The Influence of Market and Government Policy on Resource Use and Environment in Agriculture

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1. INTRODUCTION

The incentive of this study is given by the United Nations Conference on Trade and Development (Unctad), who want to investigate the links between market conditions and the intensity of resource use, in particular the environmental effects, for agriculture. The discussion on these links is intended to improve the understanding of the impact of changes in market conditions on the intensity of resource use and on the environment. The Unctad is seeking policy proposals (market instruments) which ensure that international commodity trade promotes sustainable development.

In the past, agricultural policies have been legitimized as catching-up the arrears in food production. However, the problems in world agriculture now, demand a re-orientation of national- and international policies. With a view to the future it is necessary to develop policies that support the development of a sustainable agricultural system world wide. This paper can also be seen as part of the discussion on sustainable agriculture and sustainable development (see, Brundtland 1987)

The main objective is to investigate how, and to which degree different types of economy, markets and government policy influence the intensity of resources use and resource depletion in agriculture.
The approach of this study is as follows. In paragraph 2 we introduce some concepts and starting-points which are necessary for comparing resource use in countries with different types of economy and policy. In the first part of this study we look at the intensity of resource use in agriculture. We make use of an economic model and study developed by Hayami and Ruttan. They investigate how agriculture production and development of technology in different countries is defined by the availability and scarcity of resources. It is the opinion of the authors that the Hayami-Ruttan model is faulted by its inability to deal with 'negative output', like soil degradation. To compensate for this fault, we operate with an adapted model which is elaborated in paragraph 2.1.
In paragraph 2.2 we give the points on which we make the distinction between countries or regions with different types of economy and policy. There are three points of attention: type of agriculture policy, type of economy, type of society, industrial or agricultural.
In paragraph 3 we compare the five different types of economy and policy we have distinguished. For each region or country we look at the main characteristics. We pay special attention to the problems in the African agriculture (par 3.4), because these are considered rather serious.
In paragraph 4 the findings of the comparison will be discussed. Although we use a very rough method and approach we end with a clear and simple conclusion: all over the world soil degradation and resource depletion is a serious problem.

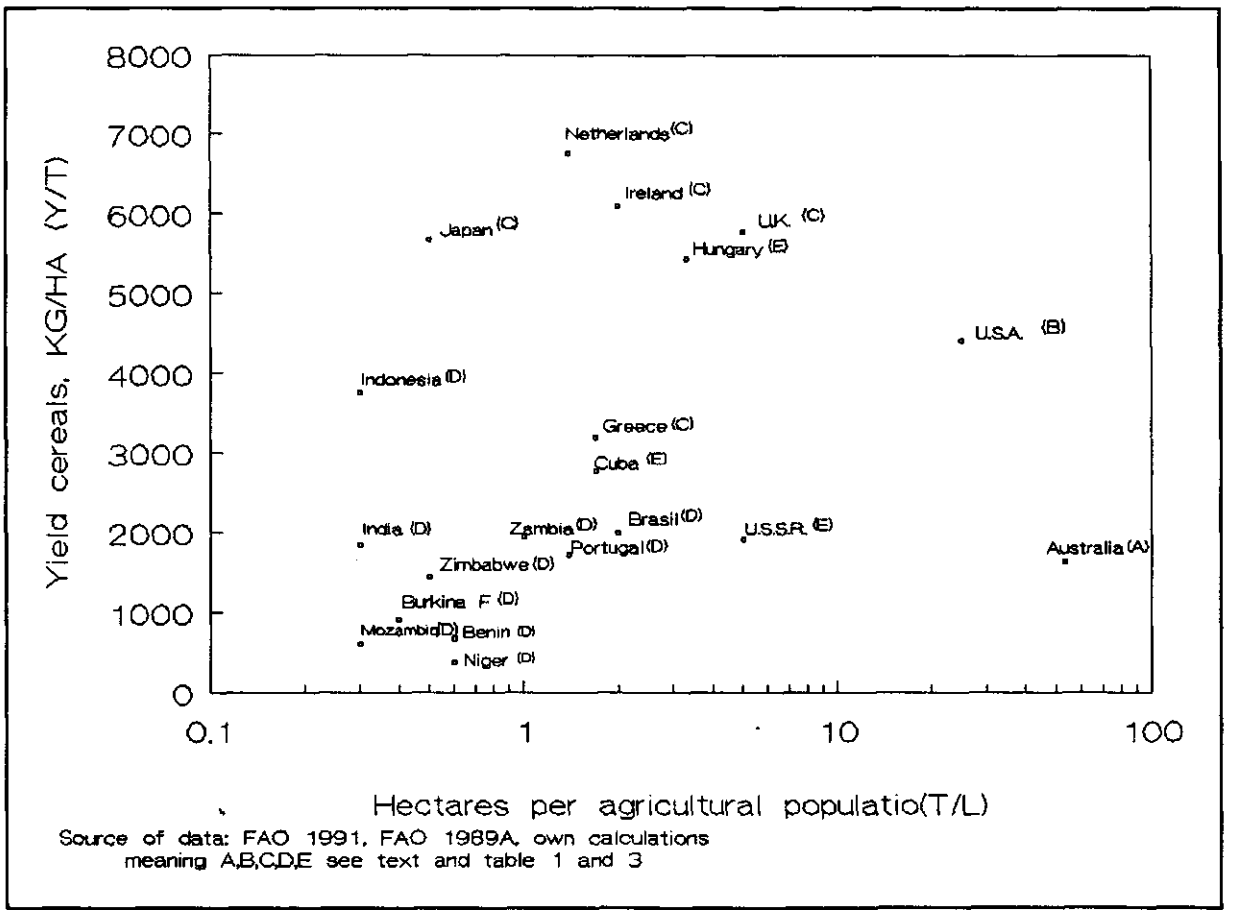
2. ASSUMPTIONS AND APPROACH

2.1 Resource use in agriculture

To investigate the intensity of resource use in agriculture, we make use of an economic model that Hayami and Ruttan have evolved (Hayami 1985). The starting point of this model is the conventional economic theory of optimum allocation and input of resources or production factors[1]. Hayami and Ruttan assume that the scarcity and availability of resources (expressed in relative low or high 'factor prices') will influence the development of agricultural technology and growth (the output). For instance, when land is sufficient and labour is expensive than the agricultural and technological development will be directed towards scale enlargement. On the other hand, when land is scarce and labour is sufficient the development will be directed towards increasing yields by utilizing more 'inputs' like fertilizers and pesticides.

The approach of Hayami and Ruttan is interesting for this study because their model gives an explanation for the different intensity of resource use in several countries.

Figure 1 Scale- and intensity levels various countries 1987



Source of data: FAO 1991, FAO 1989A, own calculations
meaning A,B,C,D,E see text and table 1 and 3

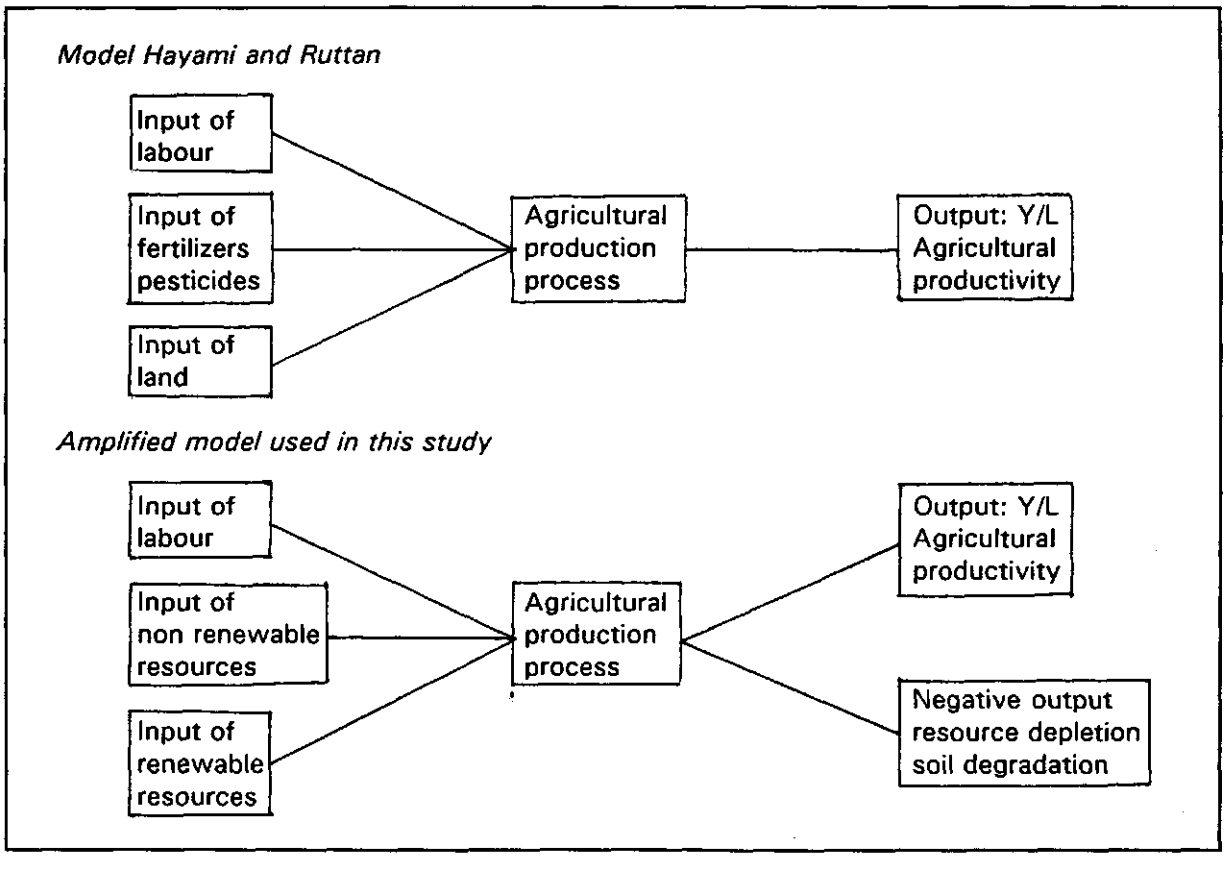
Hayami and Ruttan calculated for different countries the intensity and the scale of resources use in agriculture. They combine the output of production and input of labour and land in the next formula:
Y/L = Y/T * T/L
(Y = Yield, L = Labour , T = Arable Land)

The different positions of several countries are mapped out according to the intensity (Y/T) and the scale (T/L) of resource use (see figure 1). The production per worker (Y/L) is determined as income position per worker. In this study we have chosen countries with different types of economy and/or agricultural policy (see par. 2.2) and make the same calculations as Hayami and Ruttan. The results are displayed in figure 1. The following conclusions can be made:

- We have chosen a few countries in common with Hayami and Ruttan (U.S.A., Australia, U.K., Netherlands, Greece, Portugal, Brazil). For these countries we can check our findings with those of Hayami and Ruttan, and compare our data and calculations with theirs. It appears that the values which Hayami and Ruttan have found (see fig 5-1, pag.121, Hayami 1985), diverge little from our outcome (see figure 1). So that, we can reasonable assume that the values of the other countries we have selected are correct.
- The selected countries show a different intensity of resource use (see figure 1). In big countries like U.S.A. and Australia, farms are large in area, and the development of the agricultural technology is based on scale enlargement, with big machines for harvest and sowing etc.. Farms in countries like the Netherlands, Ireland, Japan and Hungary are compara-

tively smaller in area. In these countries the agricultural technology is mainly focused on yield increasing by using high external inputs. Unlike the first two scenarios, farmers in Burkina Faso, Mozambique, Niger and Benin, cannot profit from scale enlargement or by increasing high external input use; as a result their economic position is rather alarming.

Figure 2



In the second part of this study we also want to look at the links between the intensity of resource use and the environmental effects. Therefore, the main addition on the model of Hayami and Ruttan is that we consider the 'negative output'; the depletion and damaging of the resources, the environmental effects[2] caused by agriculture (see figure 2). We pay attention mainly to soil degradation in agriculture. To compare the different countries we take into account the following inputs and outputs[3]:

I. The inputs of renewable resources[4] in agriculture. Here we look particulary at the quantity and quality of land and soil. Also, attention is payed to the climate and soil-type.

II. The inputs of non renewable resources. Most studies which investigate the effects of agricultural policy and the market, one only looks at the output of products, the yield and the profits are considered. The 'input side' of agriculture is often not studied[5].

III. The 'input' of agricultural labour per country as a quantity[6]. We also include the subsistence rate, the availability of land per inhabitant and farmer.

IV. The output of agricultural production. Here we look at the scale and intensity of production for various countries as discussed before (see figure 1), the export balance and the importance of agriculture for the economy.

V. The 'negative output' such as the depletion and pollution of natural resources caused by agriculture. We especially look at rate of soil degradation[7] and using data from 'the world map of the status of human-induced soil degradation' (see Oldeman 1991).

2.2 Different economies and government policies in agriculture

In the present situation, agriculture is producing for a market, for other consumers and agricultural industry This means that there has arisen some important mutual relations and influences. It is clear that market (the demand of products) and government policies influence the input and output of agricultural production. Here we compare a few 'typical' countries or groups of countries that differ in agricultural economy and policy. Agricultural policy is mostly a national or supra-national (like the European Community) business. We proceed first with the national states. In view of the historical background, cultural, political and natural situation and circumstances, nations have developed and propagated their own agricultural policy and economy (see text box 1)[8]. The economy and policy of the countries can be distinguished on the following 3 points:

I. One can distinguish two types of agricultural policy: the price or market policy and the structure policy. Structure policy includes the following types of support (Burrell 1987):
- direct income-support by direct payments (for example disasters, income support for farms with natural disadvantages),
- in-direct income-support, such as credit accommodation (subsidy on interest) input subsidy (for fuel, fertilizers, transport etc.), guarantee, storage-costs and
- other support by research, enlightenment, education, inspection, re-allotment, infrastructure, marketing etc..

Text-Box 1 Why agricultural policy?

During recent decades almost all governments have influenced the structure of agriculture. They have several objectives to interfere in the agricultural markets (FAO 1987):
* Consumer food prices (stabilization, reduction, urban preference);
* Food supply (uninterrupted supply, food security);
* Producer prices (stabilization, production incentives, relative commodity prices);
* Agricultural trade (increased exports, reduced food imports);
* Revenue (provision of government revenue)
* Industrialization (provision of resources, favourable terms of trade for the manufacturing sector).

Price policy means to compensate the negative side-effects[9] of the market mechanism. Of course, price policy has to support and serve the established goals of the government policy, like protecting the own market, stable prices etc. Governments can access numerous instruments: two price system, price premiums, import quotas/voluntary export restraints, tariffs/import levies and export refunds/credits.

II. The difference between a centrally planned economy and market economy. In a centrally planned economy farmers are directed 'top down' with 'commands', and in a market economy the agriculture is stimulated with financial incentives (with or without government interventions).

III. The difference between countries which are more industrial, and countries where agriculture is the main economic activity.

On the basis of these three points we make the following rough division between countries or group of countries (see table 2):
A. Open market economy, industrial: Australia.
B. Open market economy, industrial, strong intervention of government by high subsidies, via structural policy: United States of America.
C. Closed market economy, industrial, strong intervention of government by market- and price policy: E.C. (U.K., Ireland, Netherlands, Portugal, Greece) and Japan.
D. Open plan/market economy, agricultural, precarious and various government interventions by plans (marketing boards), taxes and subsidy: African countries (Benin, Burkina Faso, Mozamb-

ique, Niger, Zimbabwe, Zambia), Brazil, India and Indonesia.
E. Centrally planned economy, strong intervention and direction by government by using plans and subsidy: U.S.S.R., Hungary, Cuba.

Table 1

	Type of economy		Agricult. policy		Rate of
	Market	Plan	Price	Struct.	industrial
A. Australia	+ +			+	+ +
B. U.S.A.	+ +			+ +	+ +
C. EC, Japan	+ +		+ +	+	+ +
D. Afr.,Br,Ind,In	+	+		+	
E. USSR, Cu, Hu		+ +	+	+	+

3. A COMPARISON OF FIVE TYPICAL REGIONS OR COUNTRIES

In this paragraph we will compare the groups of countries or countries that differ in agricultural economy and policy. We pay special attention to the complicated situation in the African agricultural economies and policies (D. par. 3.4). Some of these African countries have to struggle with both food-shortages and serious resource depletion. We have more information on the situation in E.C. (C. par 3.3) and the former U.S.S.R., therefore the description is more extensive.

3.1 Australia

In general, the agricultural practice is very extensive; there is a low input of fertilizers and the average farmer has access to large areas of land (see figure 1 and table 3). Climate is often extremely arid and soils are generally poor and highly erodible. However the coastal zone soils are relatively fertile and the climate is better, so they exploit the poor grounds very extensively, and the rate of erosion is rather low in Australia (see table 2).
Agricultural production is directed toward an export market and in return the Australian agriculture finances a great portion of the imports (35%). The subsidies for farmers are low compared to those of the U.S.A., Japan and E.C. (see table 4 and 5).

3.2 United States of America

In comparison with Australia, less people work in agriculture in the U.S.A.. The great difference with Australia is the high government expenses for agriculture (see table 5). Although average yields are higher in the U.S.A., natural resources are damaged seriously (see table 2). Soil erosion has been estimated, to be between 9 and 18 tonne per hectare per year (Pimentel 1989). The doubt of the authors of 'Paying the farm bill' doubt is cast on the effectiveness and the profits of these high government expenditures to agriculture, and the resulting high rate of soil erosion (Repetto 1991). The U.S.A. is the greatest exporter of agricultural products, but agriculture is of less importance for the overall economy than in Australia (see table 4) .

3.3 The European Community ("Europe") and Japan

Since 1957, the E.C. has been pursuing a common agricultural policy. Characteristics of the agricultural policy of the E.C. (and also Japan) are the closed borders and the emphasis on the price policy. The E.C. developed from a net importer to a net exporter. In comparison with the

Table 2 Natural resources and soil degradation

Type	Climate (Köppen)	Soil Type	Degree[1] Soil Degradation %	Cause in % Agr[2]	Ovg[2]
A.	Bw,Bs Cs,Cw,Cf	>Sandy dessert soil <Tropical red soil	Australia L:94 M:4 S:2	8	80
B.	Cf,Df	>Podsol soils San.Des.Soil./Black.Soils	N.America L:12 M71 S17	57	24
C.	Cf,Cs	>Podsol soils	Europe L28 M:66 S:5	29	23
D.	Bw,Bs,As As,Cw	>Sandy dessert soils Tropical red soils	Africa L:35 M:39 S:25	24	49
E.	Df,Dw	>Podsol soils <Black soils	Asia L39 M:46 S:14	27	26

1. L= Light M=Moderate S=Strong, 2.Agr=Agricultural activities, Ovg=Overgrazing
Source: Oldeman 1991, Boerman 1949

Table 3 Agricultural population and land use

	Total Population 1988	% agricult. Population 1988	Ha arable land per population 1988	Ha arable land per agr.population 1987
A.Australia	16	5	2,85	53,0
B. U.S	246	2	0,76	25,0
U.K	57	2	0,12	5,0
Ireland	4	14	0,29	2,0
Netherlands	15	4	0,06	1,4
Greece	10	26	0,29	1,7
Portugal	10	18	0,20	1,4
Japan	123	7	0,03	0,5
C. Average	36	12	0,17	2,0
Brazil	144	26	0,46	2,0
Niger	7	88	0,54	0,6
Burkina F	9	85	0,41	0,4
Benin	4	63	0,32	0,6
Mozambiqu	15	82	0,20	0,3
Zambia	8	70	0,66	1,0
Zimbabwe	9	69	0,30	0,5
India	820	67	0,20	0,3
Indonesia	175	50	0,09	0,3
D. Average	132	67	0,35	0,7
USSR	286	14	0,79	5,0
Hungary	11	13	0,48	3,3
Cuba	10	20	0,25	1,7
E. Average	102	16	0,51	3,3

Sources of data: FAO 1989A, FAO 1991, own calculations.

Table 4 Agricultural production (import-export)

	Value Food in 1000000$ import 1988	export 1988	balance export-import 1988	Share of total imports financed by agr.exports % 1988	Food import dependency ratio (%) 1986-88
Australia	806	5256	4450	35	
U.S.A.	12686	26554	13868	9	
U.K	13578	4990	-8588	5	
Ireland	1223	4137	2914	31	
Netherl.	11822	17265	5443	24	
Greece	2111	1478	-633	15	
Portugal	1281	281	-1000	4	
Japan			0	1	
Brazil	679	4273	3594	59	5,1
Niger	80	47	-33	13	7,4
Burkina F	54	15	-39	21	9,6
Benin	53	14	-39	21	9,3
Mozambique	179	49	-130	7	
Zambia	28	9	-19	2	14,1
Zimbabwe	23	123	100	50	4,7
India	1864	848	-1016	12	3,4
Indonesia	818	969	151	25	5,4
USSR	13258	783	-12475	3	
Hungary	236	1847	1611	23	
Cuba	799	5423	4624	58	

Source of data: World Bank 1990, FAO 1988B

Table 5 Subsidies and government support agriculture

	PSE[1] per farmer farmer (FFE[2]) 1988 $	PSE per agri.pop. agr.pop 1987 $	% budget governement agriculture 1988	Official commitment agriculture per caput 1988 $
Australia	4000	1355	0,3	
U.S.	24000	7733	3,0	
'EC'	9000	3210	62,8	
U.K			0,5	
Ireland			3,4	
Netherl.			1,0	
Greece				
Portugal				1,7
Japan	16000	4000		
Brazil				2,4
Niger			2,9	16,4
Burkina F			4,4	12,0
Benin				20,2
Mozambique			14,6	5,6
Zambia			9,0	11,6
Zimbabwe				9,3
India				1,0
Indonesia				3,3
USSR				
Hungary				6,6
Cuba				0,1

1.PSE = Producer Subsidy Equivalent 2. FFE = Fulltime Farmer Equivalent (working more than 2200 hours/year) . Source of data: OECD 1990, FAO 1991.

U.S.A and Australia, European farmers have less land available, and which they therefore more intensively using more fertilizers and labour (see table 3, figure 1). In the U.K., where the agricultural population has shrunk to 2% of the total population, agriculture is rather unimportant. However, in the Netherlands, the contribution of agriculture to the total economy is considerable (table 4). Agriculture in the Netherlands is heavily specialized and make use of favourable circumstances (such as good infrastructure, especially the ports).

Soil degradation is a problem in all countries of the E.C.. It has been estimated by the E.C. authorities that at least 25 million ha of the European Community's land is threatened by erosion. This is an area eight times the size of the Netherlands. Erosion is considered to be a major problem in the Mediterranean countries, where annual topsoil losses reach up to 2.800 kg per ha per year.
In Portugal, the Soils Service is of the opinion that although 51% of land is currently producing crops, only 28% is capable of sustaining grain production on a permanent basis (de Lange 1992). Alarming however, is the fact that in regions with relative favourable climate conditions, the erosion is also increasing seriously (for instance in U.K. between 26 and 29 ton/ha/year, Arden Clarke 1988). Regions using very intensive methods of agriculture (with a high use of pesticides and fertilizers), like the Netherlands, have to deal with a manure surplus and pollution of groundwater and soils.

The E.C. is an interesting 'case' because of the existence of an inside free market economy. Until now it appears that the free market in the E.C. does not equalize the differences between the members of the E.C.. The E.C. have chosen for regional specialization, through which they endorse the economic theory of 'optimum allocation of the means of production'. However, at the same time the pauperization and social and economical decline is still going on in some parts of Europe. 'Weak members', like Greece and Portugal, are compensated by the structure policy (they receive money to develop their rural regions) (see: E.C. Regulation Nr. 2052/88, 4235/88). In spite of the high expenditure for agriculture, the differences between the members of the E.C. have not diminished.
The protected market and high budget costs are heavily criticized by the developing countries and the U.S.A., because it is difficult for these countries to sell their products to the E.C., but At the same time however, the E.C. is able to penetrate the world market with heavily subsidized products.

3.4 The developing countries, African agriculture

The African agricultural economy can not be seen as one type of economy; Hinderink (1987) distinguishes five types of economies[10]. In nations which are analyzed, there are some correspondences. In comparison with the other nations, the African countries and other developing countries use lesser amounts of non-renewable resources (see figure 1 and 3) During many years the use of inputs was stimulated; a policy which has not been successful (per land there are of course differences). Only big plantations and/or state-farms and foreigners have the possibilities to buy inputs. The development of agriculture, in spite of all the aid programs and other assistance (the green revolution), never succeeded very well. Some countries they are challenged by a decrease in yields (f.i. Nigeria, Sudan, Tanzania, see Brown 1987, p13). The following factors have contributed to the stagnating development of agriculture.

The natural resources; the soils in Africa, especially in the sub-sahara, are in general very poor and highly erodible. The extreme climate (very long dry periods, occasionally strong rainfall etc.) makes that the vegetation can not keep the soil covered. It is hard to stop soil degradation and desertification (see table 2).
The inputs; perhaps a major constraint on the ability of marginal farmers to improve yields and the sustainability of their resource poor conditions is the lack of affordable, low-input technology for improving the productivity of traditional varieties under less favourable environmental conditions. Up to now, the vast majority of agricultural Research and Development programs for

developing countries have been geared towards developing and improving 'green revolution' crops - high-yielding varieties (HYVs). These varieties however are not appropriate for harsher environmental conditions where climate is more variable, water supply is irregular and soil quality low . More over, marginal farmers in resource-poor areas generally cannot afford the high-input 'packages' of fertilizers and pesticides that are necessary complements to HYVs, nor do they often have access to irrigation, as these areas tend to be remote (Barbier 1988).
Demographic pressures; The percentage of population involved is agriculture is high in most developing countries (table 3). This means that a great proportion of the producers are subsistence farmers. However, the production of food is very unstable and low. Besides this, in many developing countries there are a lot of land-less and small-holder farmers (table 3). By comparison, farmers in industrial countries compensate 'less land' with very high inputs (The Netherlands and Japan) and therefore they can easily produce, in most cases enough food (figure 1, table 4).
Demographic pressures, in terms of both human beings and livestock, clearly accelerate the environmental degradation-poverty process. However, in many developing countries, despite the growth of population, pressure on land for agricultural use has not come from small subsistence farmers, but primarily from the increase in acreage of large commercial holdings (Barbier 1988).
Social factors; The uses of resources is also dependent on important social factors: security of land tenure, common-property rights and intrahousehold division of labour[11]. In general farmers without security of tenure over their fields are interested in maximizing their short time investment in seed and fertilizer for the crop that is in the ground; they are not interested in long-term yields through investments in soil and water conservation measures. In early times the common property rights to grazing land and forest were strictly ruled by traditional common laws and religion. Under demographic pressures and western influence these rules disappeared, and nothing has replaced them. The result is a 'open access' problem where each individual user is only constrained by his or her ability to exploit the resource but does not pay the cost of any resulting degradation or depletion (Barbier 1988).
The interaction of these factors can mean that poor people under marginal environmental conditions frequently have no choice but to opt for immediate economic benefits at the expense of the long-run sustainability of their livelihoods.
The role of governments; in general, governments in developing countries have a great impact on agricultural development (par example in Zambia: through exchange rates, Claassen 1991). Agriculture is an important economic sector in many developing countries (table 4). The export of agricultural products is often the only way for countries to 'earn' money and pay back their debts. Still, these countries have to import food and the export-import balance is negative (table 4).
Often governments are forced to choose for short term policy of export earnings (with cash crops instead of food crops), as opposed to a long run natural resource management, because it is a condition of and the only possibility for further international lending. Therefore, in many developing countries, the existing policy framework is biased against the interest of the marginal poor in rural areas (Barbier 1988). Opposite to industrial countries, the products of farmers in developing countries are taxed by the governments (World Bank 1986, FAO 1987a, Johnson 1991). By the marketing boards, which were created in the colonial times, government influences the prices and production of export crops.
On the other hand farmers are subsidized by input-subsidies for fertilizers and pesticides. As said before, farmers don't always have money to pay for inputs and these inputs are not always available. In general the influence of price change incentives on farmers decisions is uncertain[12] [13] [14]. Nevertheless, prices influence the market and the agricultural production and consumption. In several reports the importance of market and price incentives to stimulate agricultural production and consumption is stressed (FAO 1987, Harvey 1988, Claassen 1991). It is clear that "production increases depend critically on the adequacy of the whole agricultural infrastructure; by themselves price incentives are necessary but not sufficient" (FAO 1987). The question is "is it possible to redirect agriculture to a sustainable resource management with market and price incentives if governments in particular are interested in foreign devices?".

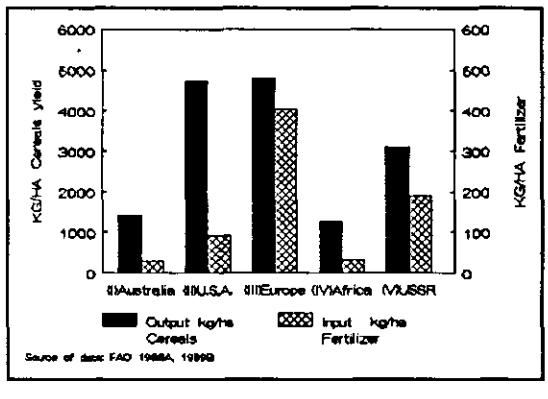
Conclusion; the traditional low input agricultural systems have been getting overburdened by

demographic pressures and social changes . Next to this, the agriculture in the developing countries has been influenced by the high input technologies of the western modern agriculture. The problem is that the farmers in developing countries can not profit from these technologies. Often they don't have the money to pay for the inputs, knowledge and technology. Secondly, in the developing countries most agrarians can not profit from agricultural 'industry' and institutions (like banks, research, enlightenment institutions) who constantly supply fertilizers, chemicals, credits, knowledge, machineries[15]. In many developing countries the support of these institutions is not developed well; and so the agrarians can't profit from the western high input technologies.

3.5 Centrally planned economy, USSR

In general one can say that in centrally planned economies there is a less efficient resource use. The U.S.A. and the (former) USSR are interesting 'study objects' because the natural circumstances (large countries, the soil and climate) are more or less comparable. Fertilizer use in the USSR is at the same rate as in the U.S.A, but the productivity in the U.S.A. is much higher, and Soviet economy is a nett importer of food (see table 4). Likewise, among the centrally planned economies there are big differences (see Hungary, figure 1, Gray 1990, p48).
The Soviet Union struggles with large erosion problems. In the Ukraine during extremely bad years erosion rates of 300-400 ton/ha/year are commonly observed (Pimentel 1989).
The central governments, at least in the recent past, have had a large influence on the agriculture development. An inefficient allocation of fertilizer and machinery is the result of a centrally planned economy (see figure 3).
In the former USSR the government dictated how much state farms should produce and how much fertilizer and pesticides the farmers should use. The government payed bonuses to Soviet state farms if they met the quotas. The result was that they pushed the farm to use excessive amounts of fertilizer. Their incentive was not to maximize yields while cutting the costs, but to meet quotas. Soviet cooperatives have more incentive to cut costs, but resources are allocated by the central government planners rather than at the farm level (Brown 1987, Van der Graaf 1990).

Figure 3 Yield and fertilizer use five types of economy.



Although the central planned and communist countries are disappearing rapidly, it is interesting to take a look at the Hungarian agriculture, where three fourths of the land is state- or cooperative-owned. Brown stresses that the Hungarian model shows that market economics can work even in the absence of private landownership, as long as the producers effectively control their work. Cooperatives in Hungary are self-managing. The cooperatives, not the central state apparatus, decide what they will grow and how they will grow it. If they respond to the market and use their food production resources efficiently, they profit (Brown 1987).

4. CONCLUSIONS AND DISCUSSION

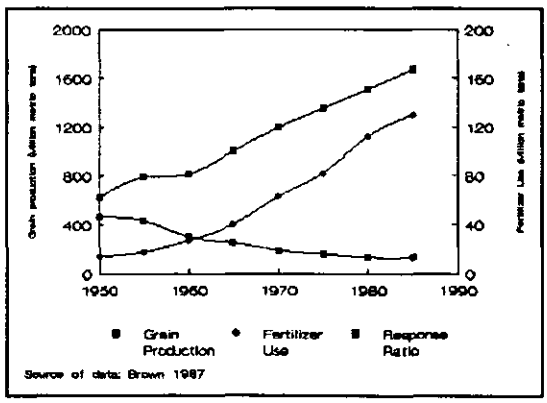
Ruttan and Hayami have tried to explain the agricultural development all over the world with the help of an economic model. They distinguish two paths of how agriculture developed and/or will develop: intensity- and scale increasing. In this approach however, all social and geological differences between the regions and farm-systems in the world disappear. Next to this, their model pays no attention to the environmental damages and other negative side effects of these agricultural development paths. Here, on the one hand, we have attempted to involve some environmental side effects (especially the soil degradation). Moreover, we integrated the government influence and made a distinction of five types of economies. But also this approach

has many shortcomings (it is still too rough and general). However, we found that the different existing economic and marketing policies do not significant differ in the degree of resource Although, the data give some dear indications.

Very roughly we indicate that in all the regions, with different policies and markets there are problems with soil degradation. In Australia, with a relatively open economy and little government support, soil erosion caused by agriculture is not a big problem. But, the agriculture in the U.S.A. (relative extensive land use, many machines), the Netherlands (intensive land use, high external input etc.) and in African nations (extensive, low input) have to deal with types of soil degradation.
In regions where external inputs are used a great deal, like western Europe and Japan, the environmental difficulties are pollution of soil and water, and waste of energy and raw materials. In countries with a relative low external input agriculture (referring to fertilizers and pesticides) such as in the U.S.A. and African countries, soil erosion from water and wind is the main menace.
In the nations where the farmers are directed 'top down', as in some African countries and in the U.S.S.R. (centrally planned economy), it is often a problem to produce enough food to feed the population. On the other side, the countries where the agriculture is stimulated with financial incentives, they have to struggle with 'over production' (E.C. and U.S.A.).
Here, we can make a remarkable conclusion about the links between markets, agriculture policy and resource use: no matter what the economy and/or policy looks like, the management of the resources is inefficient and far from sustainable. Therefore it is quite impossible to propose some general market instruments for agricultural policy which ensure that international commodity trade promotes sustainable development. It appears that the now known and approved economic systems, market- and agricultural policy-instruments are inadequate to protect the non renewable resources and to rebuild the natural resources like the agricultural soils[16].

Other studies confirm the idea that virtually all countries are destroying their own resources which results in a world wide unbalanced agriculture. Until now however, it is still not generally noticed that the negative environmental effects threaten the world-production of food. However, the increasing use of artificial fertilizers does not show a proportional raise of production levels (see fig 4): in agricultural it is basicly impossible to increase the production (output) with a proportional increase of input.
The common answer to the growth in demands for food (due to population growth), is still to increase yields by the application of high external input techniques in agriculture. However, in all probability in the long term the environmental problems will more heavily influence yields and food production. It has been estimated that every year 14 million tons of grain are lost as a result of land degradation and crop damage (Brown 1990, p64). Harris (1990) shows by means of projections that the negative environmental effects will more and more influence the world food supply. "Until 2000 the high input agriculture can supply the increasing world food demands. But, this worldwide dependence on high external input agriculture leads to a foreseeable crisis in 2000 - 2010, as continued use of intensive techniques undermines the resource and biological basis of world food supply". Harris 1990 p212).

Figure 4 Ratios of world grain production to fertilizer use, 1950-85



A closer look at the present development shows a global agriculture which is completely out of balance. All sorts of feed and food are transported over the world. In one part of the world people have to deal with an enormous surplus-production while in other parts of the world there

is still hunger and a low food production. However, in both regions they have to contend with the resource exhaustion and destruction of nature.
The balance between vegetable and animal production is also unbalanced. In recent years the world meat production and consumption has increased rapidly. A consequence is that more and more agricultural land is given over for cultivating animal feed in stead of human food (Durning 1991). In this sense, a high meat consumption also threatens the food supply[17] [18].

According to Harris, sustainable development in agriculture in the long term is only possible when the present technology shifts to another agricultural technology; therefore he points at the possibilities of organic types of agriculture (Harris 1990, p212) (see text-box 2)

Text-Box 3 Organic agriculture

> Cultivation of the primary production capacity of the local soil/climate conditions, is a first principle of Organic types of Agriculture; you can also speak of Autonomous Ecosystem Management. This Autonomous Ecosystem Management keeps itself as far as possible within the limits of the social needs for food and fibres on the one hand and the local ecological [ecosystems-] carrying capacity on the other. That means taking into consideration the actual phase in natural and cultural succession of the soil and vegetation, the stage of the ongoing ecosystem development. In increasing circles of agricultural experts, the notion of regionally screening of traditional systems of agricultural production for their indigenous knowledge regarding beneficial biological and ecological interactions, gets acceptance [FAO-SARD Declaration of Den Bosch 1991, Altieri 1991, Lampkin 1990, Dupriez 1980, Hobbelink 1988, van der Ploeg 1990]. In this framework, organic types of agriculture can be seen as the conscious and scientific communicable intensifications, up-datings and ongoing steps in the development of traditional farming and indigenous knowledge.
> The key-issue of autonomous ecosystem development remains: treating the agro-ecosystem on any scale as a living organism, supporting its own vital potentials for vegetal primary production, all biological mechanisms for mineral balancing, soil improvement and pest control included. (see van Mansvelt 1991)

This worldwide unbalance is certainly not caused only by a wrong technology. The influence of government policy and the market ('the economy') on agricultural production and resource management must not been underrated. However, here we have seen that even in countries with quite different policy and economies the agrarians equally have to deal with soil degradation.
It can be noticed that government support for agriculture increases when the nation becomes more industrialized and the agricultural population decreases. In general it can be said that the importance and the appreciation of the primary agriculture is declining; contrary, the contribution and development of the industrial production and product is better prized. Therefore, governments have tried to support and protect agriculture. They did this in such a way that they indirectly support and stimulate an industrial agriculture which destroys the natural resources. This environmental degradation appears to be consistent with an industrial approach of agriculture.
In many agrarian developing countries they also do not appreciate the agriculture sufficiently. Governments need money and so they tax agricultural products and stimulate the production of cash crops for export while there is not enough food to feed the local population.

In general, it can be said that a 'healthy' soil and a vital earth are not really appreciated. All over the worlds soil and nature are getting depleted. This does not mean that the agrarians alone are responsible and thus to blame for this mis-management. The society as a whole (consumers, governments, industry) do not wish to value soil and nature, and do not want to shoulder the responsibility. In contrary, primary production agriculture does not get the appreciation (we don't mean subsidies) that it really needs.
Therefore, when looking for sustainable resource management, we have to seek to a 'deeper level' because we should apparently find a 'source' of the lack of appreciation and responsibility for nature. Here we come to a more philosophical level, and have to involve the fundamentally culture-nature discussions. Many philosophers have pointed at the problematic and strained relation between human and nature (Passmore 1980, Berman 1981, Barbour 1980 Zweers

1984). It is connected with a deep rooted basic-attitude of rational humans against nature. The roots of this attitude lay in the Enlightenment en the development of the natural science in the western world (Sheldrake 1988, Sheldrake 1990, Capra 1975). This attitude is now wide spread over all the world.

Related to this, analysts have come to point to the basic opposition between ecological and economical interests (Boulding 1965, Brundtland 1987, Daly 1990, Schumacher 1974, to name a few). It is important to consider the nature of that basic opposition, or, in other words, to make clear what the basis of that basic opposition is exactly.
Generally speaking, current society, represented by its policy-makers, are convinced by the idea that economic data are, scientifically speaking, at least as "hard" as ecological ones, and politically even "harder". Gross National Products (GNP) calculation, financial input-output analysis, calculation of profits and losses, data on scarcity and values of commodity, are much more impressive than data on losses of topsoils due to erosion, of deforested and desertified areas, of decreases in species, habitats or landscape diversities, resource depletion, and so on. Somehow, the economical data do score higher appreciation than the ecological ones, although the latter are based on [hard, natural] science whereas the others are much more obviously based on socio-psychological validation such as attribution of values to commodity, perceptions of scarcity, profits and losses, the GNP-growth mania[18]. All these items and data, being rather arbitrary socio-political types of decisions, are derived from models characteristic for "soft" [= non-beta] science. However, once calculations are being made, the "hardness" of those data is granted: miscalculations are rare, forgetting that they are inevitably based on some versions of the mentioned presumptions.
The point to be made here is that the opposition between ecology and economy is not a fact, but basically a human concept, part of a self created mental map or paradigm, and thus, essentially, part of some type of ethical statement.
Prince Claus of the Netherlands recently stated in his opening address at the 20th SID World Conference held in May 1991 in Amsterdam that "it seems to me that if we look at the evolution of economic theory over the last two hundred years we can conclude... that it has been basically concerned with the question of how those who are already rich... can increase their wealth still further. Economists have given less attention to issues of distribution. Indeed, I believe that mainstream economics represents in many respects an orthodox consensus which can be shown to be deeply conservative. ...It seldom tells us we need something new, something different. Perhaps we must await the appearance of a 'green' Keynes to help us out of this predicament. But preferably a Keynes who is born in and belongs to the 'South'. (de Lange 1992; see, for an other view on economics: Daly 1990, Schumacher 1974, Stein 1937, Steiner 1922).

The present day economy can't handle and fully integrate the values of nature and earth: the integration of ecology and economy is far from succeeded. But the immense environmental problems emphasize every day that the living earth and its natural, renewable and non-renewable, resources, the basis of a human shaped world-economy (and not money). Only elaborating on such notions, can effective political instruments to warrant sustainable production systems, eventually be developed.

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NOTES

1. Nature, Labour and Capital are the three 'resources' (means of production) which are necessary to generate the products in the economy . In economic science they speak of factor-input and non factor-input (Lipsey 1990). Factor-input includes the 'permanent' means of production Labour, Capital and Land. The non factor-inputs are the variable acquired means of production like fertilizer, pesticides and fodder. In the agricultural production-process Nature is still of great importance. It is possible to make a distinction between renewable natural resources and non-renewable resources. Renewable resources include the soil, the plants, the animals (genetic resources), but also ecological systems like landscapes and 'the environment'; that means all the 'living things' which can reproduce itself. Non-renewable resources are the mined minerals and fossils (energy). In agriculture we can recognize these minerals for instance in the external 'inputs' like fertilizers, pesticides, oil for machinery, medicals for cattle.

2. In the economic theories they also speak also of 'the external effects'. During the production-process all sorts of unintended profits and losses will arise which can't be expressed in a market price. These external effects cause an deviation between the public and private profits and costs. In the economy they distinguish positive and negative external effects. For instance, landscape building can be seen as positive and pollution of drinkwater as a negative external effect of agricultural production.

3. In this model we did not involve the input of capital and machinery. We assume that in agriculture the input of land and/or fertilizers and pesticides is correlated with the input of machinery and capital. For instance: when farmers have much land available, they also have enough machines to till the land. And, a high external input agriculture needs an agro-industry which supplies and process the high input and output (the products).

4. Renewable resources, like land and soils, are in principle renewable when these resources are managed and treated in a right way. However, if the management is very bad and soils erode, the land will be in the long run unsuitable for agriculture.

5. Data on the use of pesticides per hectare are difficult to find (secret) and often unreliable. In the developing countries there is the problem that the pesticides and fertilizers are particulary used in on cash crops of the great (sometimes government) farms. But the subsistence farmers rarely use inputs like pesticides.

6. It is almost impossible to 'measure' at national level the quality of labour (the craftsmanship). It is only possible when you collect the data on farm level. Bolhuis en van der Ploeg (1985) discern, like Lacroix (1981), three phases of 'farm-work' and quality of craftsmanship (see also van der Ploeg 1990):
A. Farm-work in a subsistence agriculture. The craftsmanship moves within the strictly boundaries of the eco-system. The eco-system conditions the labour of the farmer.
B. Phase of independent farm-work. The craftsmanship creates 'degrees of freedom' and modifies the local eco-system. The production is intended for the market and the reproduction takes place on the own farm.
C. Stage of the incorporated farm-work. The farm is strongly twined with agri-business (also banks, administration etc.) and the reproduction takes place for a great part outside the farm; i.o.w. other institutes and firms are specialized in the improvement, breeding and research etc. and Craftsmanship changes in 'entrepeneuring'.
The phases (and the development) of farm-work, exist next to each other in different stages in the present world and there is a different use of the natural resources. Farm-work is always a mix between mental and physical labour, but it differs where the farmer is concentrating his of her attention on. In phase A. all the operations of the farmers are defined by the ecological system. There is not really a conscious intervention in Nature. In phase B. farmers get more grip on local eco-system and they can manage the so called 'living labour-objects' (by reproduction of the soil, the cattle and plants; van der Ploeg (1990, p26) points at the special labour process in agriculture). The mental and physical labour is mostly focused on Nature. In phase C. the attention of the farmer is for a great part shifted to machinery, scientific technology, government policies and rules, administration, guidance etc. (in other words the social and technological surroundings of the farm); the farmer obtains the (scientific) knowledge about the agricultural work and living labour-objects for a great part from outside the farm. In this stage the farmer tries to dominate the local eco-system around and on the farm with the help of technical and external inputs.

7.In Oldeman 1991 they distinguish four types of soil degradation: water erosion, wind erosion, chemical deterioration, physical deterioration. Water erosion is by far the most important type of soil degradation (56%).

8.The strategy of nations with regard to their agricultural development does not say a thing about the ideas and strategies of individual agrarians in regard to their resource use.

9. In the first instance they understood the 'negative side-effects' in the economic theories as the undesirable and unmeaningless social and economical effects. Since the eighties the environmental effects are seen as the main negative side-effects (see also note 2).

10. The first type consist of those economies which were less attractive to the colonizing European countries, because of the geographical position and/or the ecological conditions (lack of known rich mineral resources). Countries of this type are e.g. Mali, Niger, Benin.
Second type represents economies where, under the impact of foreign capital, commercial peasant agriculture evolved as the dominant sector of production. Favourable ecological conditions and/or geographical position facilitated the growing of crops for export; this type occurred in Ghana, Senegal, Ivory Coast.
Third type of economies were these countries with good ecological and geographical conditions where Europeans settled: Kenya, Zimbabwe, South Africa, Angola.
The decisive role of mining and its control by foreign capital characterize the fourth type of economy. These countries show large discrepancies between highly developed modern industrial sector and an underdeveloped agricultural sector. Examples: Zaire, Zambia, Gabon.
The fifth type is like the third type of economy, but in these countries they have to cope with mass migration of male workers while a significant part of their national income is made up of wages remitted from abroad. Countries of this type are e.g. Botswana, Burkina Faso, Malawi.(Hinderink 1987, p62-63)

11. Special reference can be made to the food supply and the re-production as important tasks cared for by women. It is known that men are more interested in money and cash crops, while women are often concerned with food supply (see f.i. Shiva 1988).

12. Repetto stresses that "hundred millions of dollars are being spent annually to subsidize the sale of dangerous chemicals (often chemicals who are forbidden in the western countries) to untrained farmers, to be released without adequate control or supervision, and the agencies responsible have no way of knowing when those subsidies are accomplishing their purpose" (Repetto 1985).

13. The effects of price changes on the resource uses in agriculture are very difficult to analyze in developing countries. "Current data bases in developing countries, where they are reliable, are disaggregated by administrative and political boundaries (i.e., region, province, district etc.). It is often extremely difficult to obtain the same economic and environmental data by major agro-ecological and resource systems zones; e.g. watersheds, semi-arid lands, uplands, forests etc. It may be equally difficult to obtain reliable data on certain key marginal socio-economic groups (Barbier 1988).

14. There are also big differences between the consumers in developing and the industrial countries. For 'real' consumers in developing countries, who live in the urban areas, a great part of their budget is spent on food. A higher price for foodstuffs has big implications for them.

15. In the socio-agricultural literature they speak of the Technological Administrative Task Environment. This is the necessary external 'environment' of the industrial and specialized farm which support the agrarian with all sorts of inputs (see: van der Ploeg 1990).

16. Therefore we have to search to new instruments. Probably an instrument to prevent resource depletion is to 'up-value' natural resources. In practice it means that the use of (non renewable) natural resources could be discouraged with the help of energy-taxes (eco-tax) or input taxes. This is one step to change the economy to a sustainable direction. Also an important precondition is that the tax-system make a shift in such a way that labour gets relative 'cheaper' and expending and consuming gets more expensive. This means that expenditure should be taxed and on the contrary earnings should not. It is possible to make those products which pollute extra to have a higher tax (a sort of eco-tax). On the other hand, the primary products like food, should not be

taxed (are low), so that everyone can buy food.

17. 7 kilo grain is necessary to produce 1 kilo pig meat. For 1 kilo cattle meat 4.8 kilo grain is necessary, and 1 kilo chicken meat needs 2.8 kilo grain. (Durning 1991)

18. The meat consumption per country is different. On average, in the U.S.A. they eat 112 kilo per year , and in India only 2 kilo (based on carcass weight). In rich countries they eat in general more meat than in the poor countries; but culture, religion etc. also influence meat consumption (Durning 1991).

19. Interesting is the work of the economist Hueting, who have found a method for the calculation of a sustainable national income. In this method he expresses the loss of nature and environmental damage in monetary terms (Hueting 1991). He concludes that the continuing growth of the production in the economy (GNP) is the heart of the environmental problem.

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