determined not only in quantitative, but also in qualitative and quality terms, considering safety aspects in the food chain from bulk purchase to consumption by victims.

Non-emergency food insecurity

Also in normal, non-famine situations food safety aspects may be intertwined with those of food security, in sometimes unexpected ways. An example is the use of bitter, highly toxic cassava varieties. In some African communities farmers deliberately opt for those varieties although far less toxic ones are available as well. The main reason is that the poison, indicated by the bitter taste, reduces voracity by herbivores and theft by people during times

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of food scarcity and thus contributes to their food security. Such toxic varieties are only used in communities where cassava dependency is high. This may be related to earlier experienced famine. Even the most toxic cassava can be turned into safe food by processing. So, *adequate processing is the key to eliminate the dilemma that poor cassava farmers face: to choose between food safety and food security*. Unfortunately, the traditional ways of processing in Africa are time consuming, so that in times when the increased food security offered by toxic cassava is most needed, the safety is most at stake as a hungry person lacks the necessary patience. Introduction of fast and effective but simple detoxification methods may then help to bridge the gap between cassava security and safety.

Conclusion

People are passively at higher risk and actively take greater risks regarding the safety of their food when the food security is (perceived to be) at stake. This has to be taken into account in planning food security and food aid.

What can be done?

* In a famine-prone area, for the most commonly chosen risky "famine foods", methods may be developed (and timely disseminated!) for efficient detoxification and for nutrient disclosure to enable human utilisation of the biomass.
* Relief food should be submitted to measurements regarding safety in the food chain from bulk purchase to consumption. Storage of foods (sometimes unplanned) is a critical stage.
* HACCP (Hazard Analysis of Critical Control Points) should be performed for different scenarios of relief foods, but also for common local and special famine foods. The conclusions from such scripts should be integrated in disaster (prevention) plans and general food security programmes.
* A compilation could be made for the different kinds of unsafety, different situations and vulnerable categories or groups in both acute emergencies and seasonal food insecurity. Much can be learned from past experience. A start can be made by documenting information from famine relief workers and from survivors of famines.

BOX 1: *Common threats of food safety come from*:

- **Phytotoxins** (inherent plant toxins; e.g. cyanogenic glucosides in cassava and sorghum, L-DOPA in velvet beans, solanine in potatoes)
- **Phycotoxins** (toxins in animal products; e.g. tetradotoxins in puffer fish)
- **Microorganisms,**
  Causing food spoilage, thus food losses, increasing food scarcity;
  Pathogenic microorganisms like salmonella and listeria spp.,
  Toxin forming microorganisms like clostridium botulinum
  Mycotoxins (toxins produced by fungi) like aflatoxin B_1 (liver cancer), ochratoxin A (kidney cancer), fumonisin B_1 (nephrotoxic, oesophagus cancer), deoxynivalenol (immunotoxic, food poisoning) and zearalenon (oestrogen).
- **Contaminants**,
  Pesticide residues
  Residues of veterinary medicines
  Heavy metals (e.g. cadmium from dyestuffs in kitchen utensils, mercury, lead)
  Other industrial pollution
  Additives (for preservation, coloration)
- **Parasites** (e.g. trichinoses and tapeworm in pigs)

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BOX 2: *Some of farmers' arguments for choosing bitter cassava varieties:*
- higher yield, especially in dry, poor soils
- faster bulking (maturing)
- longer in-ground storability
- protected against herbivore voracity
- protected against human theft
- less losses from the social obligation to share food
- stored dry roots better protected against weevils
- yields more or stronger alcoholic drinks

Note: this does not mean that all bitter varieties have these traits!

BOX 3: *Examples of intertwinedness of food safety and food security.*

Case: The rise of bitter cassava in south Mulanje, Malawi.
Fifty years ago, soils were fertile and maize was the dominant staple. Cassava was eaten once in a while as a snack. Because of population pressure, field sizes were reduced and fallow omitted. Maize yields decreased severely and cassava, which thrives also on poorer soils, became the dominant staple. Nowadays bitter cassava is gaining importance, replacing sweet varieties, because of its anti-theft properties in this food deficit area. Also the social obligation to share ones food during harvest and peeling is avoided this way, leaving more to store and to eat for the family. The unsafety at harvest increases the food security.

Case: Mogincual, Mozambique 1994: Toxicity prevented starvation.
When the displaced peasants returned to their farms at the end of the civil war, they found only bitter cassava in their fields. Sweet varieties and other crops had been looted by guerillas, soldiers, monkeys and swine. As they did not know how to detoxify rapidly, serious problems of acute poisonings were experienced daily. However, if that crop would not have been toxic, probably no food at all would have been left to them. A clear discrepancy between food security and food safety. A small extension campaign was launched on fast detoxification by the Ministry of Health.

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GRAIN BANKS, A VIABLE OPTION TO FOOD SECURITY ?

Grain banks are considered to be an important vehicle in the struggle for food security in the Sahel-region. On top of that, they form an instrument for village organisation.
Grain banks are a typical issue of the Sahel countries and are present in the areas that are structurally grain-deficit or have an unstable grain balance.
Several definitions exist: 'A grain bank is an enterprise in the hands of a village organisation which is responsible for the management of a stock of grain which serves to enhance the food security at village level.' 'A grain bank is a social and economic community organization for collection, conservation, storage and investment of grains to obtain food security at village level.'
They are meant to break the yearly impoverishment cycle of the peasant: Excessive selling and usage of grains at harvest time; selling animals in the months to bridge to the next harvest when animal prices are low, to buy grains which is then expensive.
In most cases all families are members without paying a fee. In the period just before harvest, when family stocks are depleted, they can claim the grain stocks in the granary. After the harvest, the stocks are replenished by purchases from the earlier sales cash. The advantages for the members are the price stability over time and saving on the opportunity costs of transport and time loss and sometimes the possibility to buy on credit.

Grain banks are seen as the starting point for a development process at village level. The improved organisation and the positive effects on the food security can form the starting point for other development activities.
In the areas that rather have a structural grain surplus, other grain (outlet) banks exist, that sell off the surplus. The advantage for the members is in general the better price they get for the grain. Mixed forms exist in the transition zone.
Usually, grain banks initially receive a credit from grain bank projects. The conditions and amount vary, the latter being usually between $ 1000 and 14000, sufficient for some 10 Mt of grain. Often, there is also an initial form of subsidy in the form of subsidy on interest or on building the construction.

Economic viability and profitability

The units need a certain profit margin as a self supporting business to survive. On the other hand, the individual and collective advantages for the members should be clear enough to keep them motivated to continue the organisation.
The main source of income is the sale of grain to the members. The costs imply the purchase, packaging and transport of grain, depreciation of the building and scales, salaries, costs of physical losses and others.
The profit for the business depends on the margin in price between buying and selling; the turnover (sales); selling on credit to its members; expenditures on other than grain bank items; received subsidies. The two elements that undermine the profitability most appeared the non-refunding of the internal credits and the use of revenues for other (mostly community based) expenses.

Profitability can be considered from the point of view of the entrepreneur and of the government. Next to the net profit that the first considers (financial profitability), the government also takes into consideration the societal costs and benefits, totalling the economic profitability.
The profitability of grain banks can be calculated as the calculation of cost-benefit over one year, or on the basis of a balance of capital over several years. The latter is most applied, as less detailed data are needed, which makes it easier, but the information gives less direction for possible improvements.

Two publications on the question of whether or not grain banks are profitable, an FAO report of 1990 and a USAID & DAI study of 1991, came to disagreeing results. However, they did not include empirical data to substantiate their opinions.
Combined analysis in 1993 (P. Van Wijk for SNV/Mali, 'De economische levensvatbaarheid van graanbanken') of 3 large studies, with data from more than 100 villages over several years, showed an economic profitability in a narrow sense, corrected for subsidies, of 13 to 20%. This was more than the 10 to 13% interest rates of commercial bank credits, which is good.
The failure of some grain banks is suggested to be due to amateurish approach of the projects or to the start problems of organizational nature at village level.
The relation between the grain banks and the commercial enterprises in the grain market and their mutual influence has not yet been studied.
It was concluded that grain banks are viable village enterprises and that the cooperative form of business is a suitable management structure for grain banks. The long performance of some banks shows that grain banks are capable of sustainably coping with the demands of the grain market (Van Wijk, 1993).

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Are the grain banks capable of ensuring food security?

A large study in Mali (Van Altena, 1997) on 'Les Greniers de Prévoyance au Mali' was conducted. The initial credites a bank received was enough to buy about 20 kg per 'member'. This was calculated to be a reasonable amount to compensate for the average grain deficit in a bad harvest year, starting from an average yearly need of 200 kg/member and the worst production per member in 10 years of 180 kg, corrected for losses etc. So, that capacity is enough for ensuring food security. But, in this case, only about 10 kg was in stock just before the lean season. It was concluded that only about half of the grain quantity calculated to be necessary to permit feeding the population in case of crises was in stock. There was a discrepancy between the consumers' and the producers' interest. In the critical period of 1996, when the stocks should have been restored, a large proportion of the capital was financial and another part had been spent on other expenses, due to other preferences than having the stocks. It seems that the longer ago the last crisis, the less motivated the population is to organize a food stock at communal level.

It is suggested that the grain banks also had a positive effect on the production conditions, as the peasant can now feed himself during harvest time.
The grain banks were operational in the majority of the villages, they had contributed to the organizational capacity of the village and invested in communal goods.

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29th INTERNATIONAL COURSE ON FOOD AND NUTRITION

Food and nutrition security: caring for women and children

Module on urban nutrition

Street foods: the health hazards

Facilitator: R. Nout

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STREET FOODS

- ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers especially in streets and other similar public places

- ready-to-eat food: any food (including beverages) which is normally consumed in its raw state or any food manipulated, processed, mixed, cooked, or otherwise prepared into a form in which it is normally consumed without further manipulation

- preparation:
  1. at home
  2. on the street

- vending:
  1. stationary (road-side stall)
  2. mobile (hawker)

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STREET FOODS

Some examples:

Indonesia:

- Es cendol (sago, coconut milk, sugar, ice)
- Nasi rames (cooked rice, meat, vegetables, etc)
- Es puter (coconut milk, sugar, flour, made into icecream)
- Gado-Gado (boiled/steamed vegetables)

Africa:

- Fritures (fried plantain, yam, fish, etc)
- Fruits
- Donuts (dumplings, often fried)
- Beverages
- Sandwiches
- Complete meals

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STREET FOODS

Urbanisation:

- increased food demand in cities
- less traditional life style: "eating out" for breakfast or during lunch breaks
- important influx of poor, unqualified people from rural areas

Importance

1.For Producer:

- mainly female
- no official qualifications needed
- no or little investments required
- income generation (Indonesia 1992: about 2-3 * official minimum wage)

2.For Customer:

- need for convenience (special dishes that take too much time or special skills to do at home)
- need for fast feeding (nearby, and quick serving)
- population: low - upper middle income, including big number of children.

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TABLEAU 2
Les femmes dans l'alimentation de rue

Pays	Pourcentage de femmes parmi les vendeurs
Bénin (Cotonou)	90
Congo (Brazzaville)	55
Côte d'Ivoire (Abidjan)	81
Ghana (Accra)	94
Kenya	75
Lesotho	85
Mali (Bamako)	80
Mauritanie (Nouakchott)	75
Nigéria:	
(Ibadan)	86
(Kaduna)	79
(Lagos)	81
Sénégal (Dakar)	77
Togo	87
Ouganda (Kampala)	72
Zaïre (Kinshasa)	82
Zambie	70

Note: Ce tableau a été dressé à partir d'études plus ou moins ponctuelles effectuées de 1987 à 1995 avec des objectifs divers et selon des méthodologies différentes. Ces chiffres sont donc indicatifs et ne peuvent que difficilement être comparés entre eux.

Source: FAO, 1984-1996.

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TABLEAU 3
Revenus journaliers par vendeurs provenant de l'alimentation de rue

Pays	Revenus/jour
Bénin (Cotonou)	1 500-15 000 FCFA
Burkina Faso	7 102 FCFA
Congo	2 000-20 000 FCFA
Côte d'Ivoire (Abidjan)	3 000-10 000 FCFA (22 000 FCFA mensuel[1])
Madagascar	71-143 FF/mois
Malawi	60-250 K/mois
Mali	1 000-3 000 FCFA
Maroc (Rabat-Salé)	1 715 DH[2] (800 DH/jour)[1]
Mauritanie (Nouakchott)	200-5 000 UM (supérieurs aux salaires publics)
Nigeria	25 $EU/mois[1]
(Ibadan)	2,5 $EU
(Lagos)	3,5 $EU
(Kaduna)	3,5 $EU
Tanzanie	120 Tsh (24 Tsh/jour)[1]
Togo	1 500-15 000 FCFA
Ouganda (Kampala)	10 $EU (50 $EU/mois)[1]

[1]Salaire minimum garanti dans le pays.
[2]150 pour cent des vendeurs de nuit ont un revenu supérieur à celui d'un enseignant de l'école secondaire.
Note: Ce tableau a été dressé à partir d'études plus ou moins ponctuelles effectuées de 1987 à 1995 avec des objectifs divers et selon des méthodologies différentes. Ces chiffres sont donc indicatifs et ne peuvent que difficilement être comparés entre eux.
Source: FAO; 1984-1996.

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TABLEAU 1

Typologie des consommateurs – pourcentage par rapport au total du groupe considéré (sexe, état civil, âge et taux de fréquentation)

Pays	Hommes	Célibataires	Moins de 30 ans	Fréquentation (1 fois/ jour)	Fréquentation (2 fois/ jour)
Côte d'Ivoire (Abidjan)	74	66	35	52	-
Ghana (Accra)	65	71	75	36	44
Mali (Bamako)	-	-	60	58	-
Maroc (Rabat-Salé)	(majorité)	(majorité)	60	-	-
Nigéria (Ibadan)	58	49	70	40	34
(Lagos)	70	31	56	46	26
(Kaduna)	62	66	75	43	14
Ouganda (Kampala)	76	58	77	-	-
Zaïre (Kinshasa)	95	53	(âge moyen 38 ans)	-	-

(-) pas d'information disponible

Note: Ce tableau a été dressé à partir d'études plus ou moins ponctuelles effectuées de 1987 à 1995 avec des objectifs divers et selon des méthodologies différentes. Ces chiffres sont donc indicatifs et ne peuvent que difficilement être comparés entre eux.

Source: FAO, 1984-1996.

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TABLEAU
Type d'aliments achetés par les enfants à l'école

Nourriture	Cotonou n = 227		Bamako n = 361	
	Aliments de base	% d'enfants acheteurs	Aliments de base	% d'enfants acheteurs
Plat préparé	Pain	60	Pain	26
	Maïs	52	Tubercule	21
	Beignet	39	Haricot	20
	Riz	29	Blé	18
	Tubercule	11	Fonio	11
	Haricot	6	Légumes	4
			Mil	2
Fruit	Mangue	18	Goyave	7
	Agrumes	15	Agrumes	6
	Autres	2	Autres	9
Arachide		22		15
Boissons	Maïs	14	Eau	9
	Eau	4	Lait	2
Glaces		22		37
Sucreries		9		18

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STREET FOODS

Problems:

- **Hygiene aspects:**
  - The environment:
    unsanitary conditions

  - Food handling:
    lack of knowledge
    lack of incentives to improve
    poor quality (cheap) raw materials
    lack of protection of the food against pollution
    time - temperature abuse
    recycling of unsold food
    lack of facilities for cleansing, washing of utensils, dishes etc.

  - Microbiological hazards:
    survival of pathogens (Salmonella, Shigella, E.coli, viruses)
    growth and toxin production by toxinogenic bacteria (B.cereus, Cl.perfringens, Cl.botulinum, S.aureus)

- **Nutritional aspects:**
  - high fat content (deepfried foods), combined with starchy staple foods:
- tendency for imbalanced diet:
  - hazard: hypertension, cardio-vascular disorders, obesitas

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Hazards Associated with Holding and Reheating Foods at Vending Sites in a Small Town in Zambia

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ABSTRACT

Hazard analyses were done at 11 cooked-food-vending sites and related food-vending operations in a small-town market along a highway in Zambia. The analyses consisted of observations and time-temperature measurements at the vending sites and interpretations of results of laboratory tests of samples of foods (including leftovers) collected after holding and reheating. Salmonellae were isolated from dried ants, a cooked meatball on display, and pumped river water used by the vendors. Ants for sale at the market contained 10^7 *Bacillus cereus* cells per g. *Nshima* (boiled maize meal) was held at high temperatures in pans over glowing charcoal fires which steam was generated throughout the entire holding period during the day, preventing bacterial growth. Large populations of *B. cereus*, however, were isolated from a sample left overnight at ambient room temperature. Cooked foods other than *nshima* were held at room or outdoor ambient temperatures throughout the day and overnight. High aerobic mesophilic colony, thermotolerant coliform and, in a few foods, *Escherichia coli* counts were found in foods after several hours of holding during the day of preparation and of foods held overnight. Temperatures attained during reheating were variable and sometimes would have resulted in survival of foodborne pathogens that multiplied during holding.

Key words: Food vending, hazard analysis, Zambia, food safety

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Street and market foods are often vended over long durations and may or may not be reheated before serving. Holding cooked foods at room or outdoor ambient temperatures for several hours is the primary contributory factor to outbreaks of foodborne diseases *(1, 2, 19)*. Hazard analyses of vending sites have shown that cooked foods are often held in ways that are assessed as high risks of leading to microbial growth and potential foodborne illness *(6, 7–9, 13, 14, 22)*. Furthermore, street-vended foods, after hours of holding or holding overnight, have been found to have high microbial populations *(6, 7–11, 17, 18, 20)*. Reheating could alleviate some of these hazards, but this action has not always been done effectively at vending sites *(6, 7–9)*. Inadequate reheating is a frequent contributory factor to foodborne outbreaks *(1, 2)*.

Hazard analyses were conducted of food-vending operations in a market in a small town in Zambia to evaluate cooked-food-holding and reheating practices. Risks were assessed from observations and time-temperature measurements, with consideration of simple, economical, and effective foodborne-disease preventive measures.

MATERIALS AND METHODS

Description of vending operations

The market is located just off a highway along with buildings that contain restaurants, snack bars, butcher shops, and a variety of small businesses. Some cooked-food vendors were located in and outside of two rows of concrete buildings perpendicular to the road. Parallel to the road was another concrete-block structure that housed more cooked-food vendors. Immediately behind this structure were two long concrete tables where fresh produce and dried foods are sold. A concrete-block building that contained additional concrete tables constructed to be an indoor market, but empty at the time of the investigation, was located toward the end of the two perpendicular structures. Two structures constructed of mat and tin were in front of the indoor market building; they housed cooked-food vending operations. These structures formed a plaza in the center where other vendors sold beans, dried fish, and cooking oil from either tables or the ground. Between the road and the plaza, other vendors with tables under roofs or covers held in place by poles sold a variety of commodities. Chickens, goats, raw and sour milk, and bread were sold in the open area between the road and the buildings. Behind the indoor market, there was a lot where corn and melons were steamed over log- and stick-fueled fires. A water tap from which pumped river water was obtained for cooking and washing was located in the middle of the lot. A short distance behind the tap was a site of a filled latrine, and a concrete-block latrine was located just behind it.

Eleven vendors cooked foods in front of the described structures. Tables and benches were located inside most of the vendors' structures where some customers ate the foods they purchased. Some vendors held their foods inside these structures, others kept foods outside near where they were cooked. A girl brought cooked chicken on a large platter which was covered by plastic to the market from her home. She sold it at the end of one of the stands where fresh produce and dried foods were displayed for sale. The chicken was held throughout the day, unheated. Late in the day her father took her place at the stand.

Most of the vendors prepared *nshima* (white maize meal

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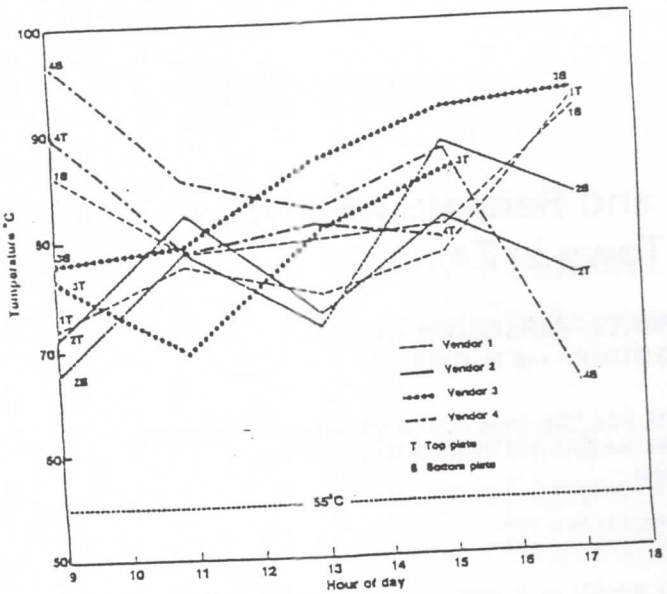


FIGURE 1. *Time-temperature exposures of* nshima *during holding at four vending sites.*

the food was being displayed. Hands of vendors would be contaminated by microorganisms, including pathogens associated with raw meat and raw chicken during handling. Hand washing by vendors was not observed.

Cooking. In the manner in which this investigation was done, although observed, cooking was evaluated at only a few vending sites. When temperatures of foods were measured during or just after cooking, temperatures above 70°C were observed. Exposures to such temperatures would result

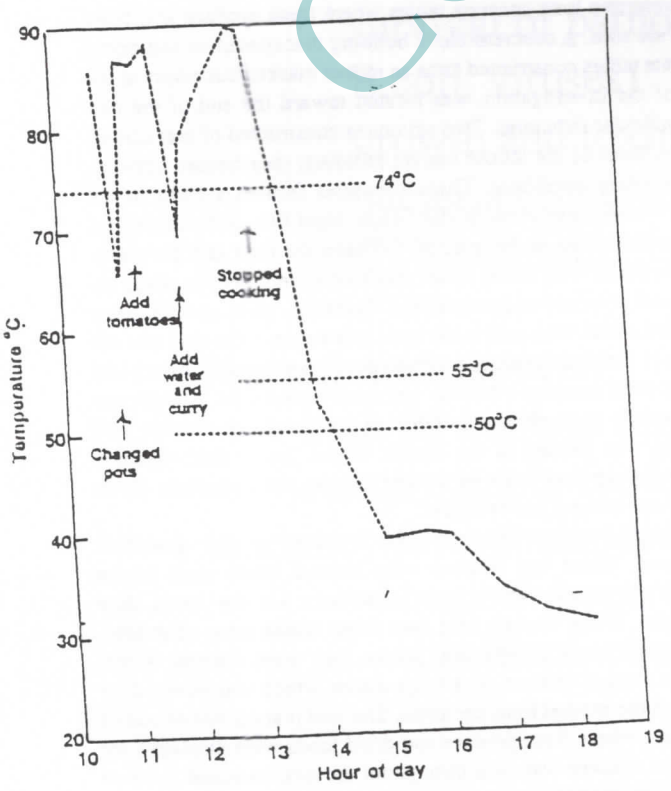


FIGURE 2. *Time-temperature exposures of beef stew during cooking and holding;* vendor 4.

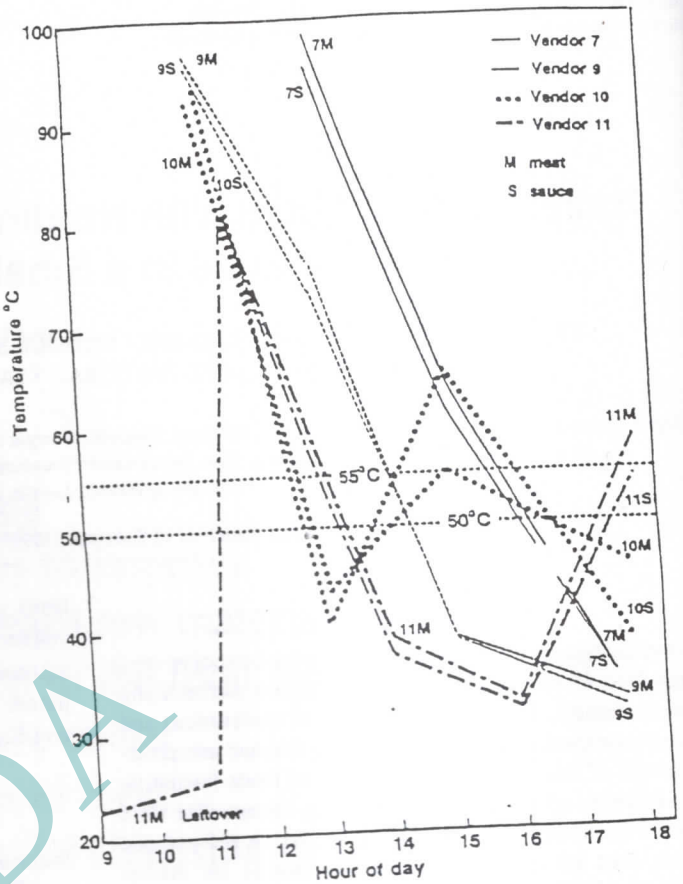


FIGURE 3. *Time-temperature exposures of meat stew during holding at four vending sites.*

in the death of vegetative forms of foodborne pathogens probably in less than a minute and at 74°F within a few seconds. Bacterial spores (e.g., *B. cereus*), however, would survive cooking.

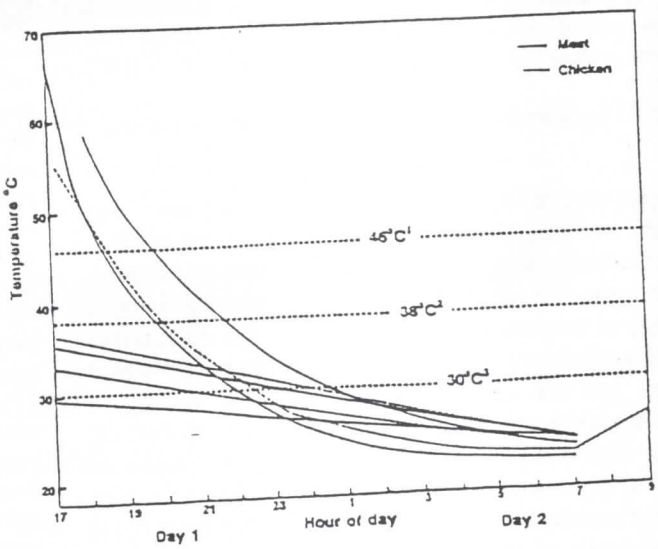


FIGURE 4. *Time-temperature exposures of chicken and meat during holding at ambient room temperature overnight. Optimal temperatures for growth of* [1]Clostridium perfringens; [2]Escherichia coli, *shigella, salmonella, and* Staphylococcus aureus; [3]Bacillus cereus.

CORDA

STREET FOODS

Projects / Interventions:

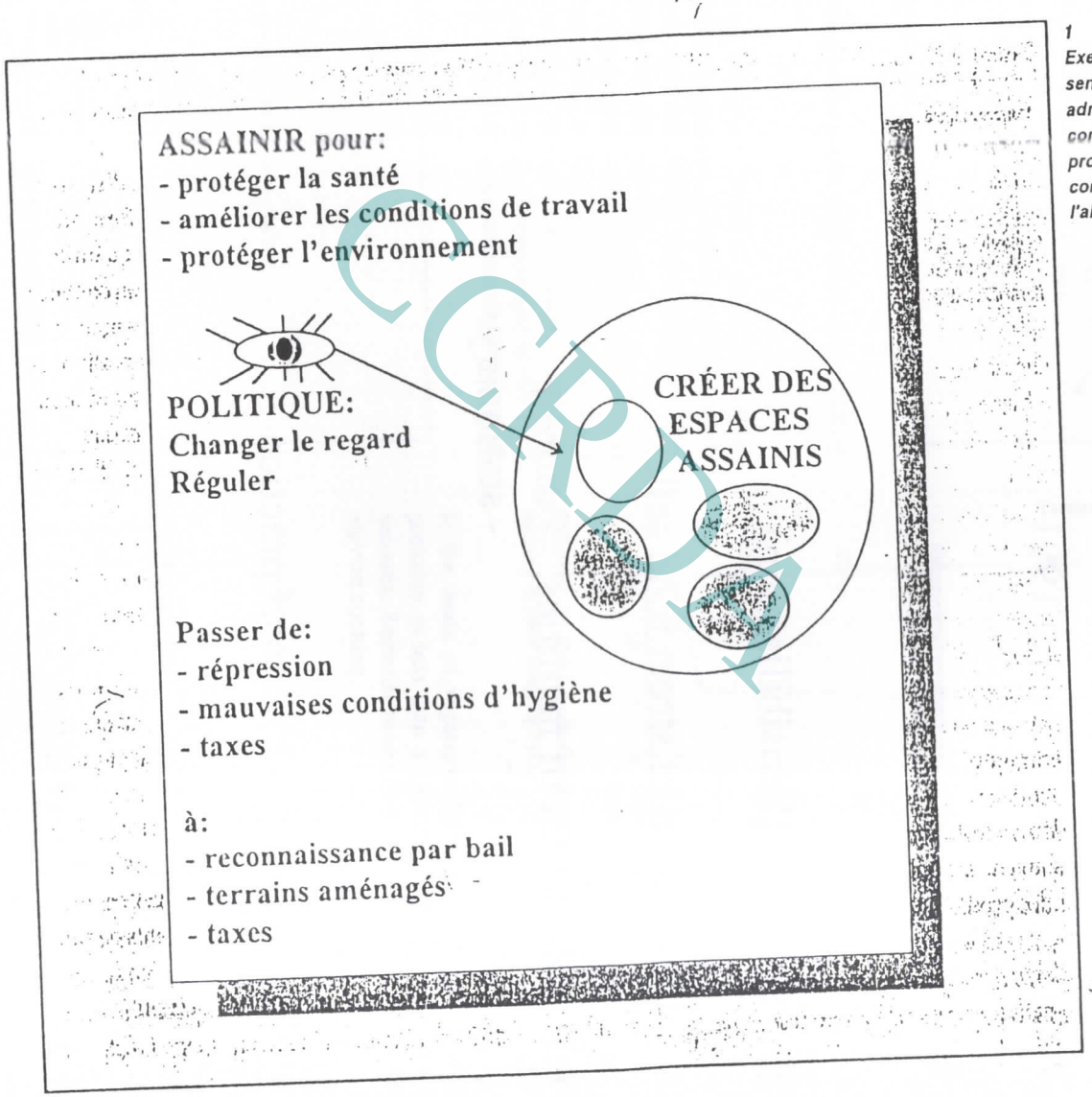
Bogor, Indonesia 1990

Peru (Cholera epidemic) 1991

Bangkok 1994

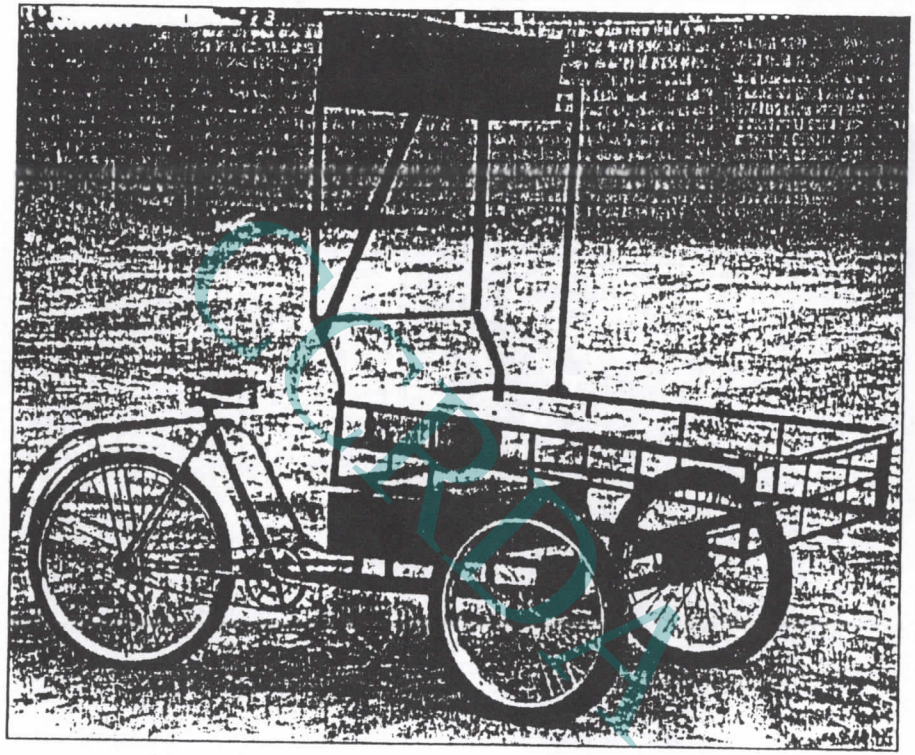
- Awareness (Sensibilisation)
- Organisation of street food sellers
- Improvement of facilities: - mobile
  - stationary
- Training
- Legislation and Codes of practice
- Licensing and/or Certification
- Status Improvement

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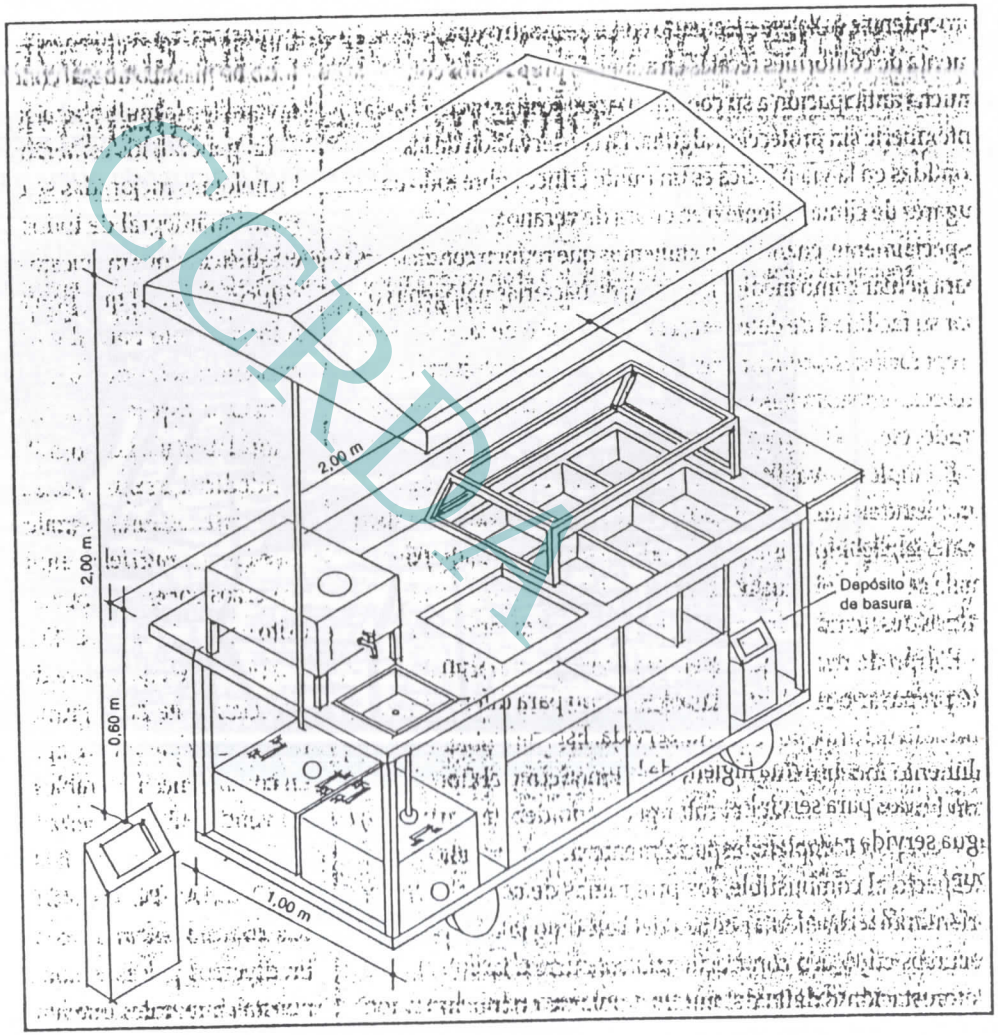
1
Exemple de fiche de sensibilisation des administrations concernées par la promotion et le contrôle de l'alimentation de rue

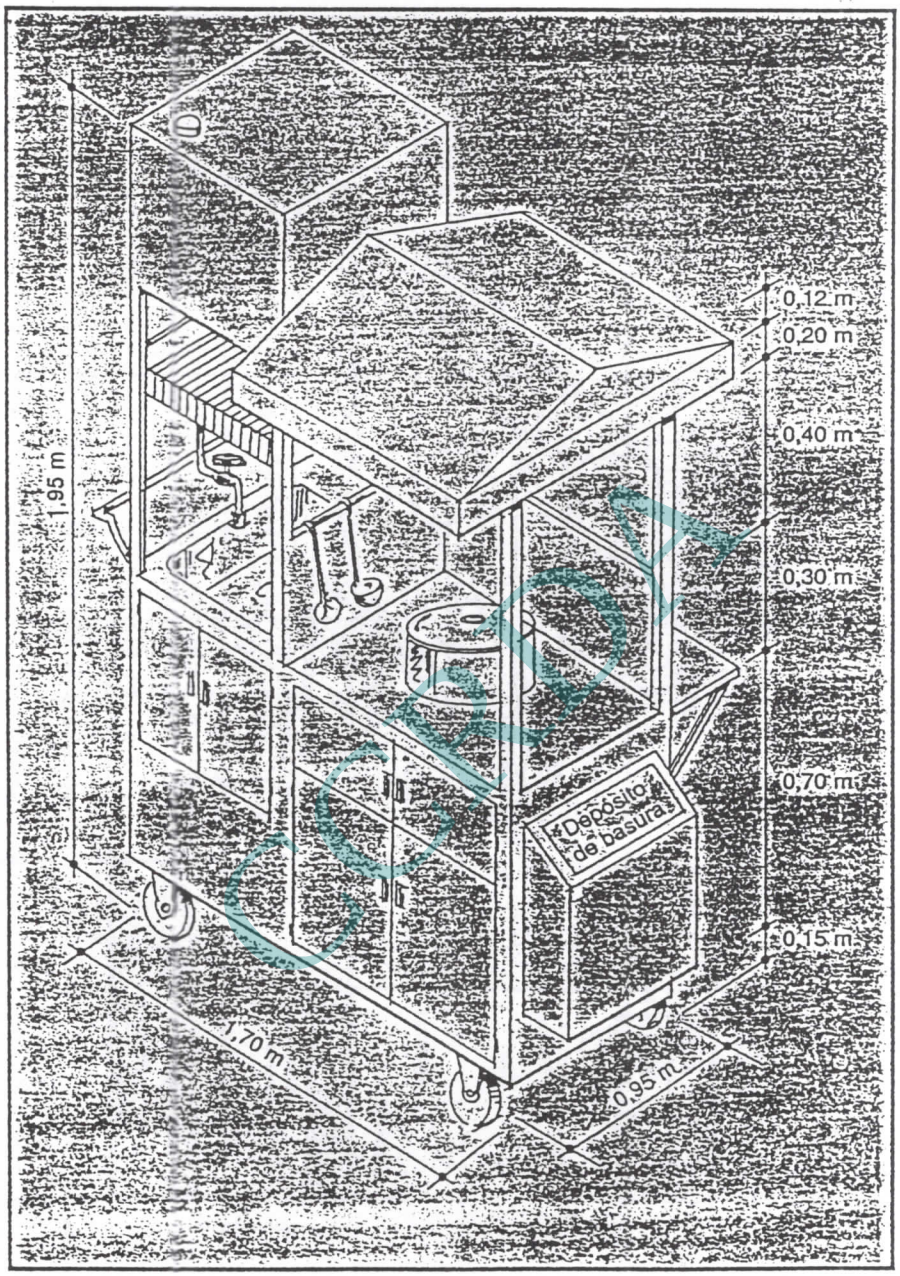
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Módulo sanitario tipo triciclo propuesto por el Ministerio de Salud Pública para Tacna, Perú

1
Carrito para la venta callejera de «tacos» en México



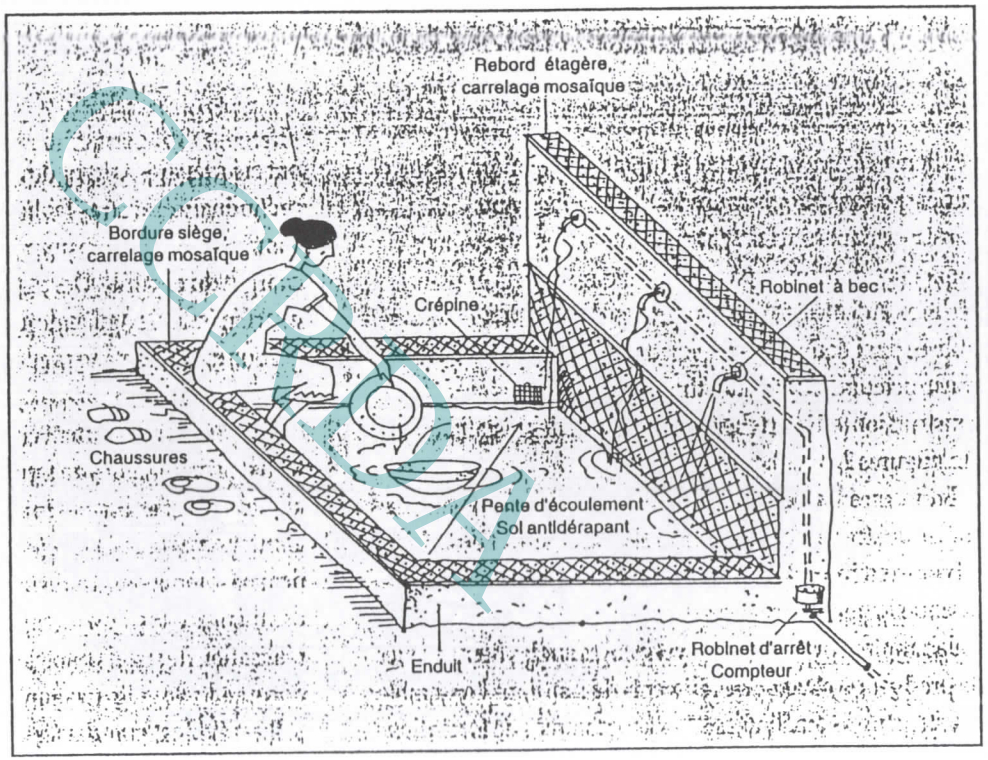


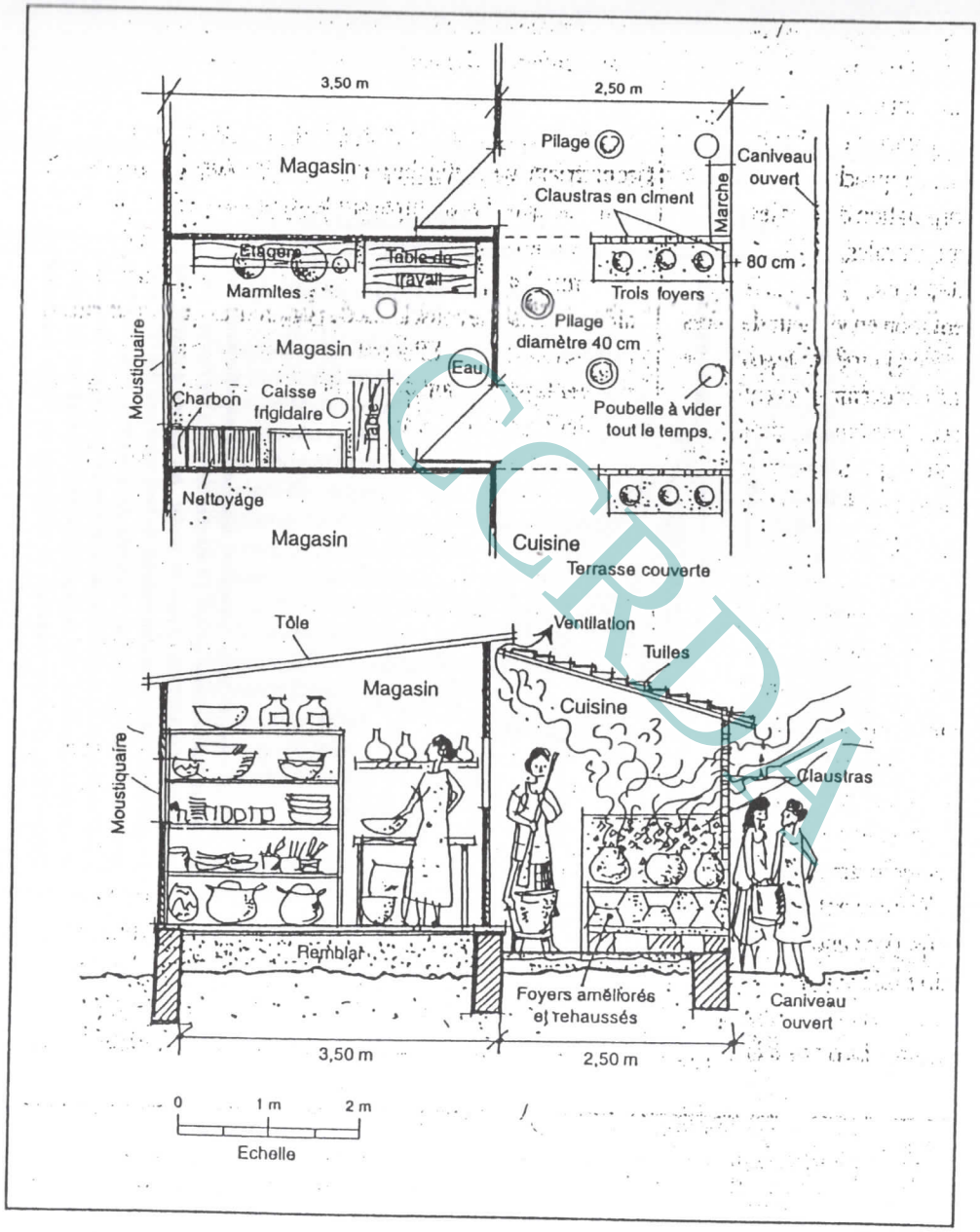
2

Modelo de puesto de venta mejorado y ampliado para cocinar propuesto por el Ministerio de Salud Pública del Perú

2

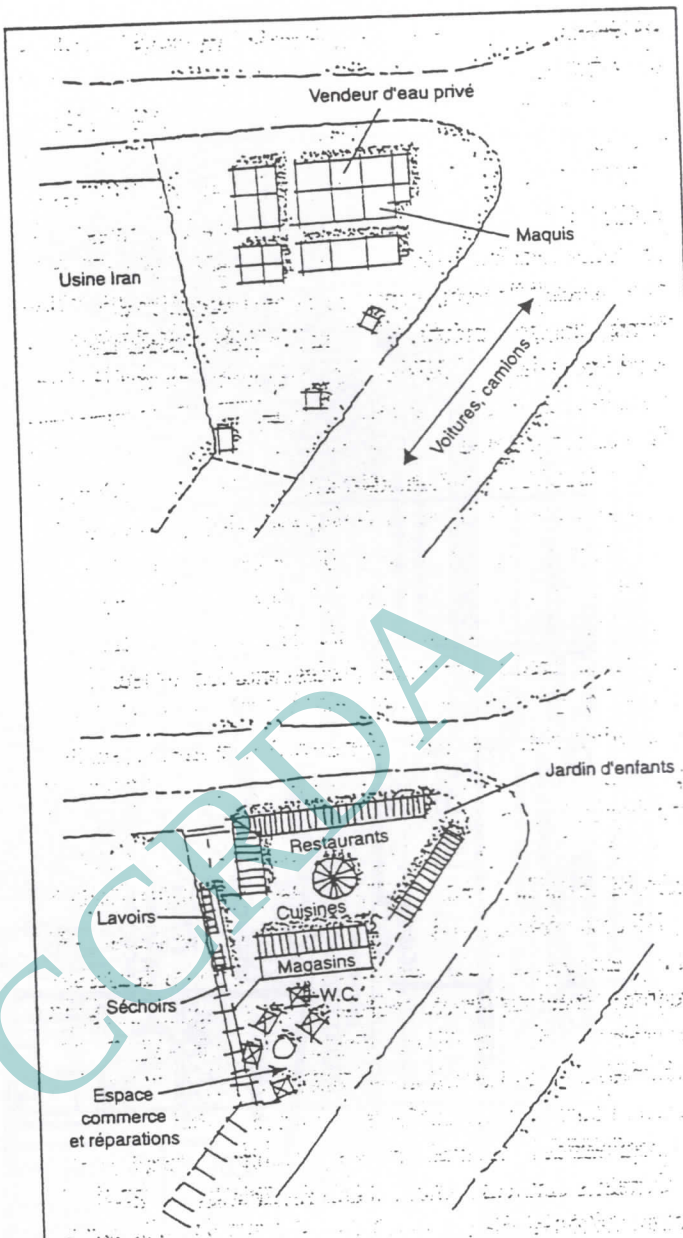
Construction de lavoirs, structure à usage collectif





3
Cuisines/magasins du maquis pilote Miran (Port-Bouët Vridi)

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En Côte d'Ivoire, le terme «maquis» désigne les emplacements des vendeuses d'alimentation de rue. Le maquis de Vridi a été l'un des sites pilotes du TCP/IVC/2353. Avant le projet, les stands entassés des vendeuses se composaient de poteaux de bois soutenant des tôles et de quelques tables et chaises pour les clients. Aucune infrastructure sanitaire n'était disponible à proximité de ce terrain vague coincé entre une usine et des voies routières. Par le projet, différents espaces ont été prévus (restauration, cuisines, magasins et sanitaires) de façon à associer hygiène et attrait.

4
Evolution du maquis pilote de Vridi, Abidjan

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CUADRO 2
Situación de la reglamentación nacional en materia de control sanitario de alimentos callejeros

País	Tipo de reglamentación	Fecha de expedición	Aspectos que reglamenta
Bolivia	Resolución Ministerial Nº 1134/92	nd	a, b, c, d
Brasil			
Paraná	Resolución Nº 31/89, Secretaría de Salud	15/6/89	
Curitiba	Ley Municipal Nº 6407	17/8/83	
Curitiba	Decreto Municipal Nº 380	21/9/87	
Curitiba	Decreto Municipal Nº 381	21/9/87	c, e
Curitiba	Decreto Municipal Nº 102	10/4/90	
Curitiba	Decreto Municipal Nº 104	10/4/90	
Natal	Reglamento Municipal de venta ambulante	5/88	
Chile	Decreto Supremo Nº 60/82	1992	a, b, c, d
Colombia	Resolución Nº 0604/93	1993	a, b, c, d, f
Ecuador	Acuerdo Ministerial Nº 14381	10/6/92	a, b, c, d, f
El Salvador	Ordenanza Municipal		a
Guatemala	Acuerdo Gubernativo Nº 443/92	7/92	a, b, c, d, f
	Acuerdo Corporación Municipal	11/92	
Honduras	Acuerdo Nº 0035	8/3/93	a, b, c, d, e
Panamá	Decreto Nº 256	13/6/92	a, b, e
	Resuelto Nº 1369	20/9/91	Control de los productos para la prevención del cólera
	Resuelto Nº 1545	29/10/91	a, b, f
	Resuelto Nº 36	28/10/91	a
Paraguay	Ordenanza de la Ciudad de Asunción Nº 7/93	6/7/93	a, b, c, d, e, f
Perú	Resolución Ministerial Nº 014-92	17/1/92	a, b, c, d, e, f
República Dominicana	En proceso de aprobación	–	–
Uruguay	Diversas ordenanzas municipales	nd	a,b,c,d,g

Nota: Los aspectos reglamentados se señalan como: a = requisitos del manipulador; b = condiciones del puesto; c = condiciones de la manipulación; d = registro y licencia; e = tipo de alimento; f = vigilancia y control; g = higiene ambiental y urbanística. Para las fechas de expedición no disponible = nd.
Fuente: FAO, 1994a.

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codex alimentarius commission

FOOD AND AGRICULTURE
ORGANIZATION
OF THE UNITED NATIONS

WORLD HEALTH
ORGANIZATION

JOINT OFFICE: Via delle Terme di Caracalla 00100 ROME Tel.: 57971 Telex: 625852-625853 FAO I Cables: Foodagri Rome Facsimile: (6) 57973152-5782610

Agenda Item 8

CX/AFRICA 92/7

JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX COORDINATING COMMITTEE FOR AFRICA
Tenth Session
Abuja, Nigeria, 3 - 6 November 1992

PROPOSED CODE OF PRACTICE FOR STREET FOODS

Street food vendors operate in many countries, but only some of these countries have regulated the practice in the business. This informal sector of food distribution is of great interest to FAO, which Organisation has initiated studies related to the trade in many countries. The safety and quality of the food served, the socio-economic and cultural impact of street vending of food on the lives of the people, and training of supervisors of street food vendors are among the areas FAO is providing assistance on a TCDC basis.

The regulation of vendors must be preceded by the existence of a regulatory mechanism one of which is a set of standards to guide street food vendors, consumers and even regulatory officials in good practice of the trade. One of the recommendations of the inter-country Workshop on Street Foods in Africa held in Accra, Ghana from 29 April to 1 May 1992 was that "street food should be recognised and proper regulations (including licensing systems) be prepared by the national authorities in collaboration with local government and representatives of both vendors and consumers' interests." As a consequence of this recommendation FAO has prepared a Draft Code of Practice for Street Foods in Africa.

The Code is more of an advisory document and an operational manual rather than a set of mandatory or regulatory requirements demanding absolute compliance. The Committee is invited to examine the draft Code and provide a forward-looking and appropriate Code of Practice for Street Foods in Africa.

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Preamble

The Intercountry Workshop on Street Foods in Africa held at Accra, Ghana from 27 April to 1 May 1992, recommended amongst other things, that 'street food should be recognized and proper regulations (including licensing systems) be prepared by the national authorities in collaboration with local government and representatives of both vendors' and consumers' interests.

The Code that follows is proposed as a first step towards the implementation of that recommendation. The provisions of the Code reflect closely those included in a similar Code elaborated by Malaysia and presently under consideration for further development.

As it stands, the Code provides for the recommendations of the Accra meeting in respect to the licensing of vendors, the health, hygiene and behaviour of vendors; their training, water supply, appliances, food preparation and its cooking handling and serving, food storage, dealing with waste, street food centres and customer facilities.

The Code also provides for a Street Food Advisory Service whose proposed function is to work with vendors offering them on-site advice and guidance to improve their operations in accordance with the requirements of the Code.

The Code is presented as an advisory document and more as an operational manual than a set of mandatory or regulatory requirements demanding absolute compliance. Following trial of the Code it may very well be appropriate to incorporate those provisions proved valuable into regulations. However, as street food vending is a most important if not essential source of food for low income earners and a source of income for many others, including women who would otherwise be unemployed, care must be taken that it is not unnecessarily obstructed and discouraged by over-regulation and officiousness.

While there should be no compromise with the health of consumers, neither should controls greater than required be applied to purveyors of street foods. On-the-spot advise to vendors by qualified advisors may be sufficient in many cases to make the difference between unsafe and safe products. For this reason, '9.5 Street Food Advisory Service' has been included in the Code in addition to 4.3 Training of Vendors'; the former being less formal than the latter, with advisors working amongst vendors during business hours.

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A DRAFT CODE OF PRACTICE FOR STREET FOODS IN AFRICA

SECTION 1 - INTRODUCTION/SCOPE

The objective of this Code is to upgrade the operation of the street food industry to ensure that the population has available wholesome, safe and nutritious food in accessible places and at affordable prices.

The Code specifies the general hygienic requirements and practices to be observed in the conduct, preparation and sale of street foods.

SECTION 2 - DEFINITIONS

For the purpose of this Code, unless indicated otherwise, the following definitions apply:

2.1 **Street Foods:** ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers especially in streets and other similar public places, (see FAO Food and Nutrition Paper 46).

2.2 **Static Vendor:** means any person setting up a stall in any public or private location for the purpose of preparing, serving or displaying for sale any food or ready-to-eat food and/or beverages.

2.3 **Mobile Vendor:** means any person with/without a vehicle going from place to place for the purpose of preparing, serving, displaying, distributing or delivering any food or ready-to-eat food and/or beverages for sale.

2.4 **Street Food Centre:** means any public place or establishment designated by the relevant authority for the preparation, display and sale of ready-to-eat food and/or beverages by multiple vendors.

2.5 **Environment:** means surroundings pertaining to the purchase, transportation and storage of food ingredients and the preparation, storage, transportation, display and sale of street food.

2.6 **Sputum:** means saliva or spittle mixed with mucus or purulent matter, and expectorated in certain disease states of the lungs, chest or throat.

2.7 **Impermeable:** means not allowing the passage of water and/or fluid.

2.8 **Crockery:** means all glasses, plates, dishes, cups, saucers, spoons, forks, ladles, chopsticks and other articles used in serving and consumption of food, including disposable articles.

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2.9 **Utensil:** means any appliance, container and equipment including traditional types used in the preparation, storage and sale of foods.

2.10 **Waste Water:** means sullage water arising as a result of the activity of vendors.

2.11 **Relevant authority:** means the Ministry having responsibility and any local authority.

2.12 **Perishable Food:** means food that is of such a type or is in such a condition that it may spoil.

2.13 **Readily Perishable Food:** means perishable food that consists wholly or partly of milk, milk products eggs, meat, poultry, fish or shellfish, or ingredients that are capable of supporting the progressive growth of microbiological organisms that can cause food poisoning and other food borne illness.

2.14 **Potable Water:** means treated water which shall comply with applicable potable water requirements, (e.g. WHO Guidelines for Drinking Water Quality).

2.15 **Clean Water:** means water from any natural source where there is no reason to believe the water is contaminated.

2.16 **Microorganisms:** means any microscopic living organism that can cause disease or food spoilage.

2.17 **Pest:** means any member of the animal kingdom,including domestic animals, capable of directly or indirectly contaminating food..

2.18 **Sealed Container:** means all forms of containers that are:

- hermetically sealed
- sealed jars, with anchor and crown type closures
- milk bottles sealed with aluminium caps
- glass jars and bottles with screw caps; and,
- cans and similar containers with or without hermetic seals.

2.19 **Disposable articles:** means any appliance, container, implement utensil or wrapper that is intended for use only once in the preparation, storage, display, consumption or sale of food.

2.20 **Water container:** means any form of food grade container which is used solely for the purpose of storing water and has not been used previously for any other purposes.

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2.21 **Street Food Stall:** means a place where street food is prepared, displayed, served or sold to the public. It includes carts, tables,-benches, baskets, chairs vehicles with or without wheels and any other structure approved by the relevant authority where on it or in it, any ready-to-eat food or beverages are displayed for sale.

2.22 **Appliances:** means the whole or any part of any utensil, machinery, instrument, apparatus or article used or intended for use, in or for making,preparing, keeping, selling or supplying of food.

2.23 **Ready-to-eat Food:** Any food (including beverages) which is normally consumed in its raw state or any food manipulated, processed, mixed, cooked, or otherwise prepared into a form in which it is normally consumed without further manipulation.

SECTION 3 - GENERAL REQUIREMENTS

3.1 Regulations

To enable official recognition and control of the street food industry as an integral part of the food supply, appropriate regulations should be prepared either separately or for incorporation into existing food regulations.

3.2 Licensing of Vendors

No vendor shall conduct his/her business of preparation, packing, storage, display and sale of any ready-to-eat food and beverages unless he/she is licensed under the relevant food regulations.

3.3 Conditions for Licensing

No relevant authority shall register or renew the registration of any vendor who does not comply with all requirements of this Code and any other requirements that are specified by the relevant authority.

3.4 Display of Notices

Every registered vendor shall at all times display conspicuously

3.4.1 His/her vendor's License

3.4.2 Where required by the relevant authority:

i) A notice printed in plain capital letters not less than 25 mm point lettering in the following or similar words, namely, ANIMALS ARE NOT ALLOWED" in and around the business

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area. Posters and/or graphical illustrations could alternatively be used.

ii) A notice indicating the proper attire for vendors specified by the relevant authority.

iii) Any other notices that are required to be displayed.

3.5 Pest Control

Every vendor shall at all times take suitable and appropriate measures as may be necessary to keep his/her stall free from pests, including rodents, flies,insects or vermin infestation.

Every vendor shall, on becoming aware of the presence of any such pest or harbourage, immediately take all practicable measures to get rid of the pest or harbourage and to prevent reinfestation.

Any food found to have become contaminated by pests shall be appropriately destroyed in a hygienic manner.

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SECTION 4 - VENDORS

4.1 Health Status of Vendors

4.1.1 Any vendor, helper or food handler, whether suspected of suffering from a communicable disease or not, who is likely to transmit disease producing organisms to food shall not conduct his business until he furnishes a certificate from a medical practitioner that he is free from infection.

4.1.2 Any vendor, helper or food handler who is suffering from diarrhoea and/or vomiting shall cease from handling food in any capacity and seek medical treatment.

4.1.3 Any vendor, helper or food handler who has been identified as or is known to be or has previously been a carrier of foodborne disease organisms, shall not be involved in any food handling activity until certified by a Medical Officer of Health as a non-carrier.

4.1.4 Any vendor, helper or food handler may be required to undergo medical examination and necessary investigation by the relevant authority before he is issued a licence and at any other time as deemed necessary by the relevant authority.

4.1.5 Any vendor, helper or food handler shall be required to be immunized against food and water borne disease such as typhoid or any other food and water borne diseases as required by the relevant authority.

4.2 Personal Hygiene and Behaviour

Every vendor, helper or food handler, during the conduct of his business, shall observe the following:

4.2.1 Wear an identification tag if issued and required by the relevant authority.

4.2.2 Dress in clean and proper attire.

4.2.3 Wear clean, light coloured overalls, aprons and other appropriate outer wear, head gear and shoes.

4.2.4 Wash hands thoroughly with soap and clean water before and after handling food, after visiting the toilet, after handling insanitary articles, after handling toxic and dangerous materials as and when necessary.

4.2.5 Finger nails should be kept short and clean at all times.

4.2.6 Hair should be kept clean, trim and tidy and should be covered during operation.

4.2.7 Persons with open sores, wounds, boils or skin eruptions which are infected shall not handle food. Non-infected cuts shall be completely protected by a waterproof dressing which is firmly secured and routinely changed.

4.2.8 Shall not eat, drink, smoke, or chew tobacco, chewing gum, or other materials, while preparing or serving food.

4.2.9 Refrain from any unhygienic practices such as spitting and cleaning nose, ears or any other body orifice.

4.2.10 Shall not wear rings, bracelets, bangles, jewellery or accessories on finger and wrists.

4.2.11 Shall not lick fingers while handling food.

4.2.12 Shall not sneeze or cough onto the food.

4.2.13 If gloves are used, they shall be clean, sound and sanitary and used for the specific purpose of:

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a) handling foods, they shall be of the disposable type;

b) for cleaning, washing and sanitizing they may be of another type, disposable or non-disposable.

4.2.14 Shall not allow visitors or customers into the food preparation and handling area to avoid food contamination.

4.2.15 No vendor is allowed to use the stall as a sleeping or dwelling place, or for any other personal activity.

4.3 Training of Vendors

Every vendor, helper or food handler shall undergo a basic training in food hygiene prior to licensing and further training as required by the relevant authority. Training is to be conducted by the relevant authority or other institutions recognized or approved by the relevant authorities. Vendors should also be made aware of their responsibility to consumers and be informed of available credit facilities and other sources of finance to assist and improve their businesses.

Simple posters illustrating the "dos" and "don'ts" of street food preparation and vending should be widely and prominently displayed in relevant places for the benefit of both vendors and consumers.

4.4 Vendor's Associations

The formation of street food vendor associations or cooperatives should be encouraged to provide a liaison point with food control authorities, provide training for members and formulate and apply industry standards.

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SECTION 5 - DESIGN AND STRUCTURE

5.1 Location

5.1.1 The location should be suitable for the purpose of avoiding contamination of the food prepared and served or sold at or from the stall. Stalls shall not be located in restricted areas such as solid waste disposal areas (rubbish dumps, sewage treatment or oxidation lagoons), animal habitats or husbandry centres (abattoirs, wet markets), offensive, dangerous and nuisance trades areas or other areas designated by relevant authorities.

5.1.2 In addition to 5.1.1 mobile vendors shall operate in areas which are free or reasonably free from objectionable odours, smoke, dust, toxic fumes or other non-prohibited areas as designated by the relevant authority.

5.1.3 The area where the stall is located and immediate surroundings should be paved with smooth impervious material that is easily cleaned and capable of withstanding repeated washing and scrubbing.

5.1.4 The space in and around the vendors' stall shall be free of unnecessary stored goods or articles, discarded articles and any obstruction in order to enable every worker to carry out his duties efficiently and to permit easy access for cleaning.

5.1.5 The stall should be conveniently located near an inlet of a drainage system or any suitable means of disposing waste water in a sanitary manner.

5.2 Structures

5.2.1 Vendors' stalls shall be of a type approved by the relevant authority and shall be constructed from impervious materials that can be easily cleaned such as stainless steel, aluminium, glazed tiles or any other materials as approved by the relevant authority. It shall be properly constructed as to be readily cleaned and maintained in a good state of repair at all times.

5.2.2 Food Preparation areas and working surfaces should be made of a smooth and impermeable food grade material.

5.2.3 All cooking ranges, washing equipment, working tables, shelves and cupboards on or in which food is placed should be at least 45cm above the ground.

5.2.4 There should be adequate provision of artificial light of sufficient intensity to ensure a reasonable standard of illumination for every part of the stall.

5.3 Sanitary Facilities

5.3.1 Water Supply

All vendors shall ensure sufficient supply of hot and cold running water at all times. Where necessary, such as in the case of mobile vendors or where potable water supply is not yet available, potable water shall be stored in clean water containers.

5.3.2 Waste Water Disposal

Vendors'stalls should have an efficient waste water disposal system which should be maintained in a good state of repair. The system should be large enough to carry peak loads and be provided with traps to ensure only liquid waste is discharged into the drain/sewer.

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5.3.3 Solid Waste Disposal

Solid waste material should be handled in such a manner as to avoid contamination of food and/or potable water. Waste should be removed from the working area of the stall as often as necessary and at least daily. All solid waste should be properly disposed into suitable containers which are secured with tight fitting lids or placed in rubbish bins or central rubbish bins. Immediately after disposal of the waste, receptacles used for storage and any equipment which has come into contact with the waste should be cleaned and disinfected. The waste storage area should also be cleaned and disinfected daily. In areas without garbage collection service, solid waste is to be disposed in a sanitary manner, as recommended or approved by the relevant authority.

5.3.4 Sanitizing Practice

All working surfaces, table tops, floors and surrounding areas should be thoroughly cleaned and sanitized at least daily. Only appropriate and suitable sanitizing agents should be used.

SECTION 6 - APPLIANCES

6.1 The requirements of the appliances shall be as follows:

a) The appliances should be kept clean. The equipment should be made of materials which do not transmit toxic substances,odour or taste, is not absorbent (unless its use is intended for that purpose and will not result in food contamination), is resistant to corrosion and capable of withstanding repeated cleaning and disinfection.

b) Every cutting board used in the preparation of food should:

i) be readily and easily removable for cleaning,

ii) be free from cracks and crevices, with only reasonable wear and tear, and

iii) have cleanable surfaces on all sides.

6.2 Every vendor should ensure that all defective, damaged, cracked, chipped and unsuitable appliances and crockery are removed from use and discarded from the stall.

6.3 All utensils shall be regularly, or as necessary, cleaned by thoroughly washing them in warm water containing adequate amount of soap or other suitable detergents and then either immersing them for one-half (1/2) minute in boiling

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clean water and draining them for two (2) minutes in potable water at a temperature of not less than 77°C and draining them.

6.4 All crockery should be of the disposable type and shall be used only once and properly disposed. In the case where non-disposable crockery is used, the crockery is to be cleaned after each use using the method described for utensils in paragraph 6.3.

In the case where non-disposable crockery is used and water at 77°C or boiling temperatures is unavailable,clean potable water, wash soap or detergent and running water rinse is allowed. However, this method is not preferred.

6.5 All appliances are to be maintained in good state of repair.

6.6 All washed and clean utensils and crockery should be handled, stored or transported, in the case of mobile vendors, separately from unclean and used utensils and crockery and other sources of contamination. They shall be stored in a clean and protected area which is not accessible to pests or vermin.

6.7 Only containers made of food grade material, not previously used for non food use, shall be used.

6.8 Wash basins and sinks for cleaning utensils and washing hands should always be clean and maintained in a good state of repair.

SECTION 7 - FOOD PREPARATION

7.1 Requirements for Ingredients

Every vendor should ensure the following:

7.1.1 Supply of ingredients,including ice, must be from known and reliable sources.

7.1.2 Freshness and wholesomeness of ingredients to maintain quality and safety of food.

7.1.3 Transportation of ingredients should be in a manner so as to prevent exposure to the environment, spoilage and contamination.

7.1.4 Only permitted food additives should be used and the amount added should follow the specifications provided.

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7.2 Cooking and Handling

7.2.1 Soak and thoroughly wash fresh vegetables and fruit whether for cooking or consuming raw, with sufficient running potable water, to remove adhering surface contamination.

7.2.2 Wash all meat, poultry, fish, eggs and other perishable raw food before using in food preparation, to reduce the risk of contamination. Never wash the above perishable raw food with other foods that will be consumed raw or in semi-cooked state.

There should be an area for handling, storing,cleaning and preparing raw food ingredients, separate and apart from the cooked, ready-to-eat food display, handling and serving area.

7.2.3 Defrosting of frozen meat, poultry fish or any other frozen food should be done in a hygienic and proper manner by one of the following:

a) Placing the frozen food under running clean potable water at 21°C until it is defrosted.

b) Placing the frozen food at a temperature of 7°C in a cooling chamber or refrigerator.

c) Using a microwave oven (following the specifications set by the manufacturer).

d) Placing the frozen food directly into the conventional cooking process and assuring satisfactory temperatures are achieved to defrost and cook in the same process.

7.2.4 The process of preparation of ingredients before cooking such as cutting, chopping, mixing should be done in a clean place. Cooked and uncooked food should have separate utensils.

7.2.5 All cooked food should be sufficiently cooked, such as poultry to 74°C Pork to 66°C and beef to 54°C.

7.2.6 Water used for the purpose or drinking, preparation of hot or cold drinks and beverages should be of clean quality and boiled before use, or be of potable water quality.

7.2.7 Ice should be made from potable water. Ice should be handled and stored so as to protect it from contamination. Containers used to transport or store ice should meet the requirements for water containers prescribed by definition 2.20.

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7.2.8 Food should not be reheated more than once; only the portion of the food to be served should be reheated to a minimum of 6°C, uninterrupted.

7.2.9 Utensils used for tasting food should be washed immediately after each use.

7.3 Serving Food

Every vendor should observe the following:

7.3.1 All vendors purchasing ready-to-eat foods for the purpose of serving or selling must assure that such food is from licensed and reliable sources.

7.3.2 Ready-to-eat food should not be handled with bare hands. Clean tongs, forks, spoons or disposable gloves should be used when handling, serving or selling food.

7.3.3 Ensure all crockery used are clean, dry and handled in a sanitary manner.

7.3.4 Plates filled with food should not be stacked one on top of the other during display, storing or serving.

7.3.5 Vendors should not handle crockery used to serve food, by touching the rim, inner side, or the food contact surface.

7.3.6 Printed material should never be used to serve food. Only food grade aluminum foil, waxed paper, food grade plastic and any other suitable material should be used for packing food.

7.3.7 Never blow into plastic bags, wrappers or packages used for food or drinks.

7.3.8 Towels used for wiping crockery should be clean, handled in a sanitary manner and only be used for that purpose.

7.3.9 All beverages offered for sale should be dispensed only in their individual original sealed containers or from taps fitted to bulk containers and made of food grade plastic or other suitable material. Bulk containers should be covered with tight fitting lids.

7.3.10 Cut fruit or other foods ordinarily consumed in the state in which they are sold may be set out in an enclosed display case, cabinet or similar type of protective device and should be

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displayed in a manner which will not affect the wholesomeness and cleanliness of such foods.

7.3.11 Food handlers should not handle money. If this is unavoidable, the food handler should wash his hands after handling money and before handling food again.

7.3.12 Ready-to-eat foods intended for continuous serving, should be kept at the following holding temperatures:

i) for food served hot.....60°C or above.
ii) for food served cold.....7°C or below.
iii) for food served frozen...18°C or below.

7.3.13 A food warmer should be used to maintain continuous holding temperatures (7.3.12 (i), and should not be used for reheating purposes (7.2.8).

7.4 Unsold Food

All unsold cooked food and prepared beverages should be disposed of in a sanitary manner at the end of the day.

7.5 Transportation of Ready-to-eat Food

7.5.1 Ready-to-eat food and beverages which require transportation to the point of sale should be placed in a well protected, covered and clean container to avoid contamination. The place where the food is prepared should be near the point of sale.

7.5.2 Any vehicle used in transporting food should be clean and in good condition, appropriately equipped to accommodate any special requirements of the food being transported and provide protection from environmental contamination.

7.5.3 Milk should be transported to the point of sale in an insulated container maintained at a maximum temperature of 4°C.

7.5.4 Ready-to-eat food and beverages should not be transported together with raw food and ingredients, animals, toxic substances and any other materials which may contaminate the food.

7.6 Food Storage

7.6.1 The food should at all times be kept clean and free from contamination, and be adequately protected from pests, environmental contaminants and stored at proper temperatures where appropriate.

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8.2 Containers used for table side condiments should be kept clean and maintained in good condition and protected from pests.

8.3 All hand service articles such as napkins, towels and hand wipes should be of the disposable type.

8.4 Hand washing facilities such as hand wash basins, clean towels and soap should be provided at all times.

8.5 All chairs, benches, tables, canopies and umbrella stands should be cleaned regularly and maintained in good condition.

SECTION 9 - STREET FOOD CENTRES

9.1 General Requirements

9.1.1 All vendors located in a street food centre shall be licensed and comply with all provisions stated in Section 3, General Requirements of this Code.

9.1.2 All vendors located in a street food centre should at all times comply with all provisions stated in Section 4, Health Status, Personal Hygiene and Behaviour and Training of Vendors of this Code.

9.2. Location, Design and Construction

9.2.1 The location of any street food centre is to be approved beforehand by the relevant authority, having taken into consideration the provisions stated in Section 5.1 - Location, of this Code.

9.2.2 The design of the street food centre shall:

a) be reviewed and approved before hand by the relevant authority;

b) provide sufficient and adequate space and orderly placement of vendor stalls, carts, display cases, food preparation, handling, storing, serving and selling areas;

c) allow for the orderly flow of materials and goods, in and out of the centres, which will prevent possible routes of food contamination;

d) allow for the proper placement of client facilities, such as toilets, hand washing and eating facilities and be located or arranged in a manner that prevents routes of food contamination;

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9.3 Liquid and Solid Waste

9.3.1 Pertaining to liquid waste disposal, street food centres are to:

a) be equipped with an efficient centralized or individual (for each vendor in the centre) liquid waste disposal system(s) approved by the relevant authority and of suitable size and design to exceed the level of demand for liquid waste disposal at peak levels of activity by the vendors in the centre;

b) maintain the liquid sewage disposal system in good working condition;

c) ensure that the liquid waste disposal system exits to a relevant authority approved sewage drain system capable of efficiently carrying away the liquid waste from the centre; and

d) comply with any other relevant authority requirements related to liquid waste disposal.

9.3.2 Regarding to solid waste disposal, street food centres are to have an efficient system for disposal of solid waste complying with all solid waste disposal requirements of the relevant authority, to include:

a) the allocation of an appropriate and separate amount of space for solid waste storage, located at a convenient but suitably distant location from food preparation, storage, handling, serving or selling areas to prevent contamination;

b) sufficient number of suitably designed and constructed waterproof solid waste containers with tight fitting lids to adequately contain the volume of accumulated solid waste produced by vendor activity in one day. Containers should be lined with suitable disposable liners or inner containers for securing waste and which are easy to handle at time of disposal;

c) the daily, and more often if necessary, disposal of solid waste from the street food centre to:

i) rubbish bins approved, designed and intended for the centralized collection of solid waste by garbage service agencies;

ii) approved sanitary land fill; or

iii) other disposal methods authorized and approved by the relevant authority.

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d) routine inspection of solid waste disposal areas for the presence or harbourage of pests, taking any and all practical measures to eliminate and further prevent, any infestation; and

e) compliance with any other requirement of the relevant authority related to solid waste disposal.

9.4 Customer Facilities

Street food centres should have sufficient toilet facilities for each sex to accommodate the vendors, their employees and clientele, conveniently located but separate and apart from food preparation, handling, storage, serving and selling areas to prevent contamination of the food. The toilet facilities should be approved and subject to all requirements for such facilities by the relevant authority. Among other requirements the facilities should:

a) have smooth walls of glazed tile to a height of at least two (2) meters;

b) should be clean, free of bad odours and provided with flushing system;

c) be well lit, ventilated, and routinely cleaned and sanitized and maintained in good working condition;

d) include hand washing and drying facilities and properly supplied with soap and other needed supplies;

e) contain posters instructing vendors and employees to wash hands thoroughly after each use of the toilet facilities before returning to work; and

f) have doors which are equipped with self-closing devices.

9.5 Street Food Advisory Service

9.5.1 The appropriate authority should provide advisors to work with vendors offering them on-site advice and guidance to improve their operations in accordance with the requirements of the Code.

9.5.2 Advisors should be good communicators, familiar with the requirements of the Code, sympathetic to both problems of the vendors and the protection of consumers and whose activities are in no way associated with enforcement.

9.5.3 Advisors should possess the trust and respect of vendors.

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9.6 Consumer Education

9.6.1 The appropriate authority should inform consumers through posters, the media and publicity campaigns about hazards associated with street foods and the steps the authority requires street food vendors to take to minimise those hazards.

9.6.2 Consumers should also be informed of their responsibility in ensuring that they do not contaminate, dirty or litter street food vending sites.

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A SIMPLE GUIDE TO UNDERSTANDING AND APPLYING THE HAZARD ANALYSIS CRITICAL CONTROL POINT CONCEPT

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ILSI Europe

WHAT IS HACCP?

Analysis Critical Control Point (HACCP) permits a systematic approach to the identification and an assessment of the likelihood of their during the manufacture, distribution and use of a product, and defines measures for their control. The HACCP plan can be integrated into a more general and safety assurance plan. In its simplest form, consists of the following elements or principles:

identification of hazards and assessment of their severity probability of occurrence (hazard analysis)
determination of critical control points required to identified hazards
establishment of critical limits that assure that an operation under control at a particular critical control point
establishment and implementation of monitoring
establishment of corrective actions when critical limits are not
verification of the system
record keeping.

the HACCP framework, the term **hazard** refers to any or condition of, food that is unacceptable because it the potential to cause an adverse health effect.

hazards are or may be caused by any of the

unacceptable presence of a biological, chemical or contaminant in raw materials or in semi- or finished products
unacceptable potential for growth or survival of organisms, or the unacceptable potential for of chemicals (for example, nitrosamines) in or finished products or in a production line
unacceptable (re)contamination of semi-finished or products with microorganisms, chemicals or material.

Hazard analysis is the procedure used to identify potential hazards and conditions leading to their presence in food. It evaluates both the severity of a hazard and the likelihood that it will occur, to determine whether it is significant for food safety. When significant hazards are identified, measures for their control have to be established.

A **critical control point** (CCP) is a raw material, location, practice, procedure, formulation or process where measures can be applied to prevent or minimise hazards. (Note that the term **control** as used here means "to have/to bring under control", and should not be confused with testing, checking or verification.)

Although application of Good Manufacturing Practice (GMP) should ensure that safe products are produced by keeping many points under control, certain aspects of GMP are essential for food safety and have to be singled out as "critical" control points (CCPs). Clearly, when at a certain point in a food-processing or preparation line a potential severe hazard has a high probability of occurrence, particular control measures are necessary; such a point is called a CCP.

Monitoring is checking the effectiveness of the control at a CCP. It involves systematic observation, measurement, recording and evaluation.

Critical limits are values or characteristics of a physical, chemical or biological nature which mark the line between acceptability and unacceptability for whatever is being measured. They indicate when acceptable (controlled) situations become unacceptable (out of control) with respect to the safety of the final product.

Verification is performed to check the system's overall effectiveness.

Record keeping ensures that information resulting from the HACCP study and implementation of the resulting HACCP plan is available for validation, verification, review, auditing or other purposes.

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APPLICATION OF HACCP: THE EXAMPLE OF MILK

The principles of HACCP can be illustrated by the example of bringing raw milk from the dairy farm to the consumer. Among the hazards to consider is the presence of microorganisms in the milk (for instance, *Salmonella*, *Campylobacter* and *Mycobacterium bovis*). It is an unacceptable event if the consumer becomes ill from ingesting these microorganisms. Hazard analysis is used to estimate the likelihood that the milk contains bacteria and to determine the probability that drinking raw milk will cause illness. In most cases, the analysis will show that consuming raw milk may be hazardous, and it will identify the dairy plant as a place where the milk can be made safe.

Pasteurisation is used to do this, and the process employed is a CCP. Pasteurisation involves heating the milk, but a fine balance must be achieved: the heating must be sufficient to control the level of bacteria but not so extreme as to make the flavour unacceptable. In practice, milk is pasteurised in the dairy by heating it, for instance, to 71.5 °C for 15 seconds. This can be the critical limit used to ensure the elimination (or in more precise terminology, reduction to an acceptable level) of a hazard. It can be monitored in the dairy by recording the temperature and flow rate of the milk. The safety of the milk can be verified by microbiological analysis.

THE BENEFITS OF HACCP

Many commercial processes involve multiple stages from raw material production or acquisition to the final product. A properly completed and implemented HACCP study identifies and controls the factors directly affecting the safety of a product. This allows the food producer to target technical resources efficiently. Identifying and monitoring CCPs is a more cost-effective method of assuring safety than is the traditional inspection and end-product testing. The records and documentation provide excellent evidence that "all reasonable precautions" were taken and "due diligence" was exercised to prevent problems, evidence which may be necessary in case of legal action.

A HACCP study will not result in control measures which will eliminate all safety problems, but it will provide information that can be used to determine how best to control the remaining hazards. It is then up to management to use that information correctly.

Moreover, HACCP can improve the relationship between food producers and food inspectors. In the past, conflicts have arisen, often over trivial matters which have taken their attention away from more important issues. If control procedures follow clearly established rules, inspectors can have greater confidence in food producers. In addition, the availability of data collected throughout the process and over time greatly facilitates the task of the inspectors by providing them with a more complete and accurate picture of the total operation than they would be able to obtain from a single inspection. Governments are also better able to accept the responsibility taken by industry because they can understand why and how controls are made. This has been recognised by Codex Alimentarius and the European Union, and consequently application of HACCP principles is recommended by Codex and is mandatory in the countries of the European Union.

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HOW TO PERFORM A HACCP STUDY

The heart of any HACCP study is the collection and evaluation of data concerning the raw materials, the formulation of the product, and the processing, storage, distribution, sales, preparation and use conditions. This is essential for each HACCP study, even if it is performed in a small or medium-sized enterprise. In very complicated or very sophisticated enterprises, a multidisciplinary team is necessary to ensure that sound, unbiased assessments are made. Each team member should have been trained in HACCP and have working knowledge of the process/product under study. A typical HACCP team consists of a manager or person responsible for the process under study, an engineer, a quality assurance manager and, very often, a microbiologist. This team will be the core group; other experts can be called in as required. A team leader should be appointed to guide the discussions and a secretary to record the decisions.

The team then goes through a sequence of seven steps, which are described in the following sections which follow the seven "principles" of the HACCP system as defined by Codex Alimentarius. The conclusions reached by the team can be summarised on a HACCP data sheet.

Activity 1: Identification of hazards and control measures

Defining the problem

The scope of the study, including the types of micro-organisms, chemicals and foreign materials of concern, must be defined. To do this, the team must examine the product's characteristics and its expected use by the consumer in terms of known hazards.

Important areas to consider are:

- *formulation:* the raw materials and ingredients to be used and the parameters which may influence the product's safety or stability,
- *processing:* the process parameters and conditions which affect or may create the hazards,
- *packaging:* protection against contamination with chemicals or (re)contamination and growth of microorganisms (permeability, integrity, tamper protection),
- *storage/handling:* the time and temperature conditions and handling in distribution centres, retail outlets and kitchens,
- *customer practices:* use by the consumer or professional cook (cooking, reheating, thawing, reconstitution), and
- *target groups:* the end user (caterers, infants, adults, the elderly, immuno-compromised or sick people).

All of these factors must be taken into account to determine the probability of occurrence and severity of potential hazards. For example, a fully sterilised cream in a can intended to be used in coffee by healthy adults will be of less concern than a soft cheese made from unpasteurised milk and intended for use in hospitals. Each study should examine specific microorganisms, chemicals and physical contaminants which may affect the safety of a particular product or group of products. In this way, it can be precisely defined for which hazard controls have to be established.

For example, the scope of three different studies might be:

- *Listeria* and *Salmonella* species, which are pathogens, as potential hazards in soft cheese,
- pesticides as contaminants in raw materials and in the line environment, and
- foreign material in finished products.

Clearly, several studies are needed to establish a complete HACCP plan.

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Producing a flow diagram

The next task is to produce a process flow diagram to serve as a guide for the study. The diagram should describe all of the raw materials and the processing and packaging steps. It should include the data needed for microbiological, chemical and physical hazard analysis, for example, information on the likelihood of contamination with chemicals and foreign materials, as well as microorganisms and their toxins, and their potential for survival and growth. Data are needed on time and temperature throughout the process and distribution, as well as on acidity (pH) and water activity (Aw) conditions, hygienic design, equipment characteristics, intermediate storage conditions and instructions for consumer use. The team should confirm the flow diagram by examination at the site of all stages of the production process.

Determination of hazards

To identify hazards, a number of questions, such as those in the decision tree of Figure 1, have to be answered for each hazard that could be of concern at each food production step. One of the first questions would be: Is it probable that the potential hazard is present in the raw material? When the answer is no, this potential hazard in this raw material is of no concern (indicated with "no hazard" in Figure 1). This is also the case when the hazard under study is not likely to be in the line or its environment. If the hazard may be there, but the product itself will not be contaminated, it needs no further consideration. However, if contamination is possible, further questions would have to be considered at each process step. For instance: Is presence at an unacceptable level or unacceptable survival, persistence or increase, probable? Again, the potential hazard does not need to be addressed in the HACCP plan if the answer is no. When the answer is yes, the next question would be: is the reduction, if any, at a later step adequate? If yes, the potential hazard is not further considered at this step (but the reduction step becomes a CCP). If the answer is no, then a "real" hazard has been identified for which control measures have to be established.

Consideration of control measures

Hazards can be controlled in many ways. Microorganisms can be killed by heating and their growth can be prevented or limited by low or high temperatures, by low humidity, by preservatives, and so on. Residues of veterinary drugs and pesticides can often be controlled by keeping a certain time between application and slaughter, milking or harvest. Strict separation between raw materials and processed foods may prevent or limit recontamination. Visual inspection, sieving, metal detectors, and so on, may be effective in controlling physical hazards. The options have to be considered for each identified hazard, and CCPs where they can be applied have to be determined as the next activity.

Activity 2: Determination of critical control points

Once the hazards have been identified and control measures considered, the study team must determine the critical control points (CCPs). The team should examine the entire process and ask, for each identified hazard at each step, questions such as these:

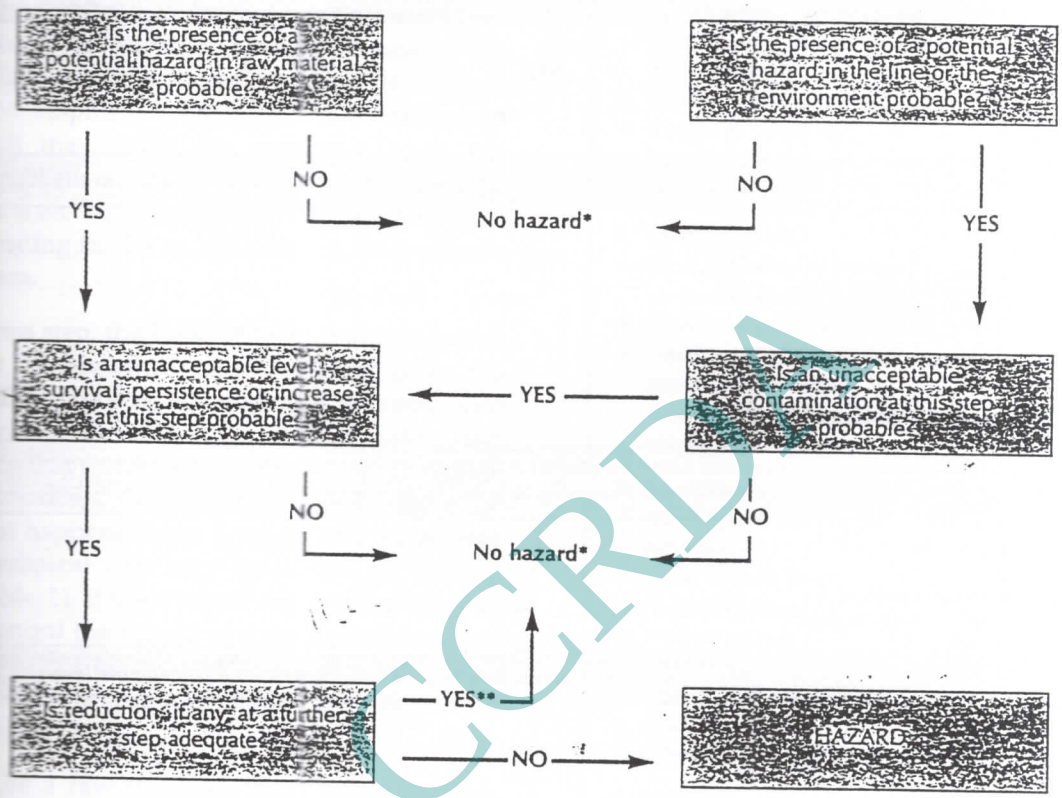
- Can the hazard be introduced into the product via the raw material under study? If this is the case, is it likely to be at, remain at or increase to, unacceptable levels?
- Is the formulation/composition of the raw materials/product critical to the safety of the product?
- Does the process under study make the final product safe by reducing the hazard to an acceptable level or by keeping it from increasing to dangerous levels?
- At this step, can the hazard be introduced into the product from the line or the environment, and if so,

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FIGURE 1

Hazard determination

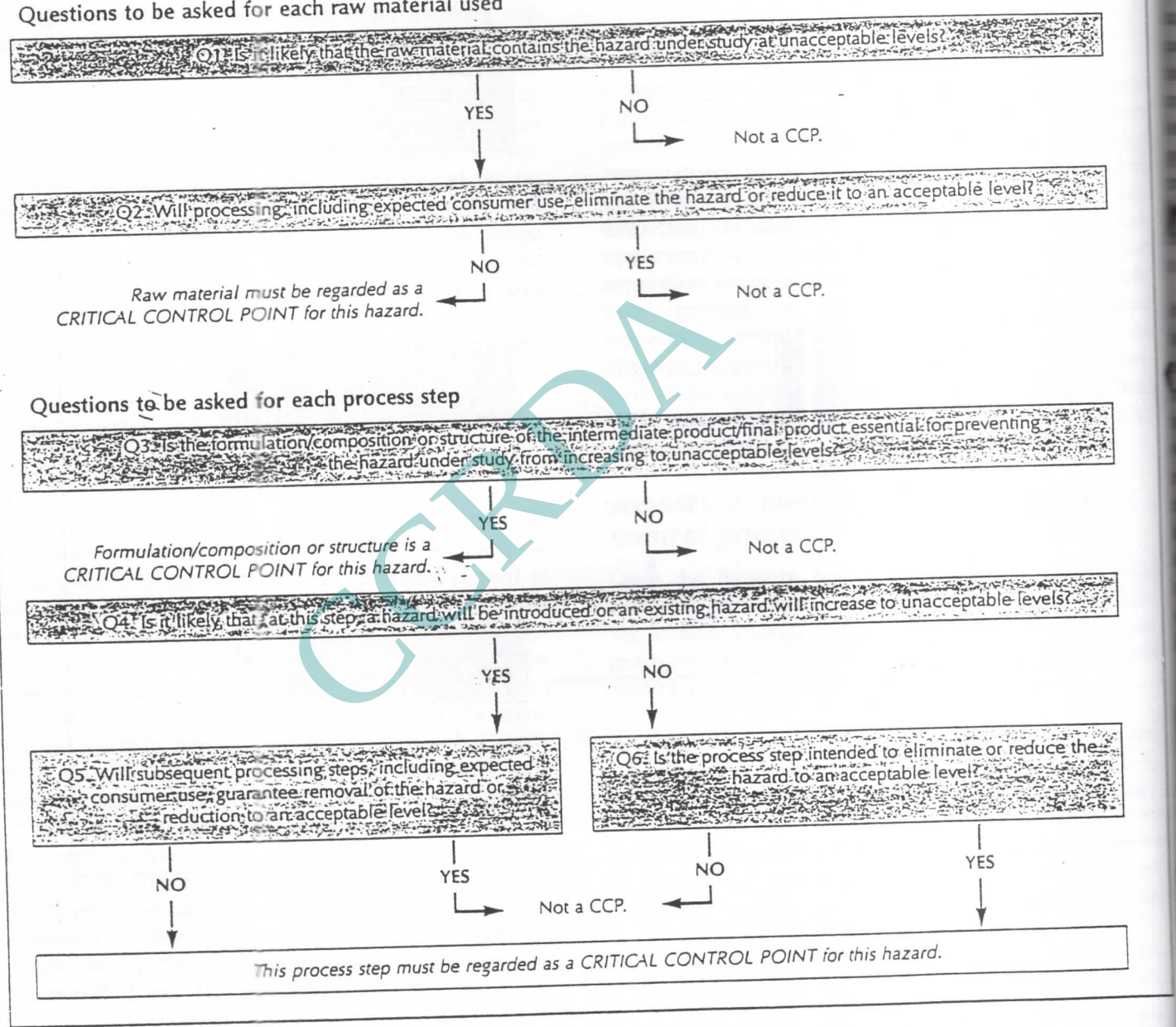
Questions to be answered for each potential hazard at each step



*Hazard to be controlled at this step.
**Reduction step becomes thus a CCP.

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FIGURE 2
Critical control point decision tree



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...is it likely to be at, remain at or increase to, unacceptable levels?

...decision tree in Figure 2 can be helpful to identify CCPs. Questions 1 and 2 in Figure 2 apply to the raw materials, and questions 3 to 6 apply to the process steps. The Appendix outlines the reasoning behind the questions. Clearly, some of the questions are similar as in those used to identify the hazards because of the essential link between hazards and CCPs. Hazard identification emphasises identification of hazardous agents which may reach the consumer when not properly controlled; during the determination of CCPs, the emphasis is on the identification of the sources of, or conditions leading to, the hazards and on the measures to control them.

...each process step, the HACCP team should consider the possible consequence of a deviation from the normal GMP procedure, whether such a consequence would be unacceptable with regard to food safety, and the possibility that it will occur. Moreover, to determine whether the process step is critical, the team must consider what happens to the product later on. A large amount of technical data may be needed for making decisions (Table 1). If the analysis suggests that it is not possible to control the hazard at a certain step and that the hazard will not be reduced to an acceptable level then the process (or product) should be modified to remove the point.

A CCP may be a raw material, formulation, location, practice, procedure or process stage, but it must be specific. For example:

- a raw material with regard to the "absence" of specified contaminants,
- a specific cleaning operation,
- separation provisions for raw and cooked products,
- the chlorination step of canned cooling water or the in-product pasteurisation step.

TABLE 1

*Types of technical data required for a HACCP study**

1. **Epidemiological data on microbial pathogens, toxins and chemicals**
   - Incidence of foodborne illness
   - Results of surveillance programmes and sentinel studies
   - Legal microbiological food safety criteria and maximum residue limits

2. **Food Safety data**
   - Likely presence of microbiological and chemical hazards in raw materials (see category 1 above)
   - Growth rates of dangerous microbes in food products
   - Death rates of dangerous microbes under a range of processing conditions
   - Fate of chemicals and toxins during processing, storage, distribution and use

3. **Raw material, intermediate and final product data**
   - Formulation
   - Acidity (pH)
   - Water activity (Aw)
   - Packaging materials
   - Product structure
   - Processing conditions
   - Storage and distribution conditions
   - Shelf life
   - Consumer use instructions, package labelling

4. **Processing data**
   - Number and sequence of all processing stages including storage
   - Range of product time/temperature conditions
   - Handling of rework (recycled material from the manufacturing process)
   - High/low risk area separation
   - Flow conditions (for liquids)
   - Presence of void spaces in processing equipment
   - Efficacy of cleaning and disinfecting

*Not all data will be required for all studies.

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Activity 3: Specification of critical limits

The team must define the critical limits that assure that a hazard is under control. The critical limit is the value that separates acceptability from unacceptability for each CCP. More stringent target values may be established to ensure that critical limits are always met. This can be seen in Table 2, which illustrates how a HACCP data sheet might be compiled.

TABLE 2

HACCP data sheet

Point of control (raw material or process step)	Hazards or conditions leading to hazards	Control measures	CCP parameters	Critical limits	Target values	Monitoring	Corrective actions
Egg product (in mayonnaise plant)	Presence of *Salmonella*	Supplier's quality assurance (QA)	"Absence" of *Salmonella*	Negative in 5 random samples of 25 g	No target value	Plant records, inspection, microbiological testing	Rejection of suspected lots
Milk	Presence of mycotoxins	Farmer's education, feed supplier's QA	Aflatoxin M	Less than 0.1 ppb	No target value	Testing	Reinforcement of prevention programs
Pasteuriser (in milk plant)	Survival of or recontamination with *Salmonella*, *Listeria*, and so on	Correct design and operation of the pasteuriser	Temperature time	Not less than 71.5 °C for 15 seconds	73 °C for 15 seconds	Temperature/ flow rate recording; record of plant sensor calibration and diversion system operation	Repasteur-isation
Chlorination of cooling water	Recontami-nation with pathogenic microbes	Automatic dosing	Free available chlorine	1 ppm after cooling	1–3 ppm	Continuous chlorine monitor	Doser adjustment (blocking of batch)

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...ivity 4: Establishment of a ...itoring system

...ring system must be established to ensure that ... CCP is under control, that is, that the criteria ...al limits or target values) are met. This is ...ested in Table 2, which identifies the CCPs (what ...e controlled) and describes the associated control ...sures (how the hazard will be controlled). ...ring methods should be rapid to be effective. ...ical, chemical tests and observations are preferred, ...r microbiological purposes, because micro- ...gical methods tend to be time consuming. Ideally, ...should allow adjustments to be made before the ... becomes unacceptable. Full records must be ... of all monitoring data for management, audits, ...analysis and scrutiny by inspectors.

...ivity 5: Establishment of corrective ...ions

... criteria are not met, the "out of control" situation ...d be rectified immediately and appropriate follow- ...ions taken. Such actions should be planned and ...ed during the HACCP study. Two examples ... in Table 2 are chlorination of cooling water and ...nisation of milk. At the CCP where the ... level of the cooling water is critical, a ... of less than 1 ppm should lead to an ...diate adjustment of the chlorine dosing. If chlorine ..., the batch should not be released until further ... has demonstrated that the product is safe. ...nisation, a temperature drop below 71.5 °C ... result in repasteurisation (via a flow diversion ...), adjustment of the heating system and an ... of the pasteurisation operation to find out ... temperature drop occurred. Once the cause of the ... has been identified, further corrective actions ... be taken to prevent it from happening again.

... data should be examined systematically to identify the points where controls should be improved or where other modifications are needed. In this way, the system can adapt to changing by constant fine-tuning.

Activity 6: Verification of the system

A properly executed HACCP study will produce a list of potential hazards and their corresponding CCPs, together with operating limits and monitoring procedures for each CCP. The fact that a system is well conceived and all the necessary terms clearly defined does not guarantee that it is effective. A hazard or CCP may have been overlooked (for example, a contaminant in a raw material or a hidden void space in a piece of equipment) or the control measures may not be adequate (leaving a possibility for recontamination) or the monitoring procedures may not be appropriate (for example, they may be too slow or not sufficiently sensitive). Therefore, verification is a crucial procedure in the HACCP system. It includes activities such as inspections and audits, the use of classical microbiological and chemical contaminant tests to confirm the effectiveness of control measures, examination of the condition of the product as found in the market place, and reviews of customer complaints. Samples examined by inspection services can also in certain cases serve to verify the effectiveness of the system. Verification, however, can never replace monitoring. It can only provide additional information to reassure the producer (and the inspector) that the application of HACCP results in the production of safe foods.

Activity 7: Record keeping

Record keeping is an essential element of HACCP. This ensures that information gathered during the installation, modification and operation of the system will be readily accessible to everyone involved in the process as well as to outside auditors. It also helps to

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should answer Q3, Q4, and either Q5 or Q6 for process stage.

formulation/composition or structure of essential for preventing the hazard from to unacceptable levels?

study team should use the appropriate technical for example, pH, water activity [Aw], temperature, and types of preservatives, water droplet size) to this question at each process stage. If, for the pH is critical to limit the growth of *botulinum* in a pasteurised product, the is yes, and the acidification becomes a CCP. If the is no, any acidification step is not a CCP.

this process step, is it probable that a hazard be introduced or that an existing hazard will to unacceptable levels?

study team should use data from the flow diagram from the examination of the production line to whether the immediate processing (such as people, equipment, walls, floors, raw materials) could contain the hazard under and contaminate the product. The team must the possibility that even if no single process allows the hazard to increase to unacceptable it may happen over several steps. In this case, an of process steps can be considered a CCP.

should also consider the following points:

- process step carried out in an environment to contain the hazard?
- packaging essential for the prevention of at this step?
- contamination from another product/raw possible?
- contamination from personnel possible?
- any void spaces in the equipment where the product can accumulate and stagnate, causing the hazard to increase?
6. Are the bulk product time/temperature conditions such that the hazard could increase in the product?

Note that technical data on product formulation will be needed to deal with points 5 and 6.

If the answer to Q4 is yes for any process step or group of process steps, the study team should ask Q5 for the same process step(s). If the answer to Q4 is no, the study team should move to Q6 for the same process step.

Q5. Will subsequent processing, including expected consumer use, guarantee that the hazard will be removed or reduced to an acceptable level?

If the answer to Q5 is yes, the process step(s) is not critical and the study team should ask Q3 for the next process step. If the answer to Q5 is no, then the process step(s) is a CCP. In this situation, the study team must define clearly what is critical: the actual process, the location or a practice or procedure associated with the process step(s).

Q6. Is this process step specifically intended to remove the hazard or reduce it to an acceptable level?

The study team should answer this question for each process step in the light of the flow diagram and line examination. This question will identify those processing steps that are specifically intended to impart microbiological safety to the product (for example, pasteurisation, retorting, cooking) or to remove physical hazards (for example, metal detection, sieving).

If, after answering no to Q4, the team also answers no to Q6, then the process step is not critical and the study team should ask Q3 for the next process step. If the answer to Q6 is yes, the process step is a CCP.

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GLOSSARY

Control (verb): To take all necessary actions to ensure and maintain compliance with criteria established in the HACCP plan.

Control (noun): The state wherein correct procedures are being followed and criteria are being met.

Control measure: Any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

Corrective action: Any action to be taken when the results of monitoring at the CCP indicate a loss of control.

Critical control point (CCP): A step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

Critical limit: A criterion which separates acceptability from unacceptability.

Food safety: Assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

HACCP: A system which identifies, evaluates and controls hazards which are significant for food safety.

HACCP plan: A document prepared in accordance with the principles of HACCP to ensure control of hazards which are significant for food safety in the segment of the food chain under consideration.

Hazard: A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

Hazard analysis: The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and therefore should be addressed in the HACCP plan.

Monitor: The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control.

Risk: A function of the probability of an adverse health effect and the severity of that effect consequential to a hazard in food.

Step: A point, procedure, operation or stage in the food chain, including raw materials, from primary production to final consumption.

Validation: Obtaining evidence that the elements of the HACCP plan are effective

Verification: The application of methods, procedures, tests and other evaluations, in addition to monitoring, to determine compliance with the HACCP plan.

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FURTHER READING

For details about the applications of HACCP may be found in the following publications.

Bryan, F.L. (1990) HACCP and food control. *Food* [illegible] 123–133

Bryan, F.L. (1991) Teaching HACCP techniques to food handlers and regulatory officials. *Dairy, Food and Environmental Sanitation* 11:562–568

Bryan, F.L. (1992) Hazard Analysis Critical Control Point Evaluations: A guide to identifying hazards and assessing risks associated with food preparation and storage. World Health Organization, Geneva, Switzerland

Campden and Chorleywood Food and Drink Research Association (1992) HACCP: A practical guide. *Technical Manual No. 38*. Campden Food and Drink Research Association, Chipping Campden, Gloucestershire, England

International Association of Milk, Food and Environmental Sanitarians, Inc. (1991) Procedures to Implement the Hazard Analysis Critical Control Point System. International Association of Milk, Food and Environmental Sanitarians, Inc., Ames, Iowa, USA

International Commission on Microbiological Specifications for Foods (1988) Application of the hazard analysis critical control point (HACCP) system to ensure microbiological safety and quality. *Microorganisms in Foods* 4. London, Blackwell Scientific Publications

Mayes, T. (1992) Simple users' guide to the hazard analysis critical control point concept for the control of food microbiological safety. *Food Control* 3:14–19

Mayes, T., and Kilsby, D.C. (1989) The use of HAZOP hazard analysis to identify critical control points for the microbiological safety of food. *Food Quality and Preference* 1:53–57

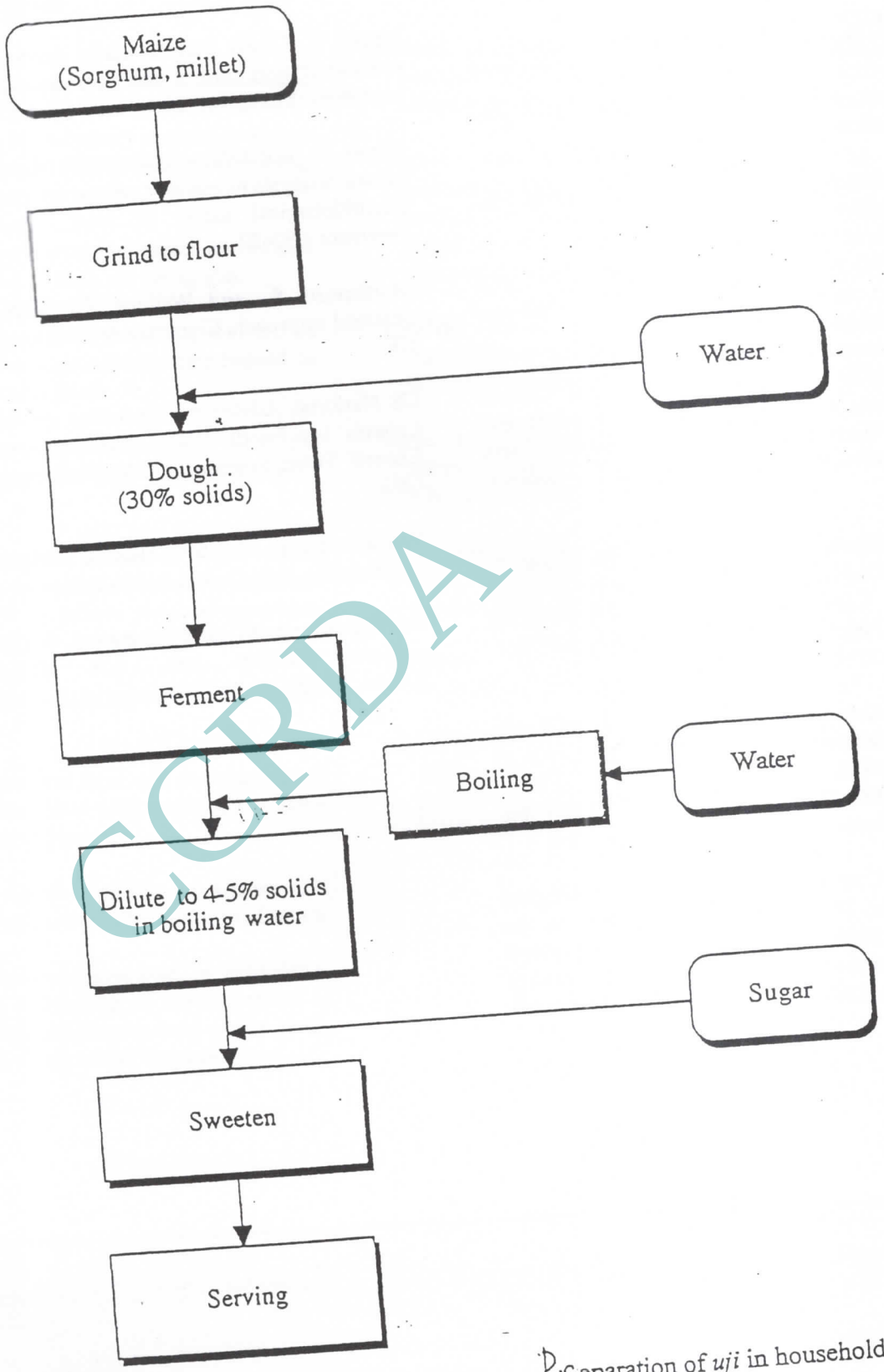
Mortimore, S., and Wallace, C. (1994) HACCP: A practical approach. Chapman & Hall, London SE1 8HN, UK

US National Advisory Committee on Microbiological Criteria for Foods (1992). Hazard Analysis Critical Control Point System. USDA, Washington DC 20250, USA

Van Schothorst, M. (1990) Hazard analysis in hygienic engineering. *Food Control* 1:133–136

Van Schothorst, M., and Jongeneel, S. (1992) HACCP, product liability and due diligence. *Food Control* 3:122–124

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Preparation of *uji* in households.

Figure 3.

CCRDA

ANNEX 4

APPLICATION OF THE HACCP SYSTEM TO *UJI* [1,2,3]

Product description

Preparation of *uji* varies depending on the region. The following description is one example of *uji* preparation as practised in Kenya.

The basic cereal in *uji* production is maize, but at times a mixture of maize, sorghum and millet is used. The raw cereal is finely ground and mixed with water in a concentration of about 30% solids. The dough, without inoculation, is fermented for 2-5 days at ambient temperature, and it is then diluted to about 4-5% solids in boiling water, and sweetened with crystalline sugar.

Intended use

Uji is consumed by adults as well as children. For the purpose of this Report, its use as weaning food is considered.

Flow diagram

Figure 3 shows the flow diagram of *uji*.

Hazards of concern

Hazards considered in this context include biological (e.g. bacteria, viruses, parasites), chemical (e.g. contaminants, mycotoxins) and physical agents.

Identification of hazards, control measures and Critical Control Points

Table 3 shows hazards associated with each step in the preparation of *uji*, and some possible measures for their control.

Raw material: Major hazards in maize, millet and sorghum are toxins, e.g. aflatoxin produced by moulds, and agrochemicals. For prevention of toxigenic moulds during storage, the raw material should, as far as possible, be stored under appropriate ambient conditions. When the ambient temperature and humidity are high, storage time should be limited. In so

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[1] This study has been carried out by the Joint FAO/WHO Workshop Secretariat.

[2] Application of the HACCP system has been simplified and adapted to household conditions. Although the approach can be used for production on a cottage and industrial scale, the requirements in terms of Critical Control Points, critical limits, and monitoring procedures may be different and more severe.

[3] Model HACCP plans are not appropriate for use until validated for a specific food and food process.

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far as agrochemicals are concerned, households cannot do much except to get assurance from suppliers about the safety of the products. The possibility of accidental contamination of grains during storage with agro-chemicals should be prevented. The grains may also contain foreign matter such as stones and insect fragments. These will not be eliminated or controlled at a later step, so it is important that households thoroughly clean the raw material.

Cereals may also be contaminated with pathogens. These will be eliminated at subsequent steps of preparation, i.e. fermentation and boiling.

Water may be contaminated with pathogens. As part of a good hygienic practice, safe water should be used, particularly for washing hands and utensils. As the fermented dough is subsequently boiled, the quality of water used for its preparation is not considered as a Critical Control Point with regard to pathogens. However, with respect to chemical contaminants, the quality of water is a Critical Control Point as chemical contaminants will not be removed during later stages of preparation.

Crystalline sugar may contain foreign matter. Some foreign matter, e.g. glass, constitutes a health risk. Care should be taken to see that sugar does not contain any foreign matter.

2) **Grinding:** This step may introduce dirt and foreign matter. As part of a good hygienic practice this should be avoided as far as possible by using clean and properly maintained equipment. However, it is unlikely that this step will introduce any major health hazard.

3) **Dough preparation:** Except for the quality of water (see step 1), this step does not present a specific hazard. As a part of a good hygienic practice, households should use safe water, as far as possible.

4) **Fermentation:** This step is important for preventing the growth of undesirable bacteria and moulds. However, microorganisms (vegetative form) surviving this step will b eliminated during the subsequent boiling step. The major hazards associated with this step are microorganisms producing thermostable toxins, e.g. *Staphylococcus aureus*, or moulds, the toxins will not be destroyed later by boiling. Fermentation is therefore a Critical Contr Point for these hazards. To prevent these hazards, the fermentation process should be rapid i.e. characteristic odours and smell of fermentation should appear within 24 hours.

5) **Boiling water:** All pathogens (vegetative form) are killed during this step.

6) **Dilution in continuously boiling water:** This step is a critical point for ensuring biological safety of *uji*, as pathogens existing in the raw material or introduced during previous steps will be killed at this step. It should, however, be noted that spores of bacte e.g. *Bacillus cereus*, may survive.

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Sweetening: Provided that sugar or utensils used for sweetening are clean, no major hazard is associated with this step.

Serving: Care should be taken to ensure that pathogens are not re-introduced into the prepared *uji* by dirty hands or utensils. Therefore, these have to be washed carefully with safe water. This is particularly important with regard to pathogens of a low-infective dose, e.g. *Shigella*. The prepared *uji* should be consumed as soon as possible. Although the acidity of the product discourages spore germination, a significant delay in serving may give an opportunity for the growth of bacterial spores which have survived previous steps – e.g. spores of *Bacillus cereus*) or microorganisms which may have been introduced by dirty hands or utensils.

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Table 3 Application of the HACCP system to preparation of *uji* in households

Step	Hazards	Control Measures	CCPs	Critical Limit	Monitoring Procedure	Corrective Actions
1. Raw material i) Maize Sorghum Millet	a. Mycotoxins	a. i) Obtain assurance from supplier of adequate preharvest and post-harvest handling of the grains ii) Store grains in dry (and if possible cool) area, limit storage time	a. Yes	a. i) No mouldiness, good smell ii) Adequate time, temperature, humidity of storage area	a. i) Observation, smelling ii) Time keeping (measurement of temperature or humidity if possible)	a. i) Discard the raw material and change supplier ii) Utilize the raw material as quickly as possible, when temperature and humidity are not appropriate for storage
	b. Agrochemicals	b. Obtain assurance from supplier of adequate pre-harvest and post-harvest handling of grains	b. No			
	c. Pathogens: *Bacillus cereus, Salmonella, E.coli*	c. Heat treatment, correct fermentation	c. No			
	d. Physical: insects and stones	d. Manual cleaning	d. Yes	d. No visible insect fragments or stones	d Observation	d. Re-clean

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Table 3 Application of the HACCP system to preparation of *ogi* in households

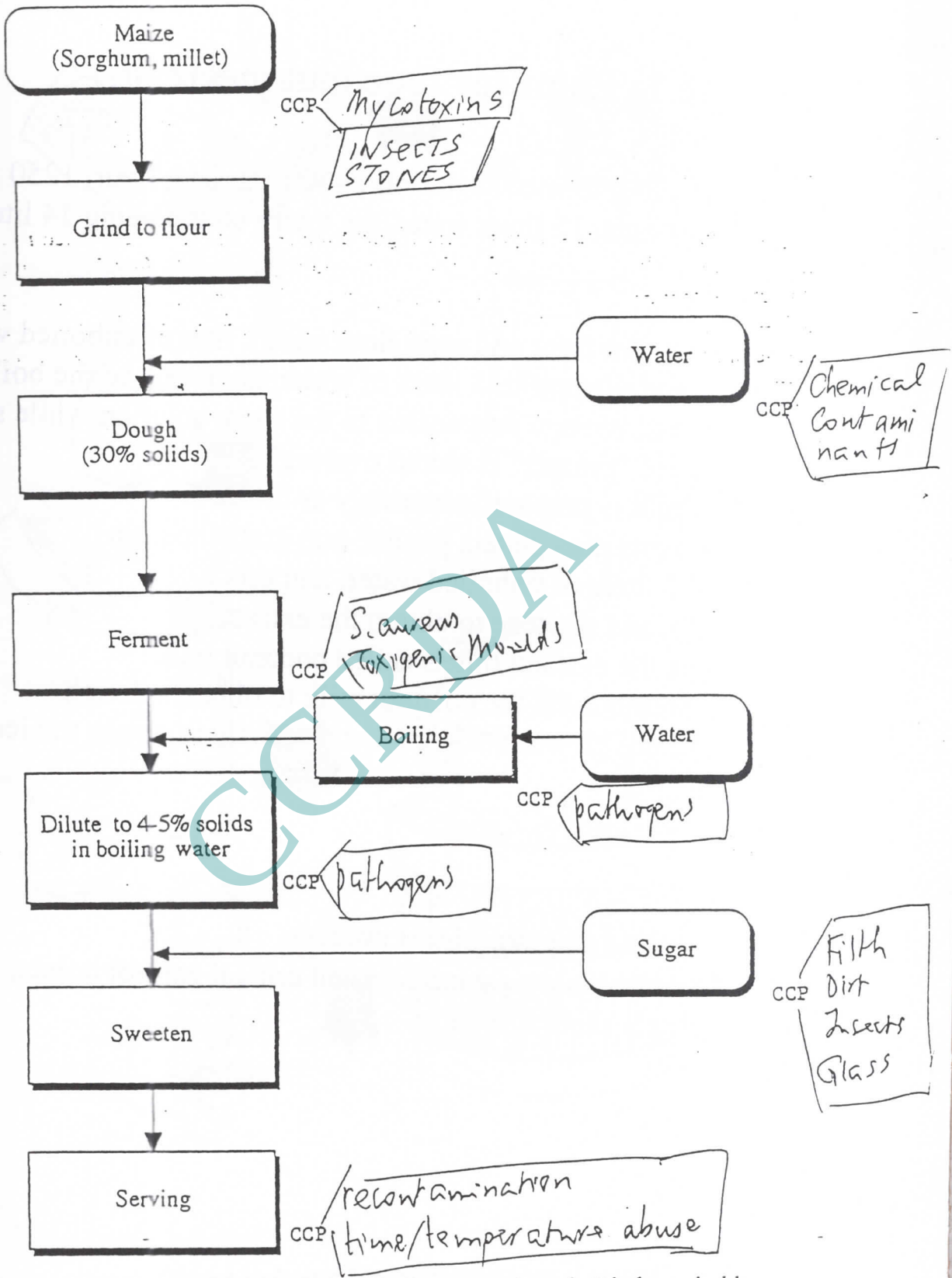
Step	Hazards	Control Measures	CCPs	Critical Limit	Monitoring Procedure	Corrective Actions
1. Raw material ii) Water	a. Chemical contaminants, depending on the source	a. Obtain assurance about the source of water, use only safe water	a. Yes	a. Clear, free of odour and off-taste	a. Observation, smelling and tasting	a. Use another source of water
	b. Pathogens, e.g. *E.coli, Campylobacter, V. cholerae, Salmonella, Cryptosporidium, Giardia lamblia, Entamoeba histolytica*, Rotavirus	b. Use safe water (i.e. filtered and disinfected) or boil the water	b. No			
1. Raw material iii) Crystalline sugar	Filth, dirt, insect, glass	Use clean sugar	Yes	No visible foreign matter	Observation	Clean the sugar (e.g. sieve) and if cleaning is not possible, discard the sugar
2. Grinding	Introduction of filth, dirt, and foreign matter	Use clean and properly maintained equipment	No			
3. Dough preparation	Contamination with water	Use safe water	No			
4. Fermentation	a. Growth and formation of toxin by *Staphylococcus aureus*	a. Rapid fermentation	a. Yes	a. Acid taste and characteristic odour within 24 hours	a. Observation	a. Discard the material
	b. Growth of toxigenic moulds	b. Remove surface mould growths	b. Yes	b. No visible moulds	b. Observation	b. Remove more of the top layer
5. Boiling water	Survival of pathogens	Thorough boiling	Yes	Bubbles	Observation	Continue boiling

CORDA

Table 3 Application of the HACCP system to preparation of *uji* in households

Step	Hazards	Control Measures	CCPs	Critical Limit	Monitoring Procedure	Corrective Actions
6. **Dilution** (to 4-5% solids in continuously boiling water)	Survival of non-spore forming pathogens	Continuous boiling	Yes	Gelatinization, well cooked	Observation	Keep boiling
7. **Sweetening** (in hot *uji*)	No hazard (for hazards associated with sugar see step 1(iii)					
8. **Serving**	a. Re-contamination by hands, utensils, environment	a. Wash hands and use clean utensils	a. Yes	a. Washing with soap and thorough rinsing with clean water	a. Observation	Thorough reheating (steam, bubbles)
	b. Growth of pathogens and spores of *Bacillus cereus*, if consumption delayed for more than four hours	b. Consumption without delay	b. Yes	b. Use within four hours	b. Time keeping	

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CCRDA

Figure 3. Application of the HACCP system to preparation of *uji* in households. The numbers refer to the steps described in Annex 4.

STREET FOODS

Excercise 1: **Es puter** (coconut icecream)

Ingredients: 125 g refined sago flour, 400 g cassava flour, 1250 g cane sugar, 15 coconuts, 12 liters water, the total volume being 14 liters.

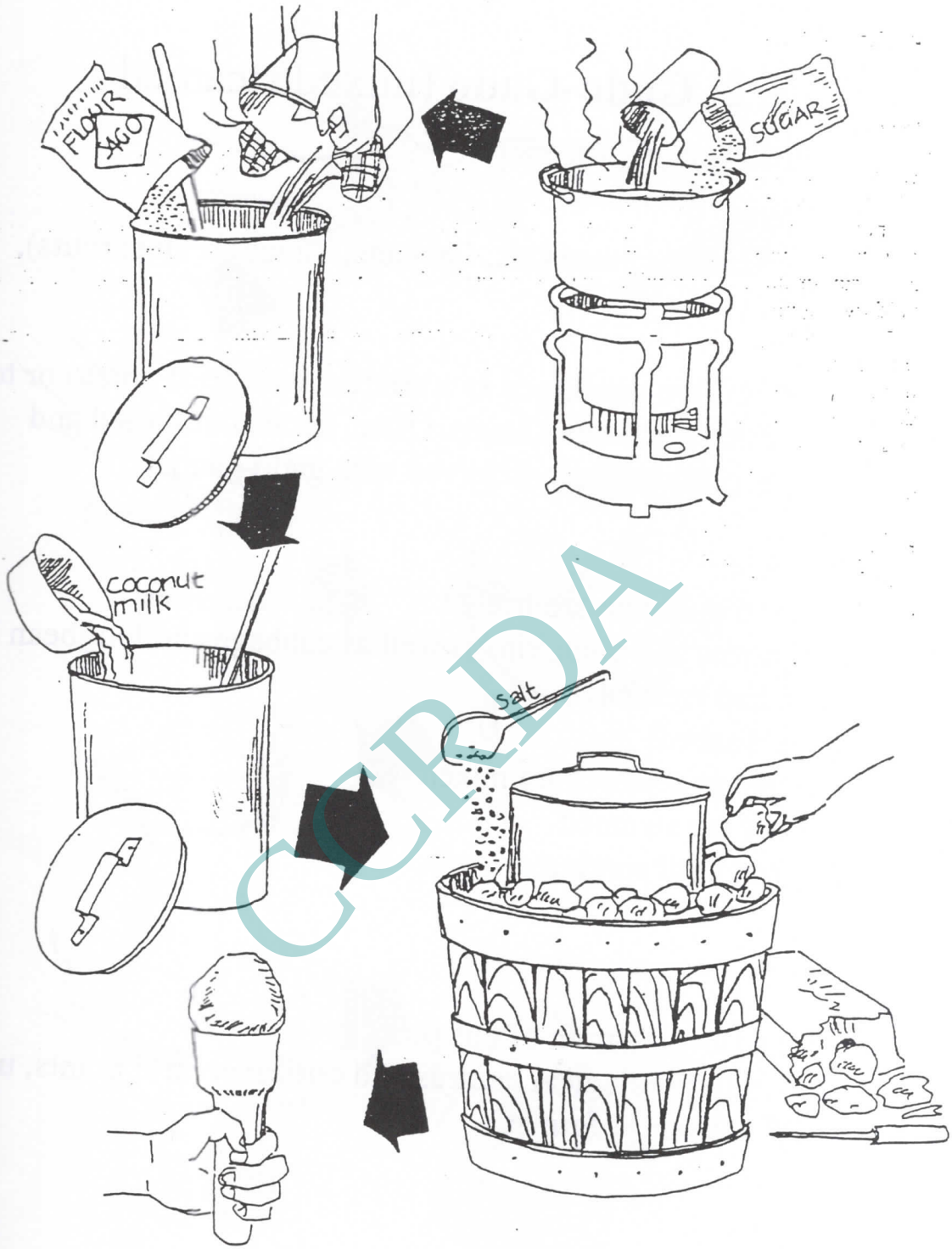
Preparation:

1. Mix the cassava flour and sago flour with 1 liter of unboiled water
2. Mix the cane sugar with 5 liters of water, and bring to the boil
3. Add the cassava/sago suspension to the sugar solution while stirring
4. The obtained "premix" is stored overnight
5. Coconut milk is prepared separately as follows:
   - coconuts are opened, peeled, and grated to pulp
   - add 5 liters of unboiled water, and mix
   - filter, and squeeze to obtain the extract
   - sieve the extract; this is called coconut milk
6. Mix the premix with the coconut milk to obtain a dough
7. Freeze the dough while stirring continuously to obtain the ice cream "Es Puter".

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Tasks:

1. Prepare a flow diagram of this process
2. Identify microbiological hazards and critical control points, using a HACCP data sheet format.



CCRDA

Figure 4.1b Process flow on the preparation of es puter;
a visualization of the methods used

STREET FOODS

Excercise 2: **Gado-Gado** (mixed steamed vegetables)

Ingredients: Carrots, Pumpkins, Cabbage, Tauge (bean sprouts), Longbean.

Gado-Gado is often consumed as a mixture with fried potato or tofu, egg, chilli sauce and peanut sauce. Often, instead of boiled and steamed rice, glutinous rice is served with gado-gado.

Preparation:

1. Carrots and pumpkin are peeled
2. Peeled carrots and pumpkin, as well as cabbage and longbean are trimmed and washed
3. Tauge is washed
4. All washed vegetables are mixed
5. Then, they are steamed
6. And stored until serving

CCRDA

Tasks:

1. Prepare a flow diagram of this process
2. Identify microbiological hazards and critical control points, using a HACCP data sheet format.

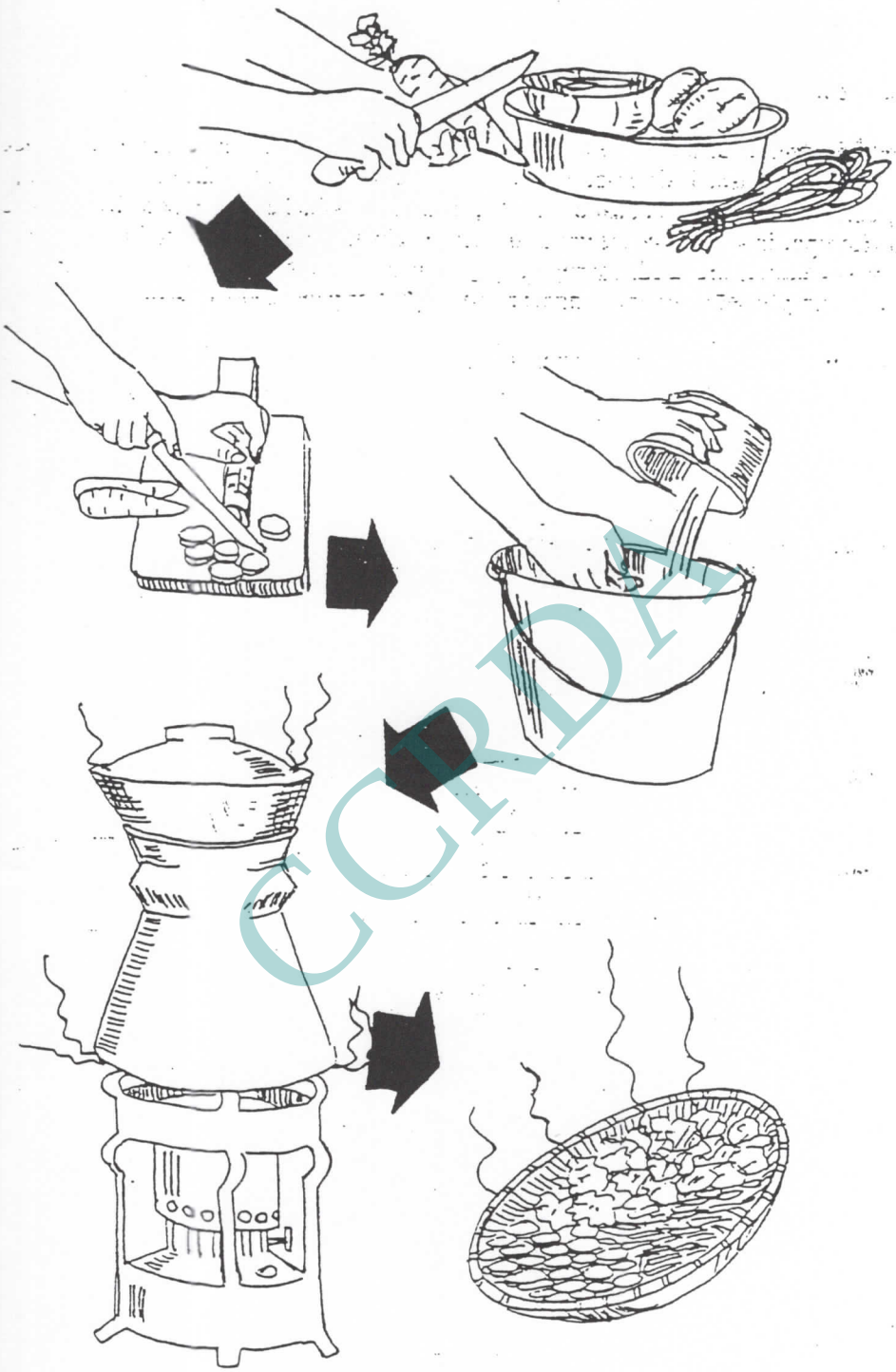


Figure 5.1b Process flow of the preparation of the vegetables; a visualization of the methods used.

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29th INTERNATIONAL COURSE ON FOOD AND NUTRITION

Food and nutrition security: caring for women and children

Module on household food security in rural areas

Sustainable agriculture and household food security

Facilitator: H. Kieft

June 2, 1998

CCRDA

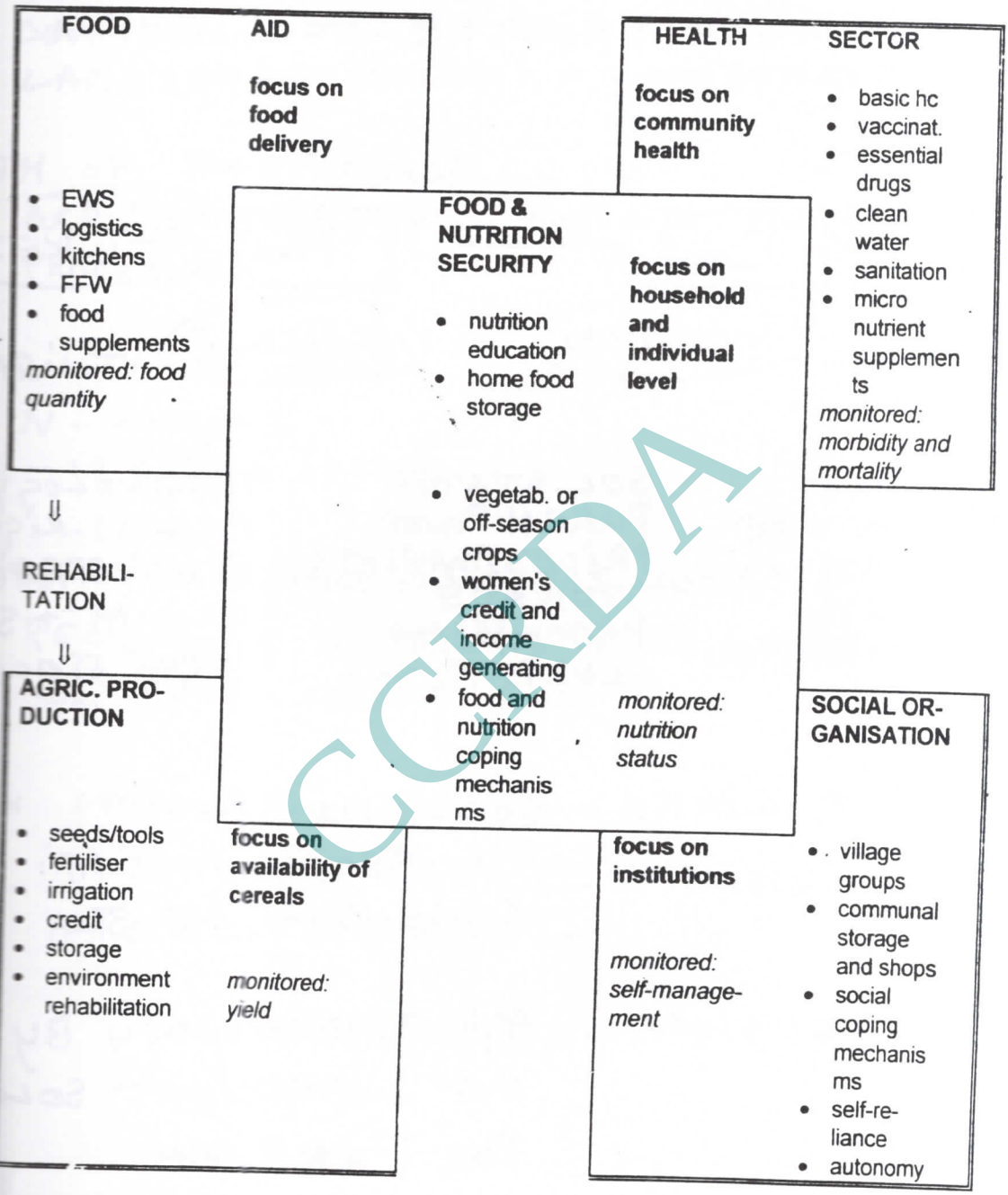
WAGENINGEN, THE NETHERLANDS

January 11 - June 13, 1998

IAC INTERNATIONAL AGRICULTURAL CENTRE

DIAGRAM FOOD & NUTRITION SECURITY AND RELATED SECTORS

Typical activities of various SECTOR POLICIES compared to activities related to FOOD AND NUTRITION SECURITY (ref. 134, page 43). For each set of activities also its **focus** and its *monitoring indicators* are shown. Note the clear integrative function of the F&NS concept.



ACTIVITIES GENERAL TO ALL PROJECTS OR SECTORS (not specific for F&NS) INCLUDE:

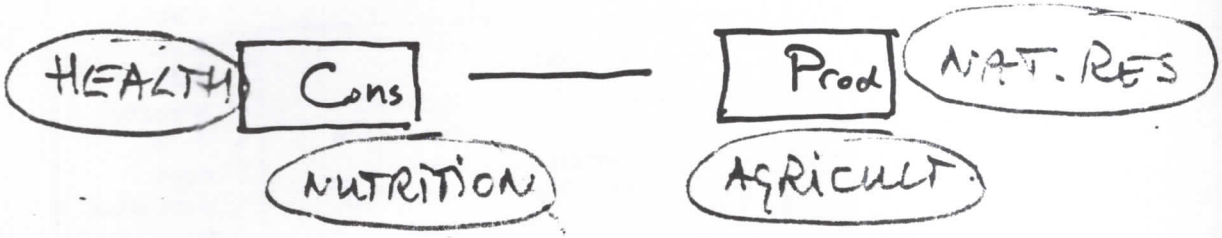
1. project management
2. staff capacity building and training
3. target group awareness building
4. participatory approaches
5. co-ordination with GO and NGO
6. gender awareness

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AGRIC ÷ FOOD & NUTR. SEC.



SIMPLISTIC FOOD CHAIN



HYGENE
FOOD INTAKE
VARIATION
QUALITY
PREPARATION

SOC. STATUS
PURCH. POWER
PRICES/MARKETS
STORAGE
PROCESSING
CONS. PATTERNS

TECHNOLOGY
ACCESS-RIGHTS
BIODIVERSITY
CLIMAT + SOIL
INPUT STOCKS

⇒ THESE LINKS: SOC-CULT
SOC. ECON
HOUSE-HOLD LEVEL

⇒ CONCLUSION : AGR. TECHNOLOGY BY ITSE
NOT SUFFICIENT SOLUTIO
FOR F&NS/HH

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FOOD & NUTR. SEC. AH AS CRITERION FOR APS.

SUFFICIENT + BALANCED DIET
- DIVERSITY
- LOCAL CROPS & ANIMALS
- COMPLEMENTARITY CROP : ANIMAL : WILD
- LANDSCAPE VALUES + MANAGEMENT

HEALTH OF FOOD PRODUCT
- AGR. TECHNOLOGY — PESTICIDES / NUTRIENTS - N
- PROCESSING

STORABILITY OF FOOD
- N - dosage
- - 10 à 30 % losses

PROCESSING & MARKETING AS LOCAL AS POSSIBLE
- RECYCLING NUTRIENTS + ORG. MATTER
- ex. MALI COTTON. PULP

HUMAN LABOUR CONDITIONS
- IRRITATIONS & DISEASES : TECHN.
- AGRO-ECO. DEGRADATION

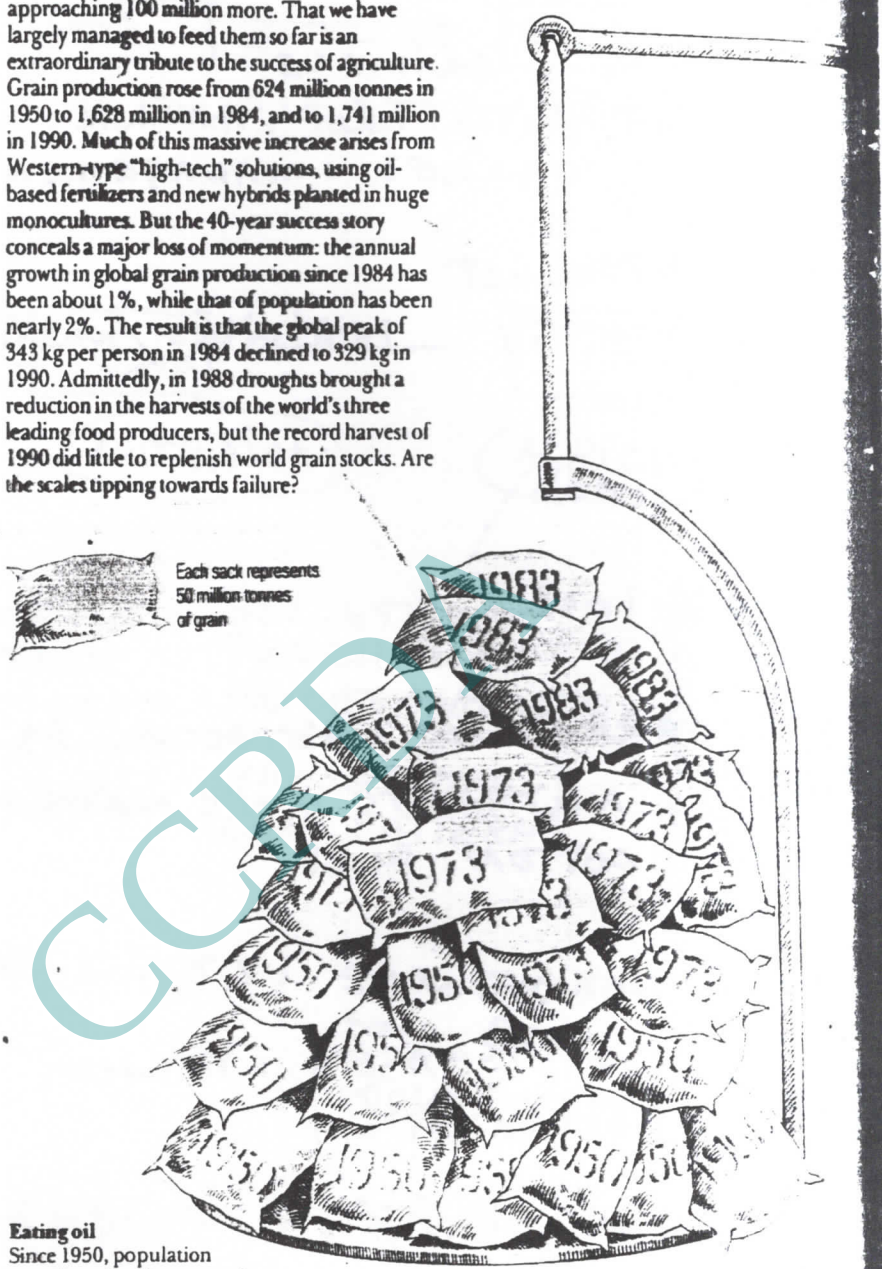
APS

MORE LOCAL ORGANISED
" HOUSEHOLD ORIENTED
" ECO-SYSTEM BASED

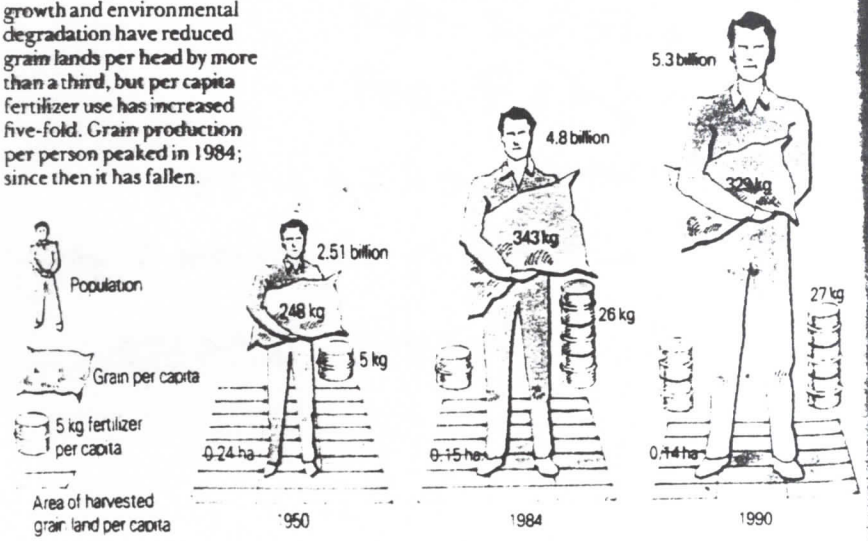
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Agriculture in the balance

Each year there are more mouths to feed – approaching 100 million more. That we have largely managed to feed them so far is an extraordinary tribute to the success of agriculture. Grain production rose from 624 million tonnes in 1950 to 1,628 million in 1984, and to 1,741 million in 1990. Much of this massive increase arises from Western-type "high-tech" solutions, using oil-based fertilizers and new hybrids planted in huge monocultures. But the 40-year success story conceals a major loss of momentum: the annual growth in global grain production since 1984 has been about 1%, while that of population has been nearly 2%. The result is that the global peak of 343 kg per person in 1984 declined to 329 kg in 1990. Admittedly, in 1988 droughts brought a reduction in the harvests of the world's three leading food producers, but the record harvest of 1990 did little to replenish world grain stocks. Are the scales tipping towards failure?



Eating oil
Since 1950, population growth and environmental degradation have reduced grain lands per head by more than a third, but per capita fertilizer use has increased five-fold. Grain production per person peaked in 1984; since then it has fallen.

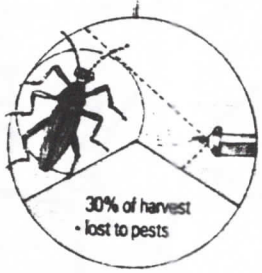


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The costs of advanced agriculture
Many of today's farmers practise a form of "deficit financing". To meet urgent needs, from food to interest on loans, they are depleting our future land base, destroying our wild and cultivated genetic heritage, using up fossil energy and groundwater supplies, and applying toxic chemicals to the land. We lose nearly half our crops to resistant pests and bad storage, produce "milk lakes" we cannot dispose of, and use vital land to grow feed for livestock, to support unhealthy meat-rich diets. Meanwhile, poorer countries experience falling food sufficiency, inadequate research facilities, and growing social inequality.



...monocultures
...planted with ... strains, all ... to the same ... – and all helping ... genetic diversity ...



Race against nature
Intensive spraying often fails to eradicate the pests which thrive on monocultures, taking over a third of our harvest. Resistant and mutant forms are always one jump ahead.



The oil farmers
If every nation expended as much oil per head in agriculture as the US, current world oil reserves would be emptied in a dozen years.



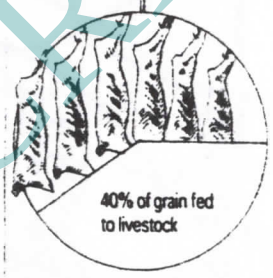
Lost genes
Traditional crop varieties are swept away by the bulldozer and replaced by the new hybrids. Yet these old forms hold vital genetic material.



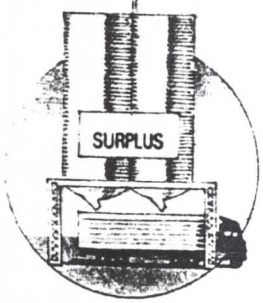
The new dust bowls
Deforestation, over-cropping, over-ploughing, or over-grazing of dry lands destroy the soil – the farmer's capital.



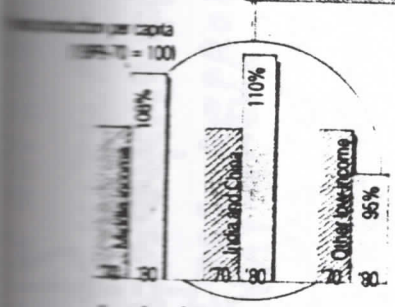
Thirsty crops
Irrigation is vital to the miracle grains. Agriculture now takes 73% of global freshwater demand.



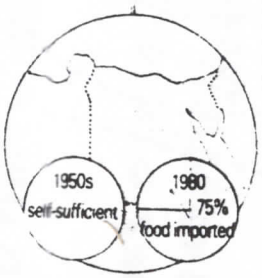
Wasteful diets
Nearly 40% of the world's grain is fed to livestock for the unhealthy meat-rich diet of the North.



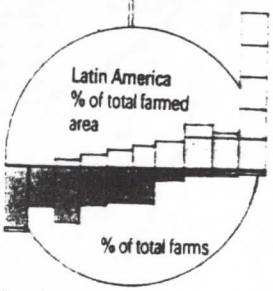
Surplus and waste
Huge EEC and US surpluses, "mountains" of butter and sugar, "lakes" of milk and wine, cost $53 billion in 1983.



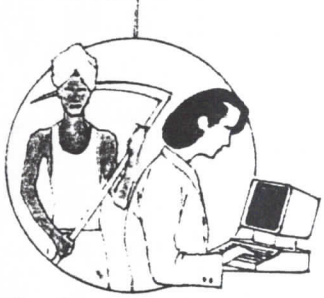
Leaving the poor behind
Even before world grain production per capita peaked, many low-income countries had been experiencing a decline in food production per person



Relying on grain imports
Egypt, with its fertile floodplain in the Nile, used to be self-sufficient in grain. Sadly, it now imports over 75% of its food requirements



Land concentration
Wealth breeds wealth: large holdings increasingly crowd out small-holders (who are generally more productive), as in Latin America, above.

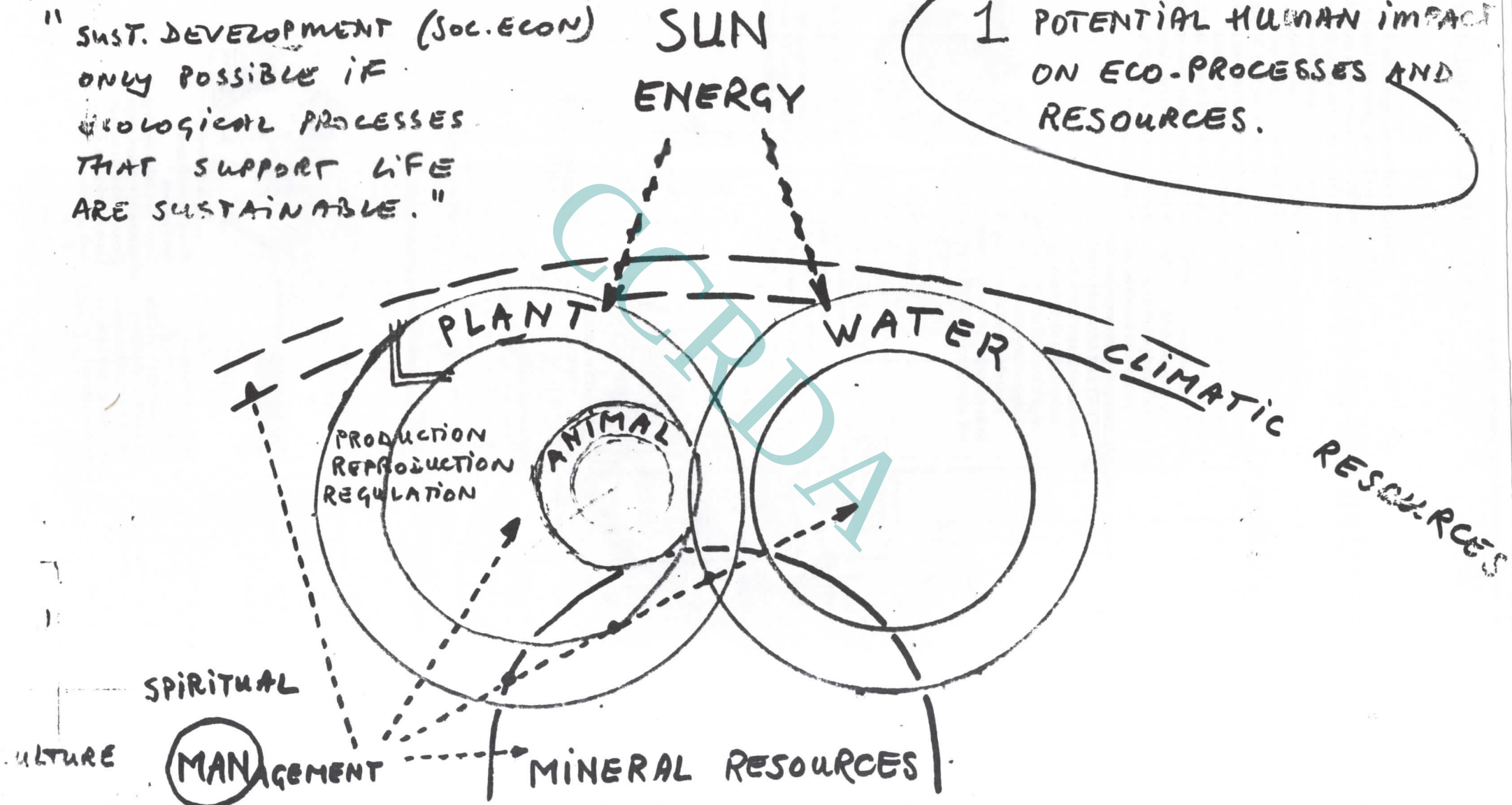


Biased research and development
Green Revolution research has tended to ignore crops grown by small farmers in Latin America and Africa – such as cassava, sorghum, and millet.

ICRDA

"SUST. DEVELOPMENT (SOC. ECON) ONLY POSSIBLE IF BIOLOGICAL PROCESSES THAT SUPPORT LIFE ARE SUSTAINABLE."

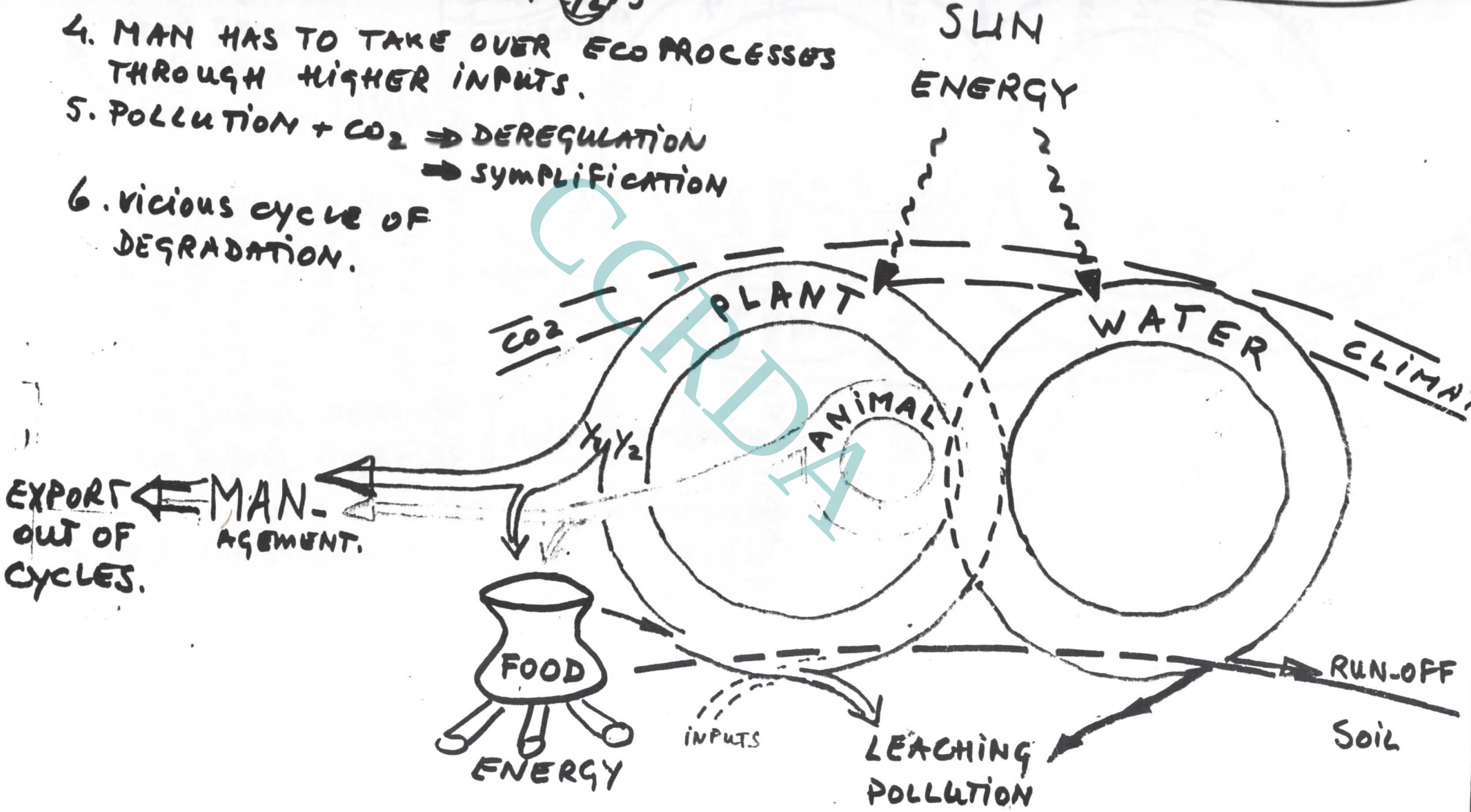
1 POTENTIAL HUMAN IMPACT ON ECO-PROCESSES AND RESOURCES.



CCRDA

1. MAN'S EXTRACTION (Y1) LONG DISTANCE
2. MONOCULTURE = SYMPLIFICATION
3. ⇒ DEREGULATION
   ⇒ LESS REPRODUCTION (Y2) } "
4. MAN HAS TO TAKE OVER ECO PROCESSES THROUGH HIGHER INPUTS.
5. POLLUTION + CO_2 ⇒ DEREGULATION
   ⇒ SYMPLIFICATION
6. VICIOUS CYCLE OF DEGRADATION.

2. NON-SUSTAINABLE MANAGEMENT.

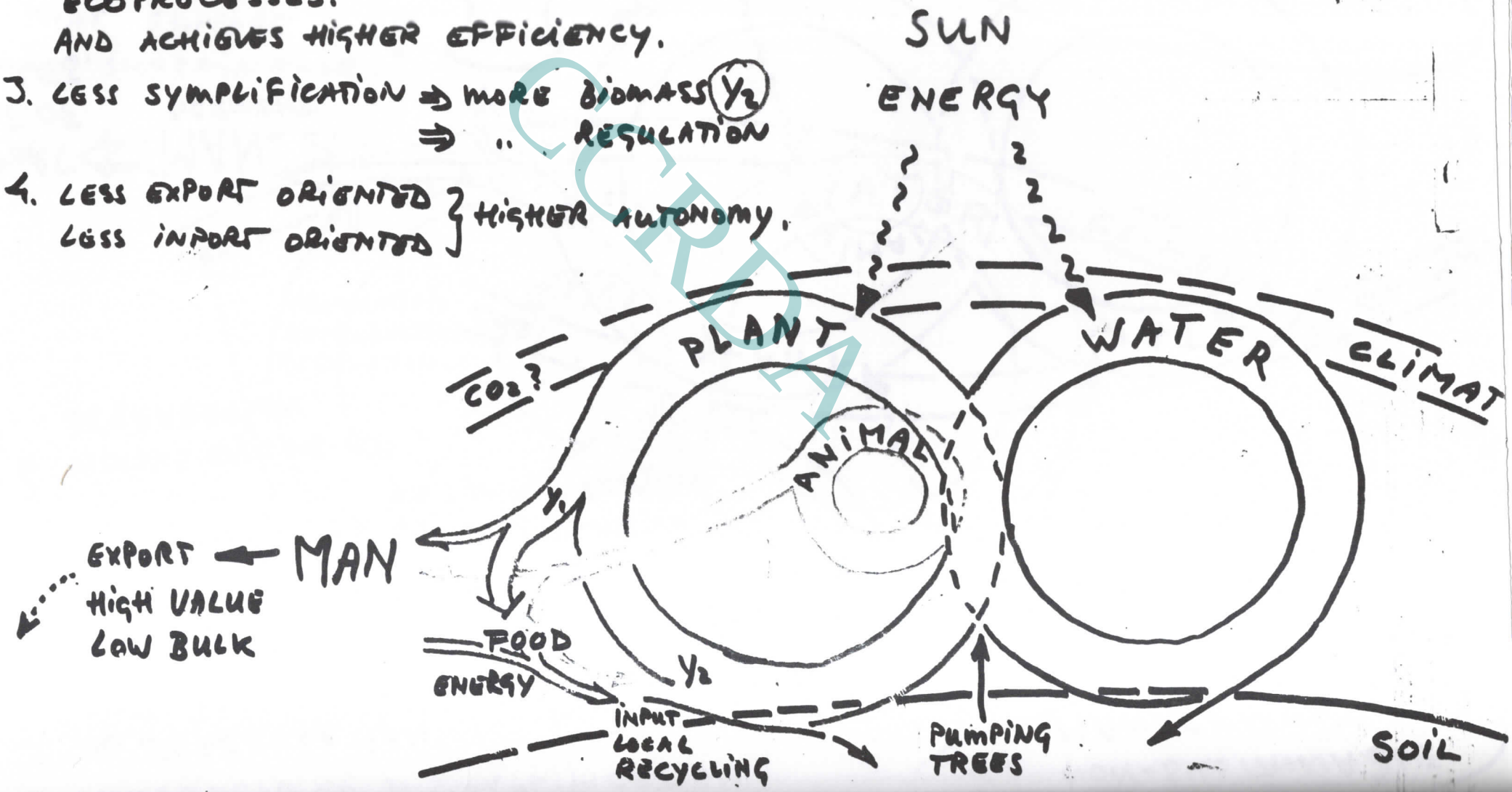


CORDA

HK '91

3. SUSTAINABLE MANAGEMENT.

1. EXTRACTION OVER SHORT DISTANCE (Y_1) RECYCLING INTO (Y_2).
2. MANAGEMENT MAXIMISES FUNCTIONS ECOPROCESSES. AND ACHIEVES HIGHER EFFICIENCY.
3. LESS SYMPLIFICATION ⇒ MORE BIOMASS (Y_2) ⇒ " REGULATION
4. LESS EXPORT ORIENTED, LESS IMPORT ORIENTED } HIGHER AUTONOMY.



CCRDA

BASIC ASSUMPTION

"SUST. DEVELOPMENT ONLY IF LIFE-SUPPORTING ECO-PROCESSES ARE SUSTAINABLE"

⇓

NORMS FOR SUST. ENVIRONMENTAL MANG OR TRESHOLDS:

MINIMUM: MANAGEMENT THAT PREVENTS DEGRADATION TO EXCESS POINT OF NO RETURN

MEDIUM: MANAGEMENT THAT MAINTAINS CURRENT PRODUCTION CAPACITY

OPTIMUM: MANAGEMENT THAT ENHANCES

- PRODUCTIVE, REPRODUCTIVE AND REGULATING FORCES TOWARDS OPTIMAL, MAINTAINABLE OUTPUT
- SUFFICIENT BIOMASS TURN-OVE FOR INVESTMENT IN FUTURE PRODUCTIVITY
- OPPORTUNITY FOR ONGOING EVOLUTION.

CCRDA

levels of criteria

FIELD LEVEL

crucial environmental and — NATURE
crucial agro-technical aspects — CULTU

FARM LEVEL

crucial environmental and — NATURE
crucial micro-economic aspects — CULTU

COMMUNITY LEVEL

crucial environmental and — NATURE
crucial social aspects — CULTU

INTERNATIONAL LEVEL
crucial climatic aspects
crucial macro-economic aspects



— N — +EQUITY
— P — +LAND REFORM
— P — +LOWER INTEREST CO

CCRDA

TRENDS

NATURE ORIENTED — 1900

INDUSTRY " — 2000

⇒ ENVIRONMENT " — ....
+
SOCIALS

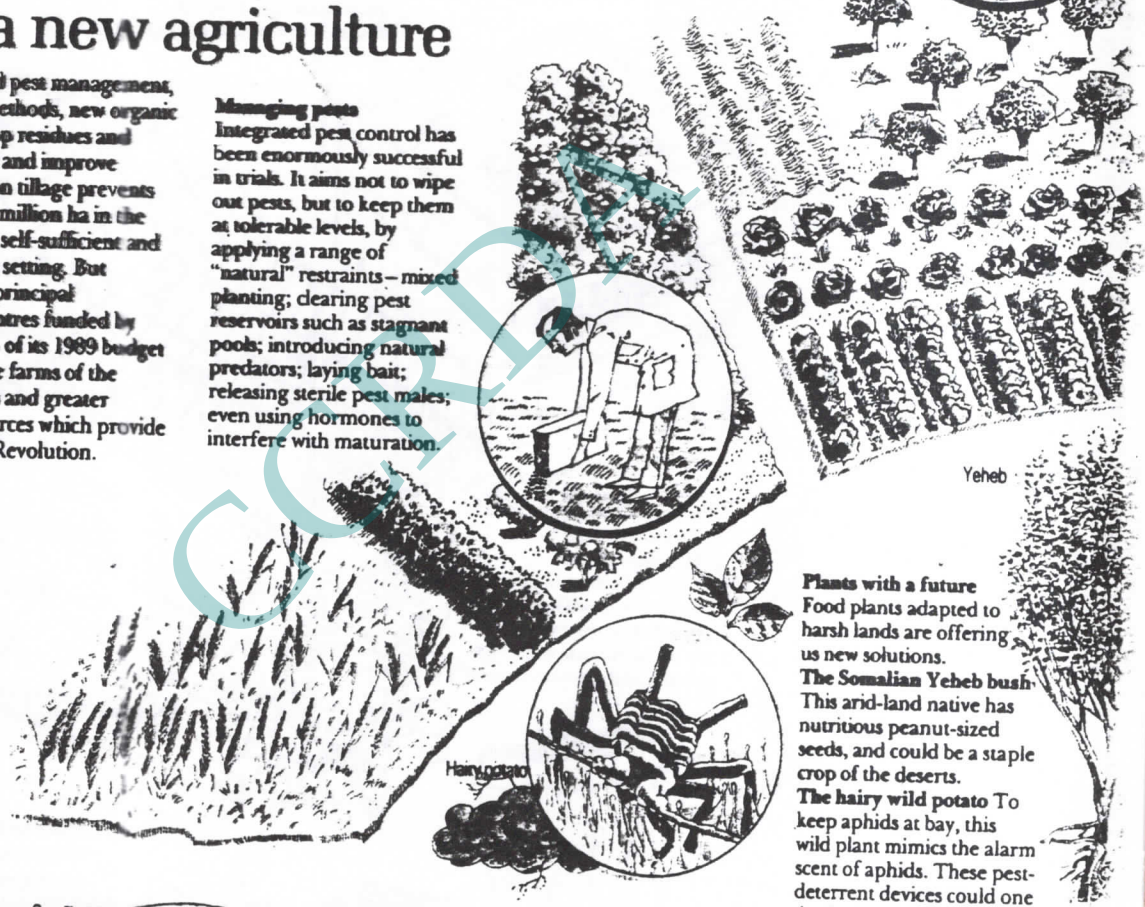
Towards a new agriculture

[illegible] has shaped integrated pest management, water-conserving irrigation methods, new organic fertilisers, and new uses of crop residues and green mulches to protect land and improve energy efficiency. Conservation tillage prevents erosion, now employed on 40 million ha in the US. Future crops will be more self-sufficient and site-specific, tailored to their setting. But research support is slim – the principal international crop research centres funded by governments devoted only 5% of its 1989 budget to biotechnology research. The farms of the future will need more research and greater protection of the genetic resources which provide the raw material for the Gene Revolution.

Managing pests
Integrated pest control has been enormously successful in trials. It aims not to wipe out pests, but to keep them at tolerable levels, by applying a range of "natural" restraints – mixed planting; clearing pest reservoirs such as stagnant pools; introducing natural predators; laying bait; releasing sterile pest males; even using hormones to interfere with maturation.

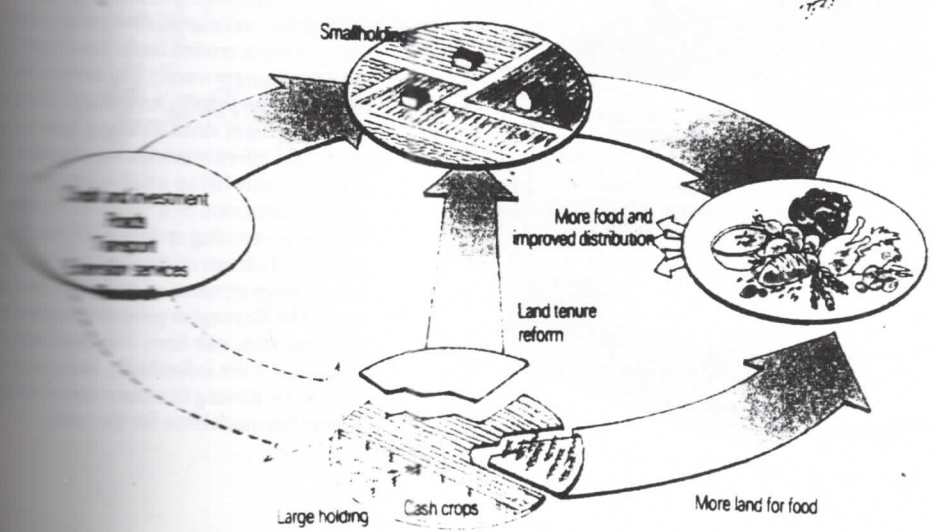
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Increased funding and new research centres are badly needed, especially in low-income areas, to develop locally adapted strains and cultivation techniques relevant to small and large-scale farmers.





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Plants with a future
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The Somalian Yeheb bush This arid-land native has nutritious peanut-sized seeds, and could be a staple crop of the deserts.
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Food first in the South
If the new agriculture is to lift the South on its wings, it must be truly revolutionary. A sharp turnround is called for, from over-emphasis on industry to farming, from export cash crops to domestic supply, and from commercial landholder to small farmer. To achieve food sufficiency, small farmers must be backed by regional co-operation, for however willing and productive they may be, they need a package of facilities to succeed. These include: credit and better prices; improved marketing, transport and advisory services; appropriate research; and security of tenure and access to good land. The best example of "food first" is China, now feeding 22% of the world's population on 7% of the world's arable land.

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Preserving crop diversity in cold storage (pp 162-3) and running local seed libraries allow farmers a choice of solutions to cultivation problems.

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Cultivation under glass in huge plastic tunnels provide valuable crops from lands otherwise unsuited to farming. Energy intensive. Israel farms the desert in order to earn export cash to import staples.


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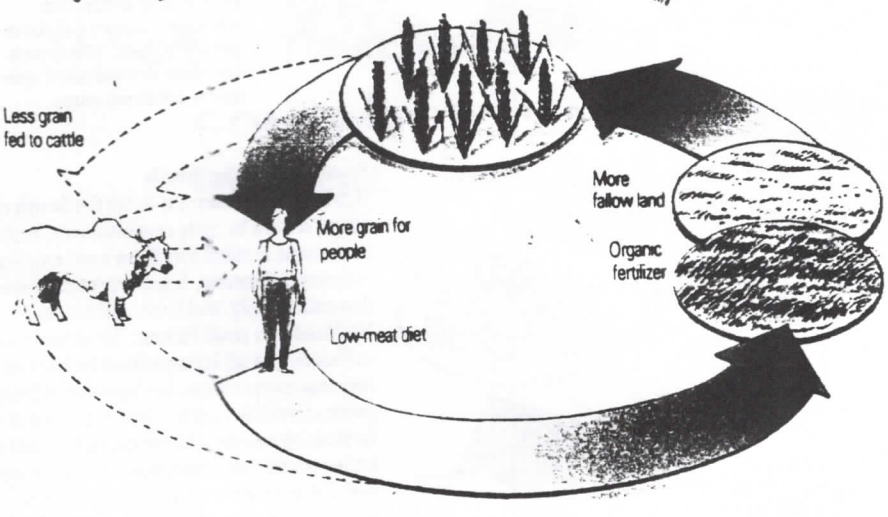
Pomelo This large citrus fruit offers a high food value.

The winged bean
Originally grown by forest-dwellers in New Guinea, this bean is now grown in 50 countries because of its high protein and vitamin content.


Winged bean


Pomelo

Trickle-drip technique
Irrigation controlled by pierced pipes both saves water and reduces salt build-up due to evaporation.



Meat last in the North
The obvious medicine for the soil sickness of developed agriculture is, at first glance, unpalatable: increased fallow periods and idling of worst-eroded lands. How then to feed the grain-hungry world? The answer to this dilemma is surprising. An average US citizen today consumes about 800 kg of grain a year, nearly all indirectly as meat – an increase since 1960, of about 160 kg which is nearly the total amount consumed by a better-fed African. Merely by reverting to diets of 20 years ago, rich-world citizens could improve their health, release large amounts of grain, and free much land. The Norwegian government pioneers this approach, with farm incentives and education. Even individually, many rich people are turning to a more meat-free diet; herein lies much hope for the world.

ICRDA

POTENTIALS OF LEIA AND HEIA 2000

(Acc. to: I.I.A.S.A. for FAO. 1984)

L • LOW TECHN. LEVEL.
M • MEDIUM TECHN. LEVEL.
H • HIGH TECHN. LEVEL.

[WORLD × 1.5
× 4
× 9]

CAPE VERDIAN
WEST. SAHARA
RWANDA
MAURITIUS
} 4 NOT ENOUGH WITH H.

BURUNDI
LESOTHO
ALGERIA
SOMALIA
NIGERIA
REUNION
KENYA
MAURITANIA
} 8 NOT ENOUGH WITH M.

ALL OTHER 30 AFR. CONTRIES ENOUGH WITH M. OR L. ≃ LEISA.

CCRDA

AANDEEL LEÏSA IN VOEDSEL PROD. AF
(OTA. 1988)

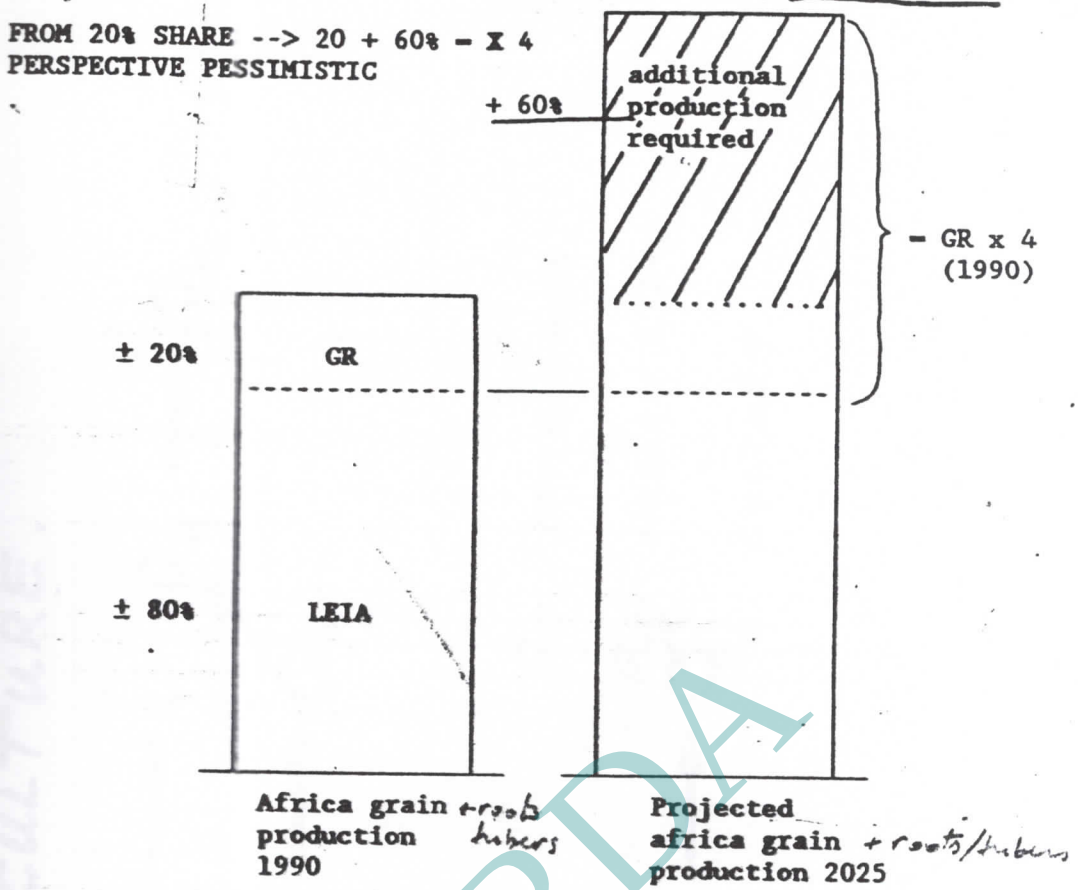
GIERST	> 72	%
SORGHUM	> 61	
MAIS	> 37	
RYST	> 76	
PINDA	> 55	
BONEN	> 69	
CASSAVE	> 93	
YAM	100	
COCO YAM	100	
RUNDVEE	80-94	
KLEINVEE	95-100	
VIS	90	

LEÏSA AAN
≥ 80 %

CCRDA

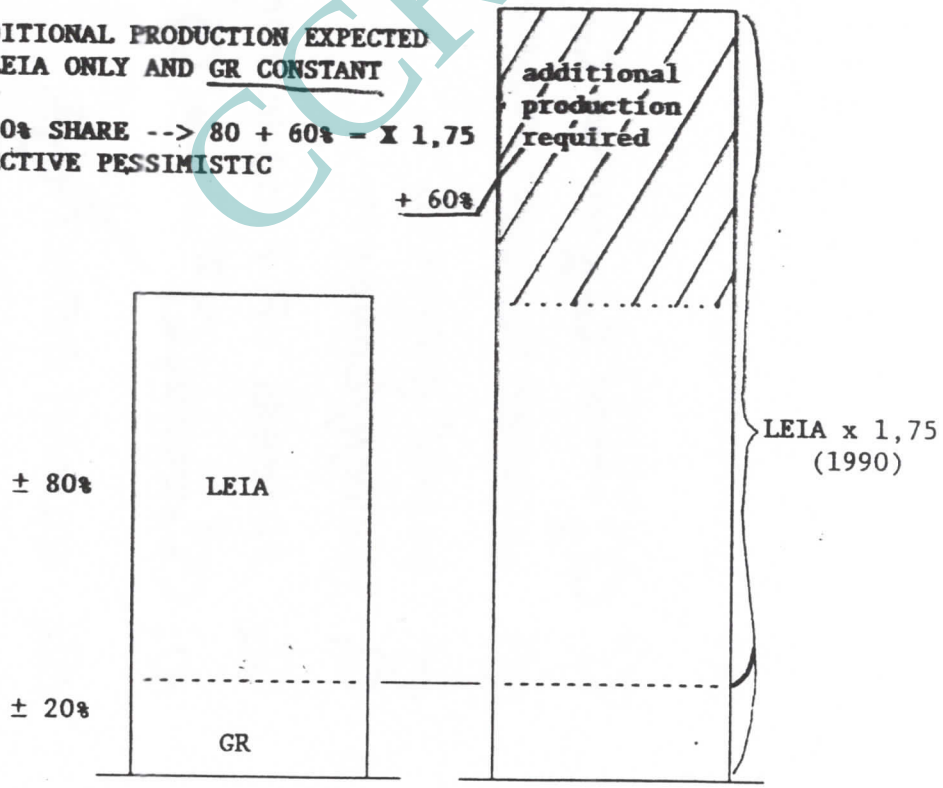
Figuur 1. ***suppositions for additional food coming 35 years***

1. IF ADDITIONAL PRODUCTION EXPECTED FROM GR ONLY AND LEIA CONSTANT



2. IF ADDITIONAL PRODUCTION EXPECTED FROM LEIA ONLY AND GR CONSTANT

FROM 80% SHARE --> 80 + 60% = X 1,75
PERSPECTIVE PESSIMISTIC



3. IF ADDITIONAL PRODUCTION EXPECTED FROM GR + LEIA
PERSPECTIVE MOST REALISTIC

CCRDA

Q: QUALITY IN (AGRI-)CULTURE.

CCRDA

$Q_1 \rightarrow Q_2 \rightarrow Q_3 \rightarrow Q_4$

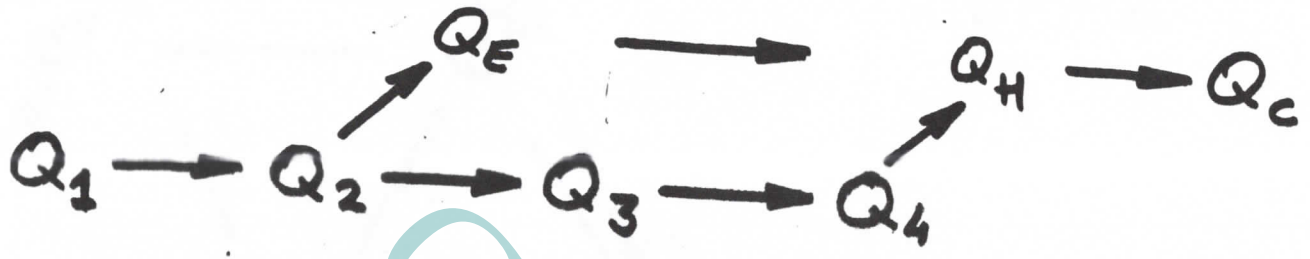
Q_1 DESIGN/CONCEPT

Q_2 PROCESS OF PRODUCTION

Q_3 PRODUCT

Q_4 HUMAN HEALTH.

A: QUALITY IN (AGRI-)CULTURE.



Q_1 DESIGN/CONCEPT

Q_2 PROCESS OF PRODUCTION

Q_3 PRODUCT

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Q_E ENVIRONMENT

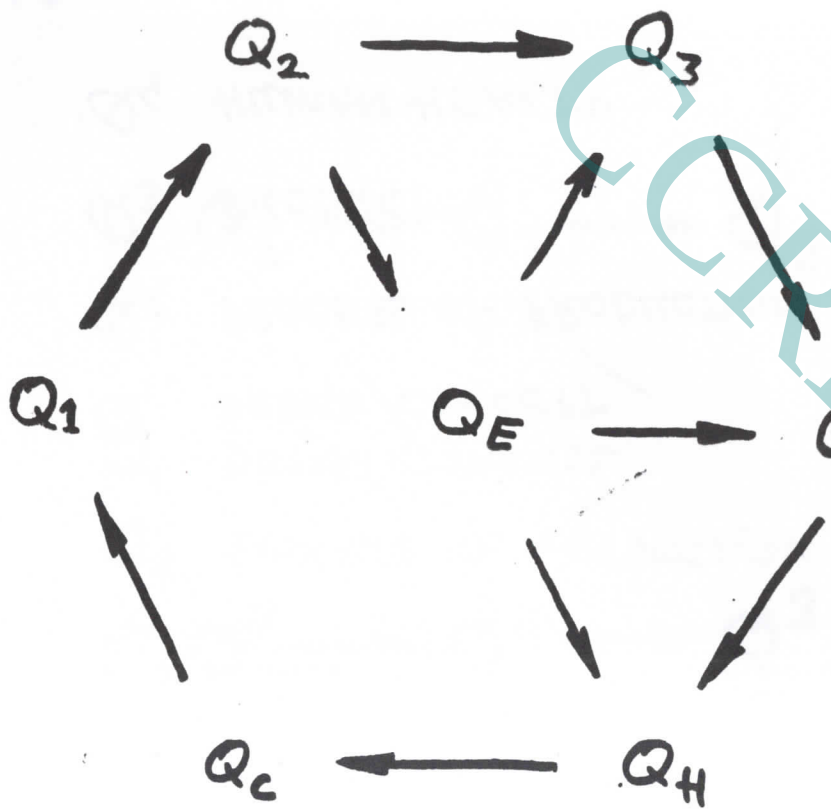
Q_H HUMAN LIFE

Q_C CULTURE

CCRDA

KONINGSVELD. H: LANDBOUW IS APART OBJECT VAN WETENSCH. ONDERZOEK
LT. 12. 1986. DOOR DE VERWEVING VAN (MANAGEMENT VAN)
NATUURLIJKE EN CULTUURLIJKE PROCESSEN. H.J.K. Ko'ng.

LINEAR TO SPIRAL



in SPACE : PLOT LEVEL

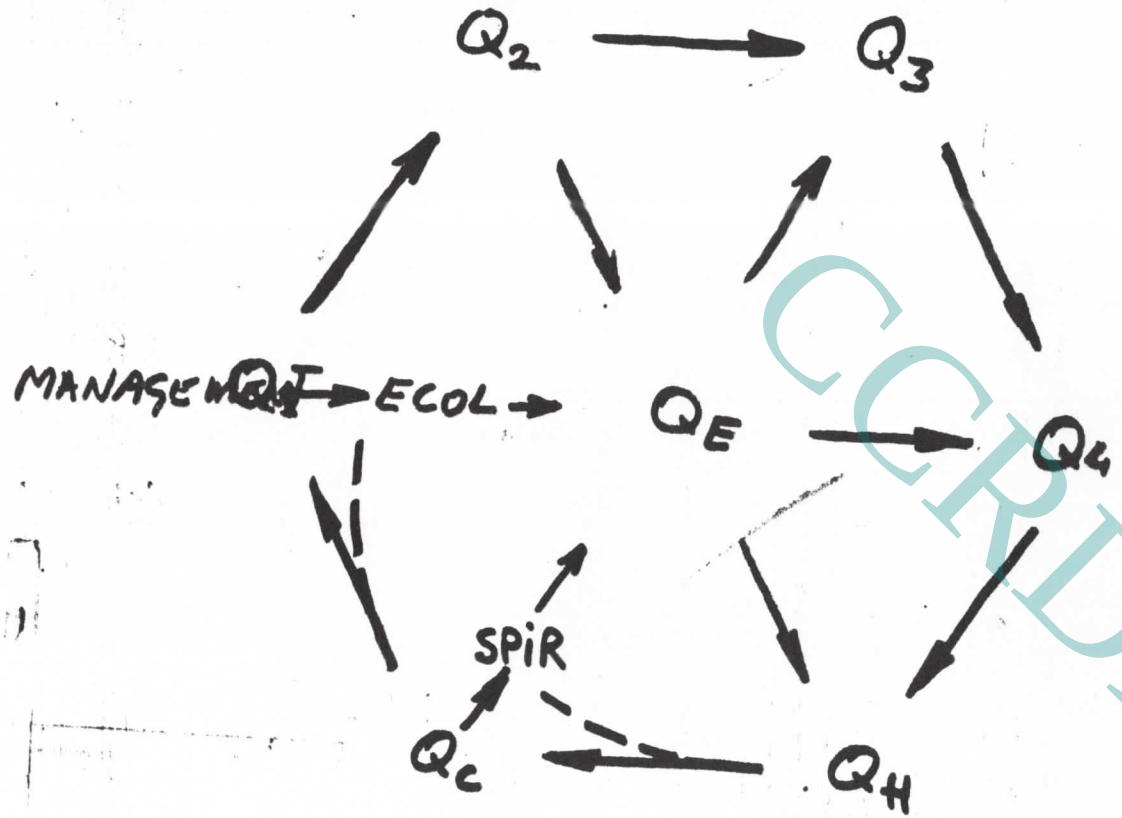
FARM "

REGION "

....

CCRDA

LINEAR TO SPIRITUAL



in SPACE : PLOT LEVEL
FARM "
REGION "

in TIME : SHORT TERM/N
MEDIUM "
LONG "/TR

$Q_E + Q_H \Rightarrow Q_C \Longrightarrow Q_{EVOL}$

SPIRITUALITEIT ↑ TRANSCENDENTIE.

INTRINSIC VALUE of NATU

TOWARDS SUSTAINABILITY:

MK. 10.'91

CCRDA

29th INTERNATIONAL COURSE ON FOOD AND NUTRITION

Food and nutrition security: caring for women and children

Module on household food security in rural areas

Sustainable agriculture and household food security

Facilitator: H. Kieft

June 2, 1998

CCRDA

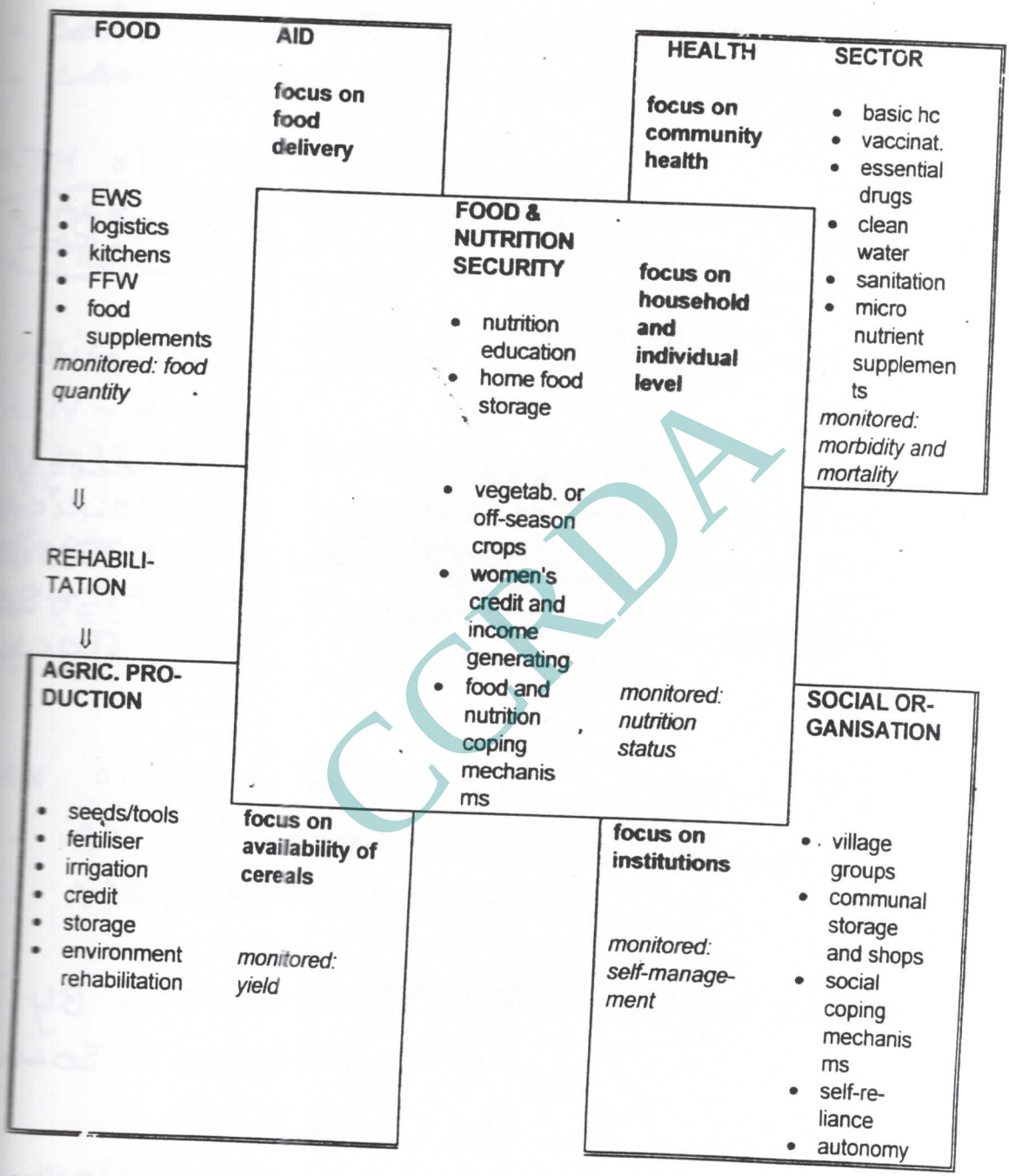
WAGENINGEN, THE NETHERLANDS

January 11 - June 13, 1998

IAC INTERNATIONAL AGRICULTURAL CENTRE

DIAGRAM FOOD & NUTRITION SECURITY AND RELATED SECTORS

Typical activities of various SECTOR POLICIES compared to activities related to FOOD AND NUTRITION SECURITY (ref. 134, page 43). For each set of activities also its **focus** and its *monitoring indicators* are shown. Note the clear integrative function of the F&NS concept.



ACTIVITIES GENERAL TO ALL PROJECTS OR SECTORS (not specific for F&NS) INCLUDE:

1. project management
2. staff capacity building and training
3. target group awareness building
4. participatory approaches
5. co-ordination with GO and NGO
6. gender awareness

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AGRIC ÷ FOOD & NUTR. SEC.



SIMPLISTIC FOOD CHAIN



HYGENE	SOC. STATUS	TECHNOLOGY
FOOD INTAKE	PURCH. POWER	ACCESS-RIGHTS
VARIATION	PRICES/MARKETS	BIODIVERSITY
QUALITY	STORAGE	CLIMAT + SOIL
PREPARATION	PROCESSING	INPUT STOCKS
	CONS. PATTERNS	

⇒ THESE LINKS: SOC-CULT
SOC. ECON
HOUSE-HOLD LEVEL

⇒ CONCLUSION : AGR. TECHNOLOGY BY ITSE
NOT SUFFICIENT SOLUTIO
FOR F&NS/HH

CCRDA

& NUTR. SEC. /HH AS CRITERION FOR APS.

FFICIENT + BALANCED DIET
- DIVERSITY
- LOCAL CROPS & ANIMALS
- COMPLEMENTARITY CROP : ANIMAL : WILD
- LANDSCAPE VALUES + MANAGEMENT

EALTH OF FOOD PRODUCT
- AGR. TECHNOLOGY — PESTICIDES / NUTRIENTS - N
- PROCESSING

TORABILITY' of FOOD
- N - dosage
- -10 à 30% losses

ROCESSING & MARKETING AS LOCAL AS POSSIBLE
- RECYCLING NUTRIENTS + ORG. MATTER
- ex. MACI COTTON. PULP

UMAN LABOUR CONDITIONS
- IRRITATIONS & DISEASES : TECHN.
- AGRO-ECO. DEGRADATION

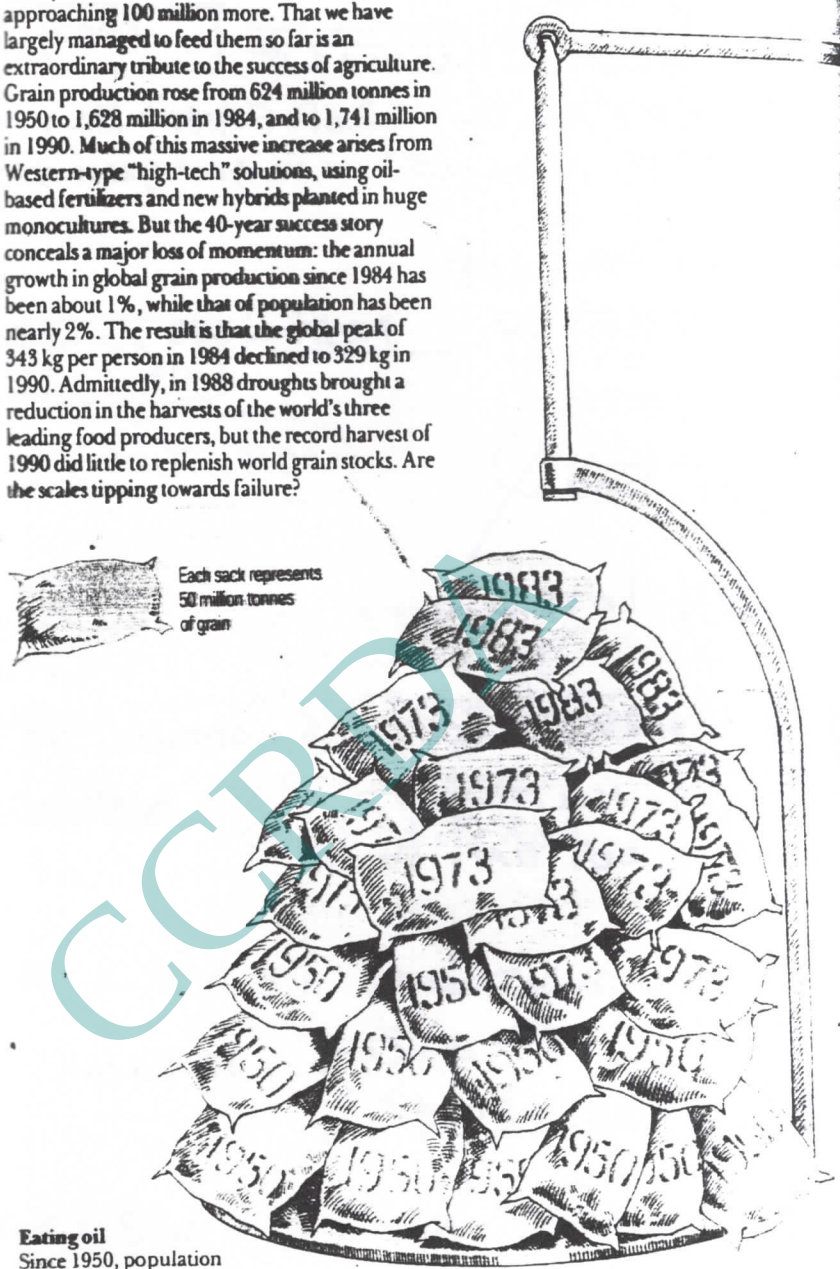
APS

MORE LOCAL ORGANISED
" HOUSEHOLD ORIENTED
" ECO-SYSTEM BASED

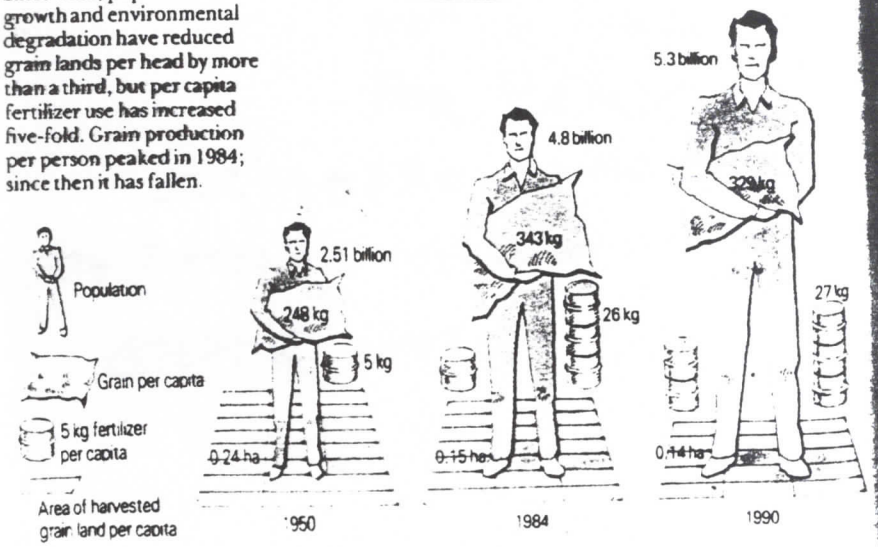
CCRDA

Agriculture in the balance

Each year there are more mouths to feed – approaching 100 million more. That we have largely managed to feed them so far is an extraordinary tribute to the success of agriculture. Grain production rose from 624 million tonnes in 1950 to 1,628 million in 1984, and to 1,741 million in 1990. Much of this massive increase arises from Western-type "high-tech" solutions, using oil-based fertilizers and new hybrids planted in huge monocultures. But the 40-year success story conceals a major loss of momentum: the annual growth in global grain production since 1984 has been about 1%, while that of population has been nearly 2%. The result is that the global peak of 343 kg per person in 1984 declined to 329 kg in 1990. Admittedly, in 1988 droughts brought a reduction in the harvests of the world's three leading food producers, but the record harvest of 1990 did little to replenish world grain stocks. Are the scales tipping towards failure?

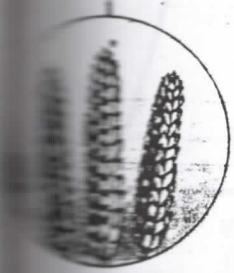


Eating oil
Since 1950, population growth and environmental degradation have reduced grain lands per head by more than a third, but per capita fertilizer use has increased five-fold. Grain production per person peaked in 1984; since then it has fallen.



CCRD

The costs of advanced agriculture
Many of today's farmers practise a form of "deficit financing". To meet urgent needs, from food to interest on loans, they are depleting our future land base, destroying our wild and cultivated genetic heritage, using up fossil energy and groundwater supplies, and applying toxic chemicals to the land. We lose nearly half our crops to resistant pests and bad storage, produce "milk lakes" we cannot dispose of, and use vital land to grow feed for livestock, to support unhealthy meat-rich diets. Meanwhile, poorer countries experience falling food sufficiency, inadequate research facilities, and growing social inequality.



...monocultures
...planted with ...crops strains, all ...to the same ...– and all helping ...genetic diversity ...



Race against nature
Intensive spraying often fails to eradicate the pests which thrive on monocultures, taking over a third of our harvest. Resistant and mutant forms are always one jump ahead.



The oil farmers
If every nation expended as much oil per head in agriculture as the US, current world oil reserves would be emptied in a dozen years.



Lost genes
Traditional crop varieties are swept away by the bulldozer and replaced by the new hybrids. Yet these old forms hold vital genetic material.



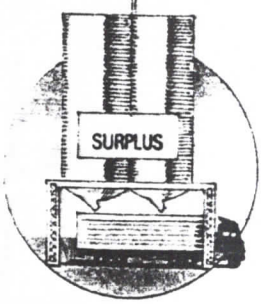
The new dust bowls
Deforestation, over-cropping, over-ploughing, or over-grazing of dry lands destroy the soil – the farmer's capital.



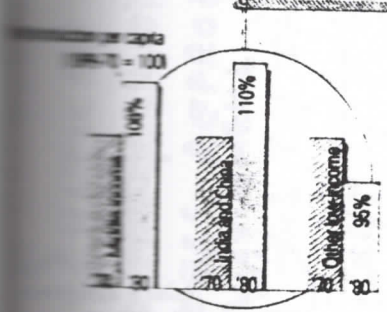
Thirsty crops
Irrigation is vital to the miracle grains. Agriculture now takes 73% of global freshwater demand.



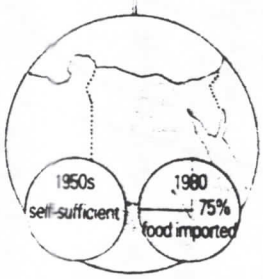
Wasteful diets
Nearly 40% of the world's grain is fed to livestock for the unhealthy meat-rich diet of the North.



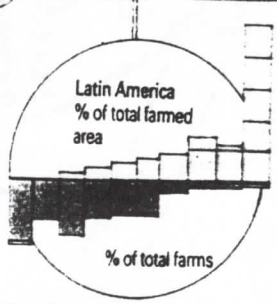
Surplus and waste
Huge EEC and US surpluses, "mountains" of butter and sugar, "lakes" of milk and wine, cost $53 billion in 1983.



...ving the poor behind
...ven before world grain ...production per capita ...peaked, many low-income ...countries had been ...experiencing a decline in ...food production per person



Relying on grain imports
Egypt, with its fertile floodplain in the Nile, used to be self-sufficient in grain. Sadly, it now imports over 75% of its food requirements.



Land concentration
Wealth breeds wealth: large holdings increasingly crowd out small-holders (who are generally more productive), as in Latin America, above.

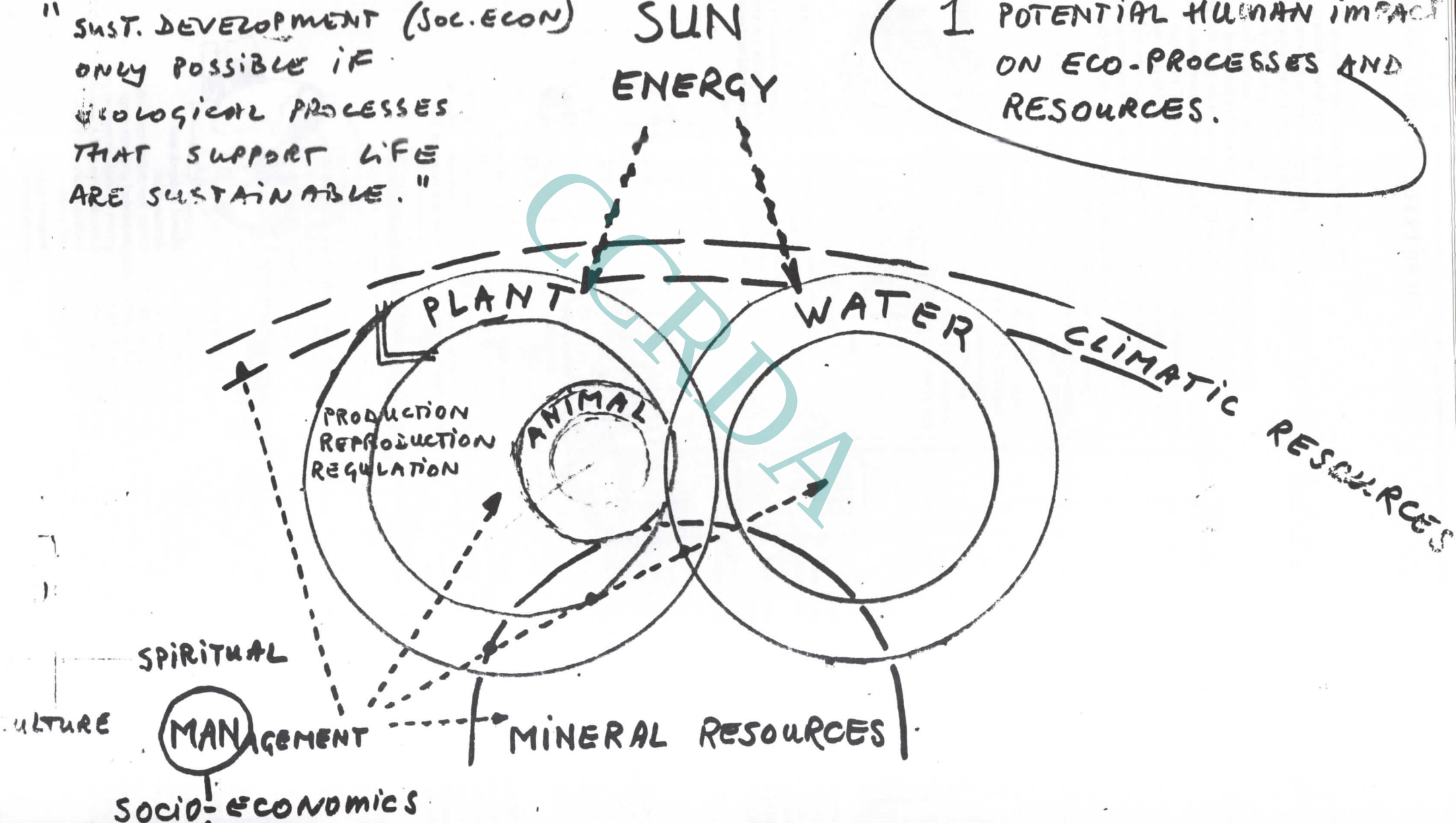


Biased research and development
Green Revolution research has tended to ignore crops grown by small farmers in Latin America and Africa – such as cassava, sorghum, and millet.

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"SUST. DEVELOPMENT (SOC.ECON) ONLY POSSIBLE IF ECOLOGICAL PROCESSES THAT SUPPORT LIFE ARE SUSTAINABLE."

1 POTENTIAL HUMAN IMPACT ON ECO-PROCESSES AND RESOURCES.



CCRDA

2. MONOCULTURE = SYMPLIFICATION

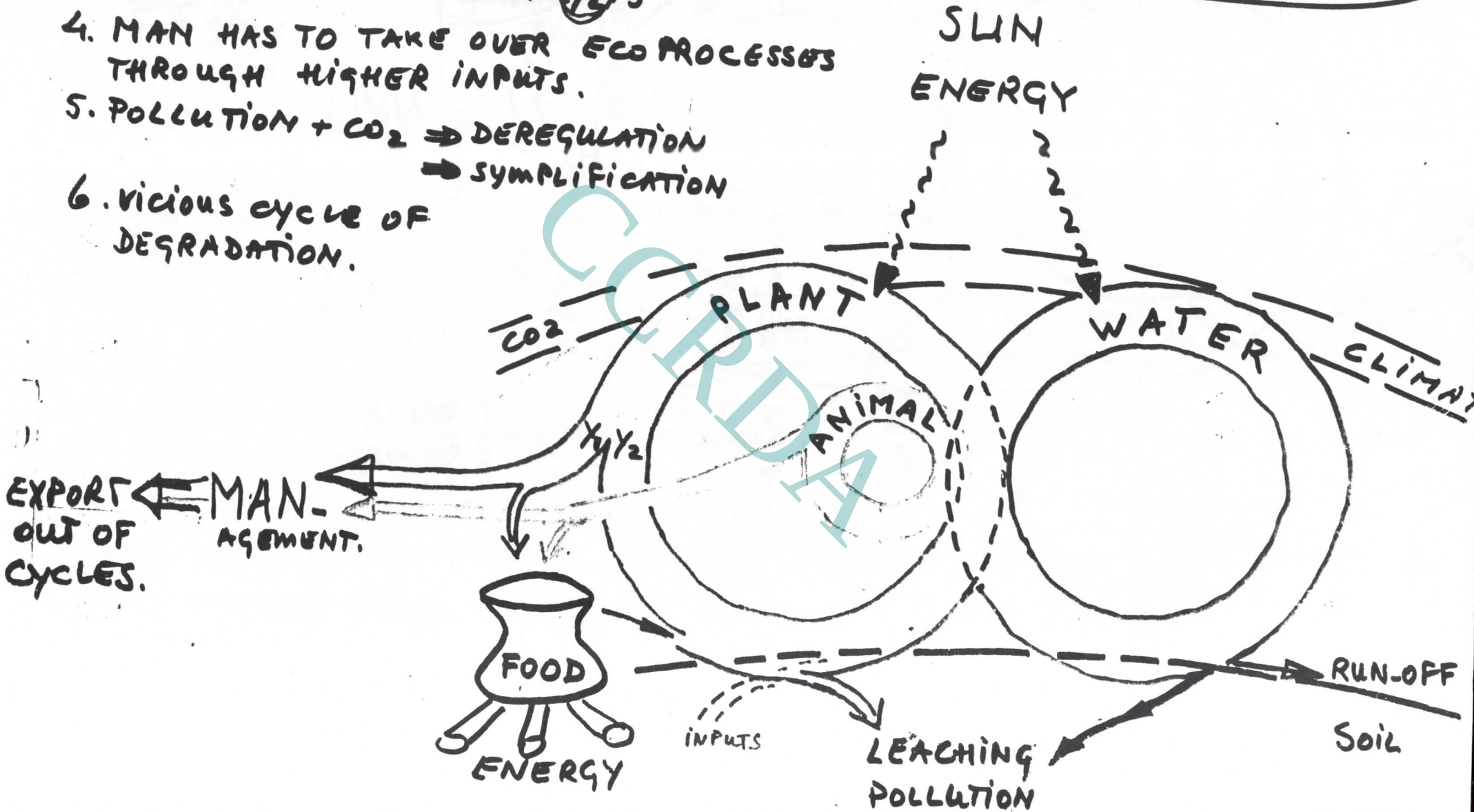
3. ⇒ DEREGULATION
   ⇒ LESS REPRODUCTION (Y/2) } "

4. MAN HAS TO TAKE OVER ECO PROCESSES THROUGH HIGHER INPUTS.

5. POLLUTION + CO_2 ⇒ DEREGULATION
   ⇒ SYMPLIFICATION

6. VICIOUS CYCLE OF DEGRADATION.

2. NON-SUSTAINABLE MANAGEMENT.

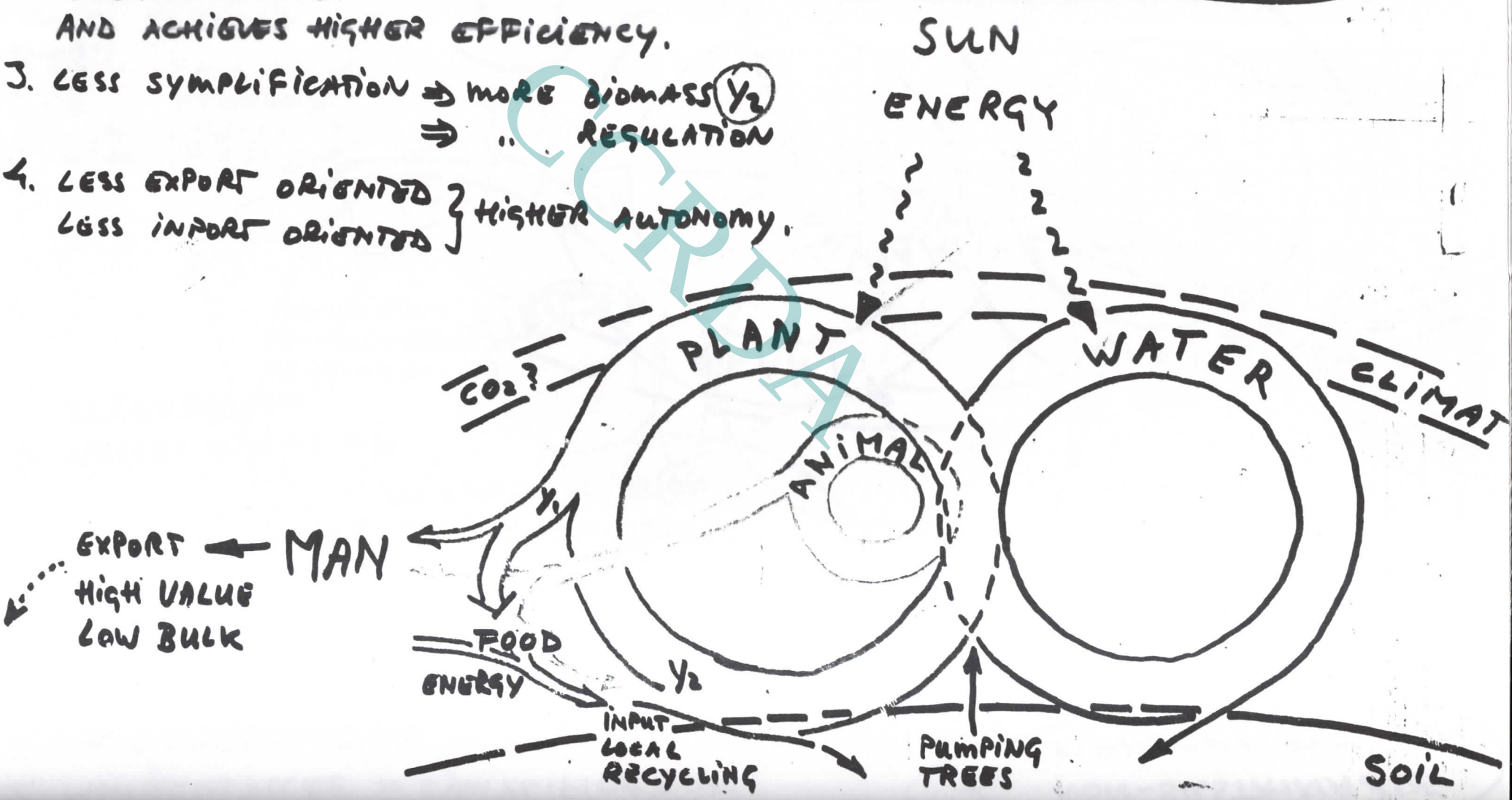


CCRDA

HK '91

3. SUSTAINABLE MANAGEMENT.

1. EXTRACTION OVER SHORT DISTANCE (Y_1) RECYCLING INTO (Y_2).
2. MANAGEMENT MAXIMISES FUNCTIONS ECOPROCESSES. AND ACHIEVES HIGHER EFFICIENCY.
3. LESS SYMPLIFICATION ⇒ MORE BIOMASS (Y_2) ⇒ " REGULATION
4. LESS EXPORT ORIENTED, LESS IMPORT ORIENTED } HIGHER AUTONOMY.



CCRDA

BASIC ASSUMPTION

"SUST. DEVELOPMENT ONLY IF LIFE-SUPPORTING ECO-PROCESSES ARE SUSTAINABLE".

⇓

NORMS FOR SUST. ENVIRONMENTAL MANG OR TRESHOLDS:

MINIMUM: MANAGEMENT THAT PREVENTS DEGRADATION TO EXCESS POINT OF NO RETURN

MEDIUM: MANAGEMENT THAT MAINTAINS CURRENT PRODUCTION CAPACITY

OPTIMUM: MANAGEMENT THAT ENHANCES

- PRODUCTIVE, REPRODUCTIVE AND REGULATING FORCES TOWARDS OPTIMAL, MAINTAINABLE OUTPUT
- SUFFICIENT BIOMASS TURN-OVE FOR INVESTMENT IN FUTURE PRODUCTIVITY
- OPPORTUNITY FOR ONGOING EVOLUTION.

CCRDA

levels of criteria

FIELD LEVEL

crucial environmental and
crucial agro-technical aspects

NATURE
CULTURE

FARM LEVEL

crucial environmental and
crucial micro-economic aspects

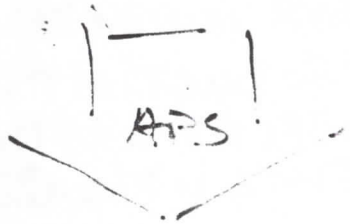
NATURE
CULTURE

COMMUNITY LEVEL

crucial environmental and
crucial social aspects

NATURE
CULTURE

INTERNATIONAL LEVEL
crucial climatic aspects
crucial macro-economic aspects



— N
— P
— K

+ DENSITY
+ LAND REFORM
+ LOWER INTEREST

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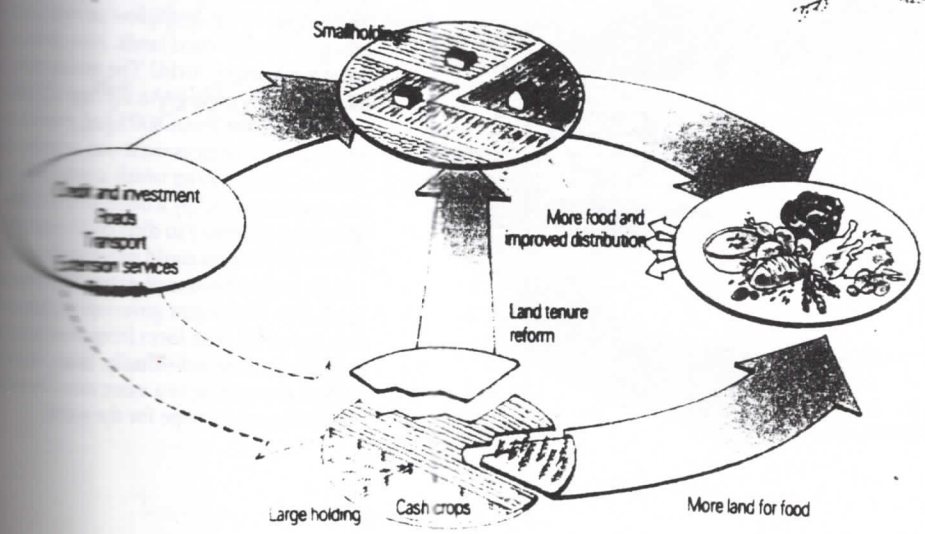


Yeheb

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Hairy potato

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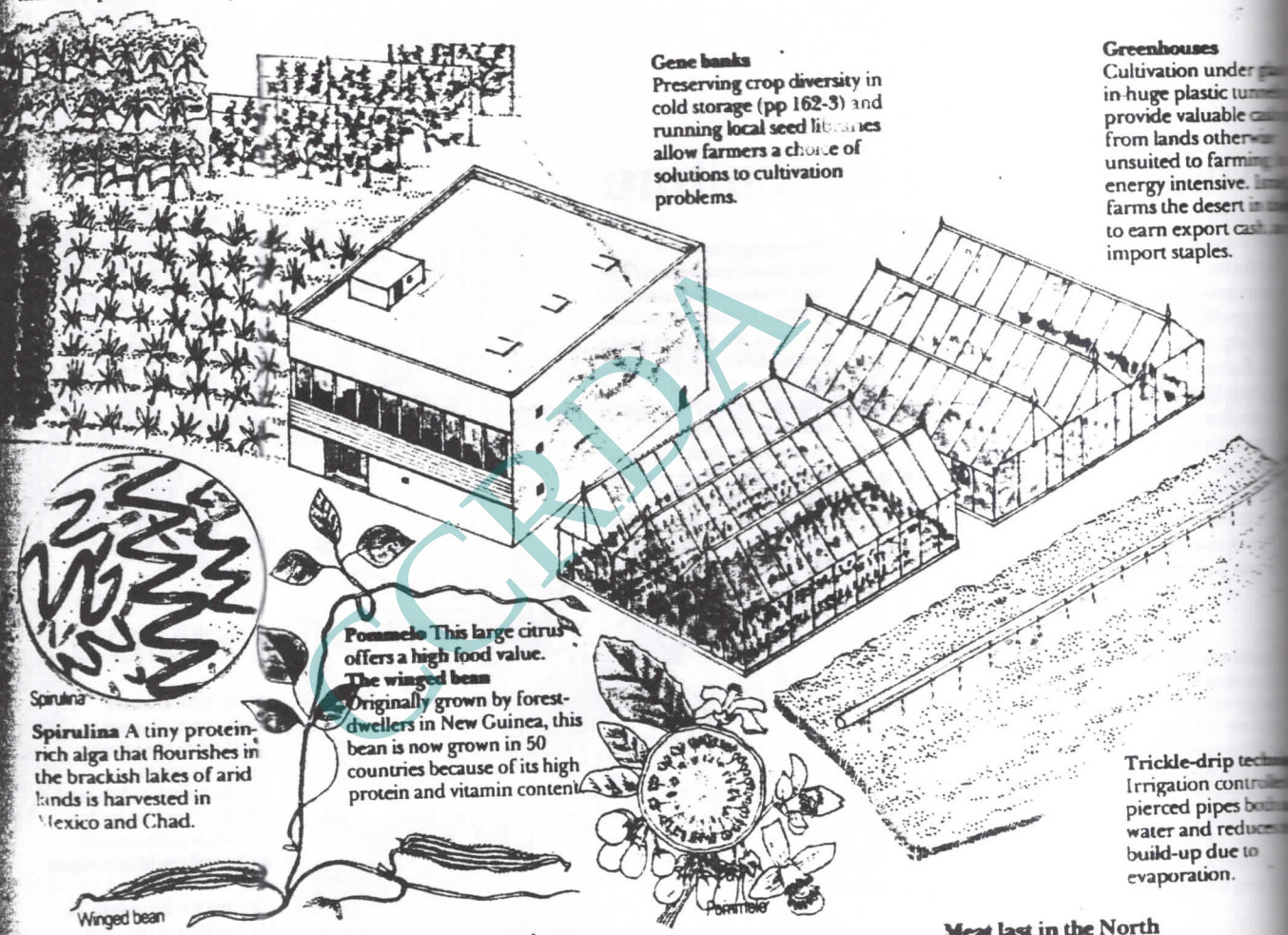
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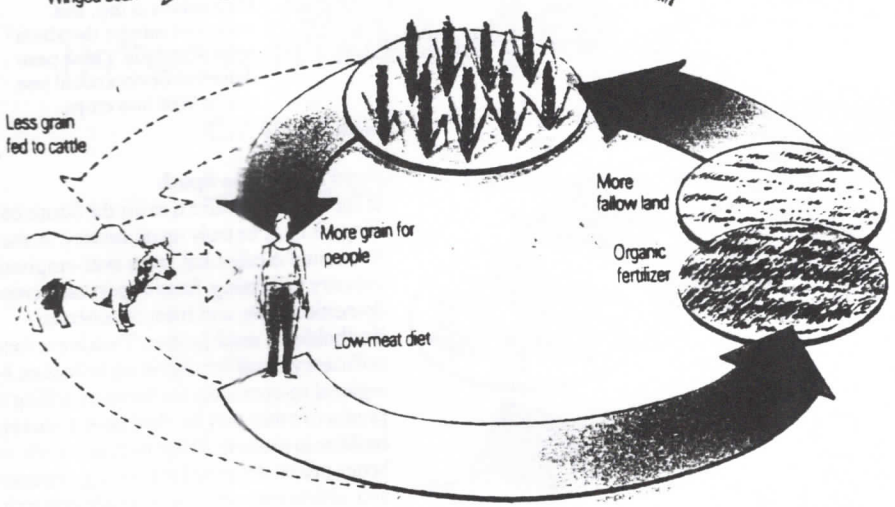
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Irrigation controlled by pierced pipes both saves water and reduces salt build-up due to evaporation.

Meat last in the North
The obvious medicine for the soil sickness of developed agriculture is, at first glance, unpalatable: increased fallow periods and idling of worst-eroded lands. How then can the grain-hungry world? The answer to this dilemma is surprising. An average US citizen today consumes about 800 kg of grain a year, nearly all indirectly as meat – an increase since 1960, of about 160 kg which is nearly the whole amount consumed by a better-fed African. Merely by reverting to diets of 20 years ago, rich-world citizens could improve their health, release large amounts of grain, and free much land. The Norwegian government pioneers this approach, with farm incentives and education. Even individually, many rich people are turning to a more meat-free diet. Herein lies much hope for the world.



ECRDA

POTENTIALS OF LEIA AND HEIA 2000

(Acc. to: I.I.A.S.A. for FAO. 1984)

L • LOW TECHN. LEVEL.
M • MEDIUM TECHN. LEVEL.
H • HIGH TECHN. LEVEL.

[WORLD × 1.5
× 4
× 9]

CAPE VERDIAN
WEST. SAHARA
RWANDA
MAURITIUS
} 4 NOT ENOUGH WITH H.

BURUNDI
LESOTHO
ALGERIA
SOMALIA
NIGERIA
REUNION
KENYA
MAURITANIA
} 8 NOT ENOUGH WITH M.

ALL OTHER 30 AFR. CONTRIES ENOUGH WITH M. OR L. ≃ LEISA.

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AANDEEL LEÏSA IN VOEDSEL PROD. AFR
(OTA. 1988)

GIERST	> 72	%
SORGHUM	> 61	
MAIS	> 37	
RIJST	> 76	
PINDA	> 55	
~~BONEN~~	> 59	
CASSAVE	> 93	
YAM	100	
COCOYAM	100	
RUNDVEE	80-94	
KLEINVEE	95-100	
VIS	90	

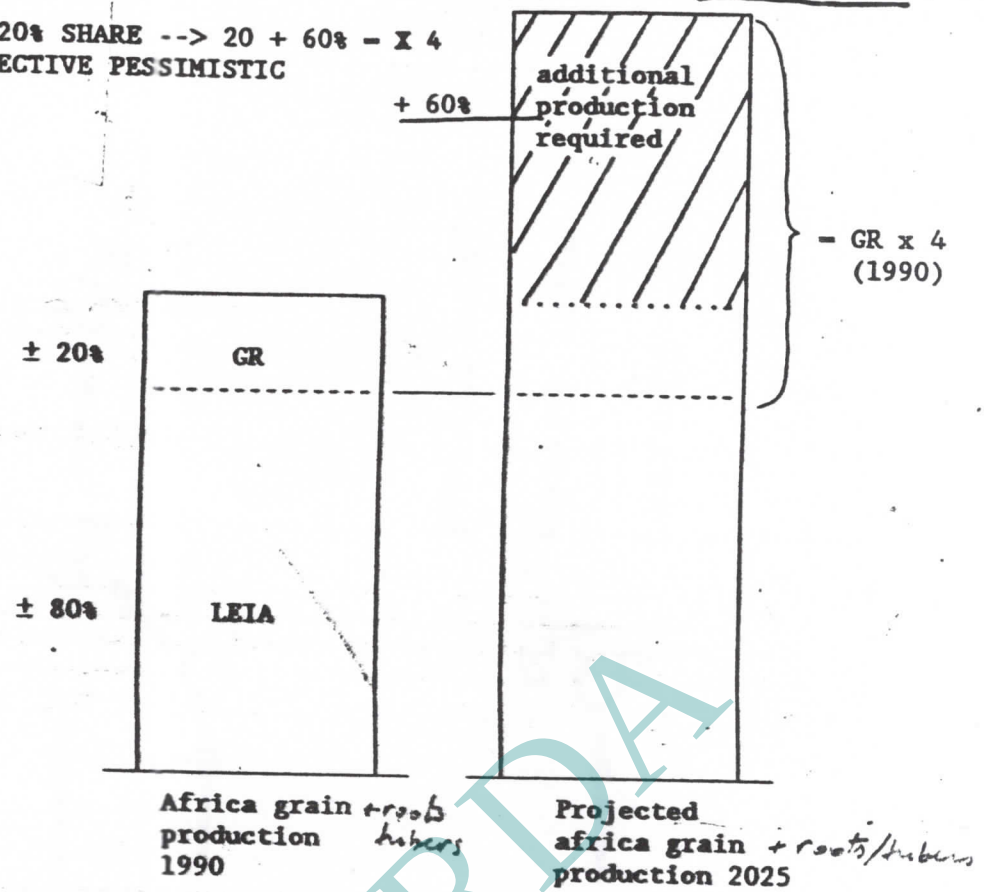
LEÏSA ~~AANDEEL~~ ≥ 80 %

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Figuur 1. ***suppositions for additional food coming 35 years***

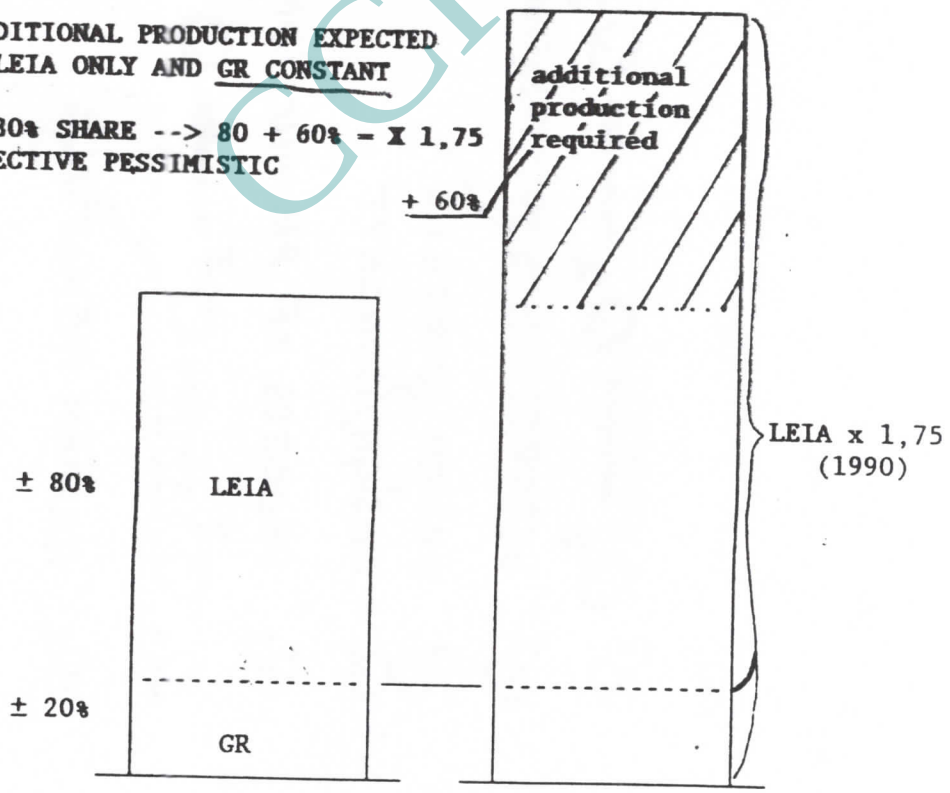
1. IF ADDITIONAL PRODUCTION EXPECTED FROM GR ONLY AND LEIA CONSTANT

FROM 20% SHARE --> 20 + 60% = X 4
PERSPECTIVE PESSIMISTIC



2. IF ADDITIONAL PRODUCTION EXPECTED FROM LEIA ONLY AND GR CONSTANT

FROM 80% SHARE --> 80 + 60% = X 1,75
PERSPECTIVE PESSIMISTIC



3. IF ADDITIONAL PRODUCTION EXPECTED FROM GR + LEIA
PERSPECTIVE MOST REALISTIC

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Q: QUALITY IN (AGRI-)CULTURE.

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$Q_1 \rightarrow Q_2 \rightarrow Q_3 \rightarrow Q_4$

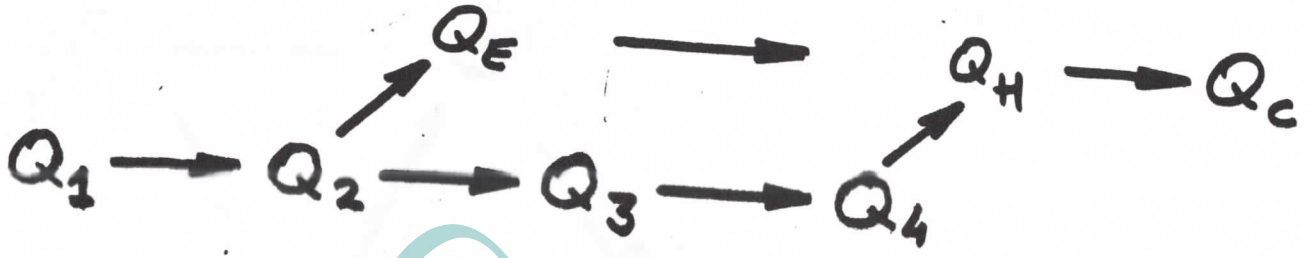
Q_1 DESIGN/CONCEPT

Q_2 PROCESS OF PRODUCTION

Q_3 PRODUCT

Q_4 HUMAN HEALTH.

A: QUALITY IN (AGRI-)CULTURE.



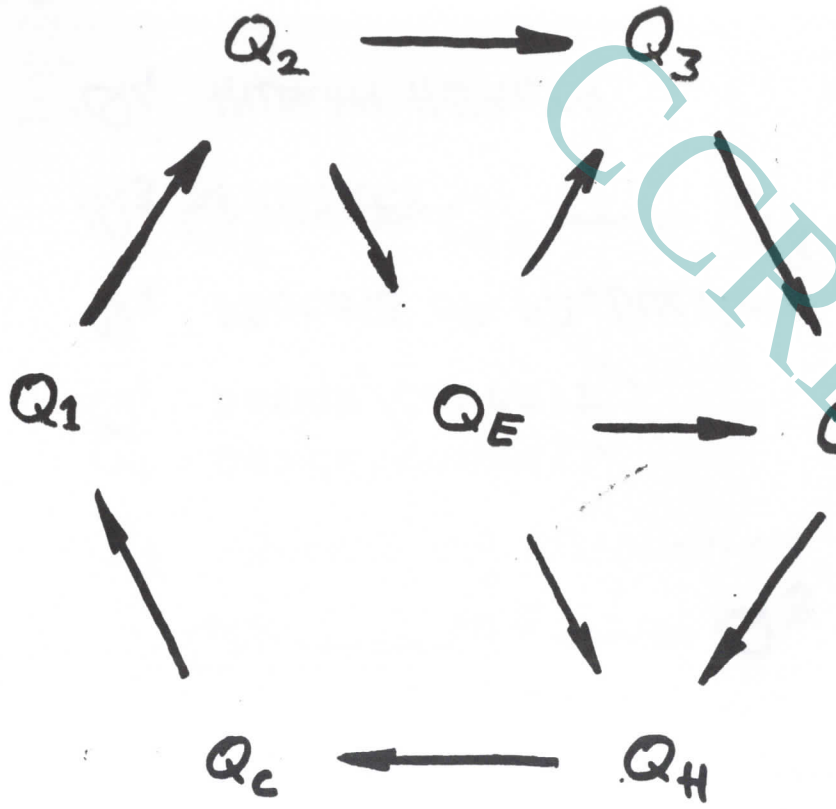
Q_1 DESIGN/CONCEPT
Q_2 PROCESS OF PRODUCTION
Q_3 PRODUCT
Q_4 HUMAN HEALTH.

Q_E ENVIRONMENT
Q_H HUMAN LIFE
Q_C CULTURE

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KONINGSVELD. H: LANDBOUW IS ~~APART~~ OBJECT VAN WETENSCH. ONDERZOEK
LT. 12. 1986. DOOR DE VERWEVING VAN (MANAGEMENT VAN)
NATUURLIJKE EN CULTUURLIJKE PROCESSEN. H.J.K. ko'ng.

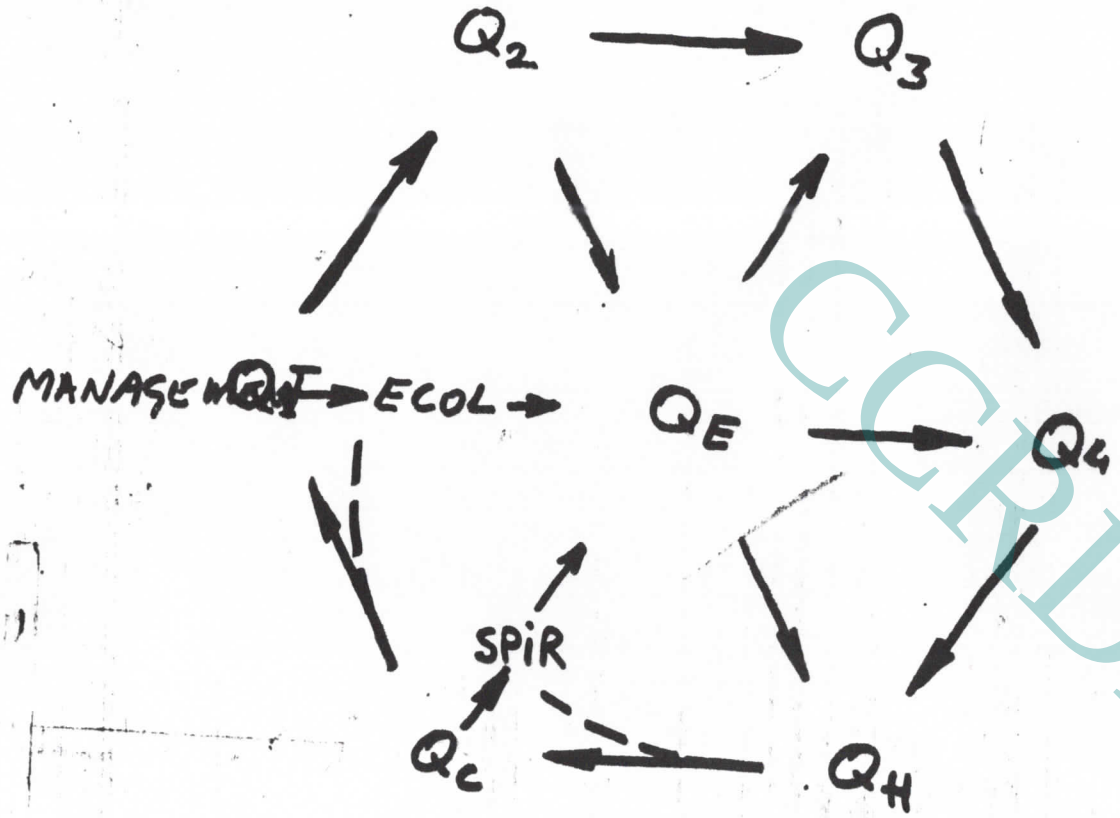
LINEAR TO SPIRAL



in SPACE : PLOT LEVEL
FARM "
REGION "
....

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LINEAR TO SPIRITUAL



in SPACE : PLOT LEVEL
FARM "
REGION "

in TIME : SHORT TERM/N
MEDIUM "
LONG "/TR

$Q_E + Q_H \Rightarrow Q_C \Longrightarrow Q_{EVOL}$

SPIRITUALITEIT ↑ INTRINSIC VALUE of NATU

TRANSCENDENTIE.

TOWARDS SUSTAINABILITY:

HK. 10:91

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