

Sustainable Development in Search of "Heroes"

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Let me begin with a Filipino wife talking about life. She says, "When there is enough food, your face can wear a smile."¹ This seems to be a simple way to win smiles but unfortunately, there are millions around the world for whom smiles do not come easily although the situation with respect to global food supply is a matter of controversy.

In a paper presented at Centro Internacionale Mejoramento de Maize y Trigo's (CIMMYT's) 20th anniversary in 1986, G. Edward Schuh highlighted a dramatic story of growing food abundance globally. He indicated that: "Rather than trending upward, the price of wheat -- has been trending downward for well over a hundred years . . . By the beginning of the 1980's the real price of wheat was roughly half of what it was 120 years earlier in 1860. Moreover, the price has declined significantly since the beginning of the 1980s . . . The price of corn has shown a similar downturn . . ." John Mellor in his 1989 speech at the International Centers Week projects that: "The 1990s can be a decade in which major strides are made in abolishing hunger, strides that may clearly indicate its approaching end." On the other hand, Lester Brown of the Worldwatch Institute argues that: "With more hungry people in the world today than when this decade began, there's little to celebrate in the food front as we enter the '90s."²

The first assessment, by its very nature, is only a partial truth because the global story conceals the realities of many particularities. The second assessment carries too many "ifs," the realization of which (as Mellor suggests) depends on continuous, location-specific, complex, largely dispersed effort on a wide front. The third is described as the view of a Hunger Expert. From where I sit, all three of them are simultaneously right. Each statement must be true somewhere. The world is big enough to accommodate them all for surpluses co-exist with shortages.

While global scenarios are indispensable because "the whole is greater than the sum of its parts," achieving sustainability requires literally on-the-ground "goodness of fit" between problem and solution. This means specific actions in particular localities to meet location-specific circumstances. Even as we "think globally," we must "act locally" (as the slogan goes).

To say that there are 700 million poor and hungry people in the world is intellectually staggering; but, if we want to do something about them, the problem must be located in time, physical, and social space. For many years and many conferences the poor have been anonymous. In order to reach them, the poor must have an identity, a name and an address. (So that we could at least send them post cards -- "Wish you were here!!!")

SOME MICROSCENARIOS

This paper is a pedestrian attempt to identify some micro-scenarios which present opportunities for a doable research and action agenda. They portray situations which range from the simple to the complex, an expression of what the real world looks like for some of us. The following are illustrative microscenarios within the global scenario:

- Loans revisited;
- The unobtrusive value of subsistence agriculture, etc.;
- Germplasm at the grass roots;
- Technology promises, Promises, PROMISES;
- People make the difference;
- Health - the unfactored capital; and
- Emerging and surviving institutions in a changing resource base.

Loans Revisited

Through the years, developing countries have obtained loans from the World Bank and Regional Development Banks to finance agricultural development projects "with the expectation that their benefits will not only allow recovery of the investments and repayment of the loans that made them possible, but will also generate a net surplus." Cernea's assessment of the outcome is: "In part, the international debt crisis is a product of repeated investments in unsustainable development programmes."

In his paper on "Farmer Organizations and Institution Building for Sustainable Development," Cernea cites the following findings from sustainability analysis and impact evaluation studies done by the World Bank itself on a group of 25 completed agricultural projects:

- Twelve out of the 25 projects appeared to have successfully achieved long-term sustainability, while 13 did not.
- The 13 projects failed to sustain the minimum flow of benefits to qualify for an assessment of continued, lasting success. At the time of project completion, the rate of return projections for these 13 projects had been satisfactory and ranged from 15 to 30 percent. However, at impact evaluation time, they all declined to less than 10 percent, and 2 projects, the economic rate of return (ERR) had turned negative. The average rate of return assessed for these 13 projects at impact evaluation time was as low as 2.7 percent. This rate reflects the inability to sustain project activities in the post-completion period.
- Generalizing the common features of the sustainable projects, the overall conclusion was: "A major contribution to sustainability came from the development of grass roots organizations, whereby project beneficiaries gradually assumed increasing responsibility for project activities during implementation and particularly following completion."

The paper also pointed out that: "all of the 25 projects submitted for impact evaluation studies (IES) were selected from among those projects which at audit or Project Performance Audit Report (PPAR) time were judged to be successful and which had good long-term prospects following completion. No projects which appeared marginal or uncertain at the time of audit were submitted to IES, because their chances for durable post-completion sustainability already seem impaired."¹³

The Asian Development Bank in its 1986 Annual Report stated that "there has been a tendency toward optimistic estimation of economic internal rates of return (EIRR) at appraisal." The Seventh Report of Selected Post-Evaluation Findings, ADB, March 1988 shows that for most of the projects (EIRR) and FIRR divergence at appraisal and at post evaluation (mostly lower at the later stage) is attributed to unrealistic assumptions and expectations.

In the Philippines, David reports that: "The World Bank has just completed a post evaluation of the Upper Pampanga Integrated Irrigation System (UPRIIS). This project is supposedly the 'flagship' of National Irrigation Administration (NIA) systems. It consists of the Upper Pampanga (Pantabangan) and Aurora-Peñaranda Irrigation Systems and has a target irrigable area of 103,000 ha. Its performance is mediocre. It encountered considerable cost overruns. Actual production is much less than projections in terms of rice and hydroelectric power. Its economic rate of return actually turned out to be unfavorable. Most alarming is the fact that the gaps between targets and actual performance widen with time."

Among the reasons cited by David for this very poor performance are: invalid assumptions during project preparation due to inadequate data base and over-enthusiasm on the part of the designers; lack of accountability for poor design; low construction standards and poor operation and maintenance partly as a result of the absence of an independent monitoring group.⁴

Considering that whether projects are marginal, uncertain, or successful, loans have to be repaid, the implications of these findings are very serious indeed. If doctors and lawyers can be sanctioned for malpractice, could not consultants and consulting firms be similarly held accountable for those tantalizing rates of return?

At the very least, their professional reputation should be tarnished and the responsibility for failings should be shared with us although the debt burden is all ours. In a world where power is heavily concentrated on the lender, is there any room for default? The cost for our country is about 40% of the P245 billion national budget this year. This is about P98 billions.

The Unobtrusive Value of Subsistence Agriculture, etc.

Studies of resource-poor and even not so poor farm households have repeatedly substantiated the crucial role of subsistence agriculture in their own sustainability. Household food security, whether in Asia or Africa appear to be a major preoccupation. One virtue in using the household perspective rather than the single commodity (rice, corn, or wheat) approach in viewing production and consumption is that we begin to see the dynamics of quality of life revealed in diversified household strategies. It is not rice; it is not corn; it is not vegetables, it is not livestock; it is not fish; it is not wage labor; it is not remittances, but all of the above, sometimes in miniscule

amounts but in unimaginable combinations. It is not just field agriculture, but also household gardens; not just men but also women and children who participate in the production and decision-making processes.⁵

An even more interesting phenomenon in subsistence agriculture is that of urban farming. The Mazingira Institute's Urban Food and Fuel Study in six towns of Kenya (Isiolo, Kakamega, Kisumu, Kitui, Mombasa, and Nairobi) found that almost two-thirds of urban households grow part of their food while about 30% grow these crops within the urban area where they live. About half of the urban shambas are owned by the household, the municipality, the government and private firms. About half keep livestock with 17% in urban livestock. Ninety-five percent consume urban crops they grow which include corn, beans, millet, cowpeas, and vegetables. Indigenous local vegetables are consumed by 81% but they are mostly purchased, collected from the wild during the rainy season, and only 9% produce them. This practice is a puzzler and perhaps one should look at the availability of planting materials. To underscore the importance of urban farming, households were asked what effect it will have on household welfare if they were stopped from growing crops in town: Forty percent said they would starve and another 40% indicated that they would be forced to buy food.⁶

But equally interesting is Panayotou's observation in Thailand with respect to rice: "Only 30-50% of total production is marketed. Fifty percent of paddy farmers sell less than 10% of their rice production and many of them are net purchasers of rice."⁷

Despite all these evidences, subsistence agriculture has not attracted research and development support perhaps because subsistence is equated with traditional technology; nonproductive, noncash, "noneconomic", difficult to quantify operations. It is not as neat as single commodity cash crop analysis.

Symptomatic of the poverty of methodology and imagination along this line is illustrated by the reason cited for not calculating rates of return on a smallholder agriculture project:

"Costs and benefits cannot be identified relative to appraisal expectation in any meaningful way . . . As the project did not involve commercial entities except for smallholder operations, an overall financial analysis of the project was not carried out."

But the most fascinating evidence of conceptual and methodological inability to deal with the problem of subsistence production lies in the following statements of a consultant;

The South Pacific Developing Member Countries still have a strong subsistence agriculture base. (They do not suffer from severe food shortages). The problem of estimating the level and more particularly at producers' prices presents measurement difficulties. It is suggested here that while the level of non-monetary production represents an important aspect of the welfare of a country, it does not provide an indication of the level of development. In fact, the continued importance of non-monetary agriculture could be seen as an indication of non-development: i.e. of continued reliance on a traditional way of life rather than the creation of industrial and commercial development. It is, therefore, suggested that although highly relevant to considerations of the well-being of the people, it is not relevant to development.⁸

One can only say that if people's well-being is not relevant to development, then what is?

Germplasm at the Grass Roots

Winrock International in its Annual Report 1987 says: "Most of the world's farmers cannot afford to buy seed; this year they'll plant seeds they saved from last year's crop. Ninety percent of all the crops grown in developing countries are shown from seeds selected and stored by farmers. Farmers in Africa routinely lose 10-50% of their seed because of storage problems." The Centro Internacional de Agricultura Tropical's (CIAT's) 1987 Annual Report uses the term Artesanal Seed Sector in referring to a similar situation while the International Potato Center (CIP) talks about an informal seed system. CIAT describes the situation as follows:

CIAT's bean program and national programs through a collaborative network have developed many superior varieties of beans - 100 or more have been released by the national programs. Even so, getting the seed of these improved varieties of plants into the hands of small farmers has proven to be a weak link in the technology chain. The problem lies in the inability or unwillingness of seed companies especially in the private sector to produce and broadly distribute the seed of new varieties because different regions require different varieties. For example, in Colombia, a country with a relatively advanced seed sector for Latin America, seed producers provide only

an estimated 15-20% of all maize seed used by farmers. For beans, the estimate is less than 3%. Small farmers, therefore, tend to save their own seeds.

The situation with respect to potatoes is similar. Studies conducted by CIP in Kenya, Ecuador, the Philippines, Tunisia, and Peru show that farmer-based informal seed systems are most important. For example, in Ecuador 99% of the seed demand is supplied by this sector. Even in a new industrializing countries (NIC) like Korea, only 15% of seed potatoes that farmers use are certified; the rest come from the informal seed system.⁹

CIMMYT's study in the case of corn shows total area planted to farmers' own seed in various regions of the Third World 1985-86 are as follows:

- | | |
|--|-------|
| (1) Africa 75% | |
| a) Eastern and Southern Africa | = 68% |
| b) West Africa | = 69% |
| c) North Africa | = 69% |
| (2) Middle East 65% | |
| (3) Asia 53% | |
| a) South Asia | = 82% |
| b) Southeast Asia and Pacific | = 75% |
| c) East Asia | = 53% |
| (4) Latin America 45% | |
| a) Mexico, Central America and Caribbean | = 64% |
| b) Andean region | = 75% |
| c) Southern cone of South America | = 27% |

On the other hand, developed countries use 98% hybrids and only 2% farmers' own seed.

As the results of this study suggest: "Maize research programs must take into account those differences in farmers' circumstances as they decide which seed types warrant the greatest investment of resources."¹⁰

Although the International Rice Research Institute (IRRI) has not conducted similar studies with respect to sources of rice seeds, data from another research project in the Philippines show that only 7% bought seeds from the local seed producer and from the experiment station. The rest used seeds from their own stock or from exchange with neighbors.¹¹ In another study, considerable yield decrease was observed when the rice seed was used after being stored for two or more seasons by Filipino farmers.¹² In wheat, about 10% reduction in yield was

observed due to the successive use of the farmers' own seed stock over a period of three years.¹³ Rather intriguing is the fact that no similar studies have been reported in rice;¹⁴ perhaps an indication that rice scientists have not defined quality of farmers' seeds as a priority problem. With the rapid spread of new rice varieties, it could have been assumed that these seeds will carry with them their inherent virtues of high yield, disease and insect resistance, drought tolerance, etc. As a matter of fact, in the M99 rice technology package which has been part of the extension message to Filipino farmers for the past 15 years, seed management is not part of it.

If majority of farmers in the developing world depend on their own seeds or their neighbors, the functional seed banks that make crops possible from season to season are based in the community. What can science contribute to the production and maintenance of good quality seeds (whether these be traditional, improved or modern) at the farm and household level? Does biotechnology have a role?

Rofik Sinung-Basuki of the Lembaga Horticultural Research Institute, Indonesia reports on a three-year project on Farmer-Designed Experimental Research on the True Potato Seed. His team introduced the principles of TPS and the farmers designed the experiments which have led to four seasons now of seed potato tubers at the village level.¹⁵

Another story from Indonesia tells about women engaged in village-level production of tomato seedlings sold in banana leaf containers for local plantings.¹⁶

Using rustic facilities in their homes, a few selected farmers in Dalat, Vietnam produce large quantities of in-vitro plantlets from which nodal cuttings become mother plants. From all these mother plants, apical cuttings are then taken and rooted in small bamboo or banana leaf pots and sold to farmers who transplant them directly to the field. The material is used for up to four generations before it is replaced with new rooted apical cuttings. In the Red River Delta, sprout cuttings taken from tubers stored for seven to nine months root well. When transplanted to the field, they gave yields up to 20 t/ha. By using tuber and sprouts, investment in seed tubers is only 15% of the cost of planting tubers alone. In 1986, 100 ha of potatoes were grown using this system.¹⁷

Technology promises, Promises, PROMISES

In our quest for sustainable agriculture, given a declining natural resource base, technology looms large as a major ingre-

dient for its achievement. Mellor, for example, notes that: "we now know what to do to rapidly eliminate hunger in the high potential areas."¹⁹ Although impressive food production gains have been made in different parts of the developing world, we need to revisit these "green revolutions" in order to apply the additional criterion of sustainability. In a small way, this was done in Cernea's study cited earlier in this paper. Perhaps, we are asking too much in expecting both rapid elimination of hunger and sustainability.

For an appreciation of the complexities and intractabilities, let us examine some current technologies and technology potentials from the elite technology-generating centers.

The story of modern rice varieties is one of a succession of brief, even if happy lives. To wage war against brown planthoppers, IR26 was released in 1972. It became the most popular rice variety in tropical Asia in mid 1970s. After three years of cultivation, it succumbed to BPH Biotype 2. IR36 replaced IR26 in 1972. The resistance of IR36 hold for more than six years but in 1982, Biotype 3 damaged IR36. Then came IR56, a cultivar resistant to Biotype 3. Preparations have been made for anticipated attack of Biotype 4.¹⁹ In the meantime Indonesia is celebrating its rice self-sufficiency, while the Philippines is politically mourning another major rice importation even as 90% of total rice production comes from HYV plantings.

Postharvest technologies have been notoriously difficult to find acceptance. An excellent example of nonadoption is the rice dryer despite years of effort and millions of dollars invested in research and development. We eagerly await the fate of sorghum dehullers being introduced in Africa. This device was one response to the problem of declining sorghum and millet consumption partly attributed to the drudgery of processing. Cookstoves have not had much luck either. Krugman found that by 1983, around 100,000 of them have been distributed worldwide of which 20-30% were used only intermittently and another 10-20% not used at all.²⁰

Even when everything seems to have been done right, the intended results remain elusive. Over a period of 11 years, Khonkaen University carried out research on the utilization of cowpeas in Northeast Thailand. They worked through three crop development-introduction models: Model I Grow for the Family Model; Model II Grow for the Village Model; and Model III The "Cash Crop" Model. The first model did not succeed. Cowpeas are not regarded as a domestic, household crop, except when grown to be eaten in green form. In the second

model, some villages grow cowpeas for processing in the village. The cowpea products which are sold back to villagers would have succeeded if insect pests and other crop management difficulties did not result in poor yields. Dehulling and milling equipment were accepted. Cowpea products developed for village food vendors were marketable and profitable. But with cowpea growing problems; food vendors also lost their interest. The third model, the cash crop model, is one which seems to be attractive to farmers if a domestic or export market could be developed.²¹

But this research project is valuable for two reasons: (1) it introduced systematic models, and (2) it gives a lesson on the naivete of the "grow and eat" model for household nutrition when the farmer wants a cash crop.

The International Crops Research Institute for Semi Arid Tropics (ICRISAT) reports that: "With the good rains in 1988, improved technology which continued to be disseminated to farmers was utilized adequately with excellent results for the first time in four to five years." It would be useful to have these results in farmers' fields documented (as they probably have). For agroforestry purposes they have perennial pigeon pea which is an exciting potential.²²

After 15 years inside headquarters, the International Institute of Tropical Agriculture (IITA) will take its alley cropping onto the farm where the experimental system will be subjected to the rigors of a hard life.²³

For the International Council for Research in Agroforestry (ICRAF) the products/services most frequently identified as research priorities by farmers participating in diagnosis and design exercises are soil fertility/erosion control, fodder, building materials, fruit, live fencing, and fuelwood. Soil fertility is a major and widespread problem of land use systems and has been identified as such in virtually every diagnosis and design exercise conducted by ICRAF to date.

Contrary to common assumptions, it is unusual to find farmers who wish to grow trees primarily for fuelwood although this is a major concern for farm families and other land users. Fuelwood is a widely valued by-product to most agroforestry technologies.

Speaking about potentials, ICRAF's multipurpose tree data base contains about 650 species that are potential candidates for use in agroforestry. Little is known about many of these and only about 20 species are already relatively widely used in research.²⁴

CIMMYT estimates that about half of the corn planted in the Third World in 1985-86 was improved. However, there is much regional variation. In Africa, for example, only one-third of the corn sown was improved, compared to almost 60% in Asia and Latin America. The area planted to improved corn also varies considerably by country. In Kenya, over two-thirds of the corn planted is improved compared to less than 15% in Tanzania. In many West African countries, the area planted to improved corn is well under one-third of the total and it is generally low as well in Latin America (with the exception of Argentina, Brazil, and several Central American countries). Use of improved corn is limited in Pakistan but more widespread in India. In China and Thailand, even higher proportions of the corn area are planted to improved material.²⁵

From this sampling, we can see that technology performance and even technology potential is at best a checkered picture even for the high potential areas. Although predicting technology outcomes is a task for the stout-hearted and the talented, one can say with some certainty that the International Agricultural Research Centers will be sustainable for the next 100 years not only because they were built to last but also because they will be sustained by the donor community. Comparative advantage is a quality which can be "comparatively bestowed."

People Make the Difference

Mellor argues that: "the historical answer to problems of low-potential areas has always contained a major element of migration, which, in turn, depends on good performance in the high-potential areas and their urban enclaves."²⁶ Because rural to urban migration is so obvious in statistics and in eye-sore population concentrations, other movements are less recognized, if at all.

In a study of population pressure in the uplands, Cruz estimates that about 29% of the total Philippine population and 55% of the migrant population for the country reside in the uplands.²⁷ We seem to be in a situation where there is no further escape from facing-up to the problem of the low-potential areas because that's where millions of people are. Their survival often depends on subsistence production in these very areas. One suspects that this "moment of truth" is not peculiar to the Philippines.

To provide concrete illustrations, we cite cases of population increase and changes in land-use patterns in specific com-

munities. Delorino's study of the Macagtas Watershed Area of Northern Samar, Philippines, reports that there were 188 households in 1975 with 977 total populations, in 1980 the figures are 248 and 1,337, respectively. Land use trends were 50% forest in 1952; 74% coconut in 1979 with only 3.4% secondary forest; in 1987 the area was 82% coconut and no more forest. The entire watershed area is titled, tenanted coconut land owned by private individuals. Estimates of erosion rates in the watershed increased from 28 t/ha per year in 1952 to 45 t/ha in 1979 to 53 t/ha in 1987. The change in land use changed the vegetative cover as well as cultivation practices.²⁸

Another watershed study by Pasicolan²⁹ showed that the yearly average rate of forest transformation to other land uses between 1953 and 1979 was 23 ha/year and 60.5 ha/year from 1979 to 1987. From 72% forests in 1953, the area has become 68% grassland in 1987. In the meantime, as much as 61% of households are full-time fuelwood gatherers; 34% part time; and 5% occasional gatherers. Selling of firewood is a year-round activity and 91% have no regular employment. Bigger household income, larger household size and more man-days increase level of fuelwood production. Distance from gathering site is not even a limiting condition for them. Fuelwood gatherers have a high degree of awareness of consequences and would prefer farming to firewood production but the land they used to farm has lost its productivity. Alternative job opportunities are hard to come by. In the meantime, there are 1,000 households in the lowland of this watershed dependent on rice production. This is the so-called high potential area. The lowlands continuing viability depends on the stability of the low-potential upland. They are not independent of each other. It is usual for resource economists to examine both on-site and off-site costs.

For an illustration of the lowland doing damage to the upland, de los Angeles studied a group of erstwhile lowlanders cultivating a watershed area in Luzon. Over a short three-year period, yields went down from an average of 27 cavans (sacks) per hectare in 1978; to 14 in 1979 and only 9 in 1980. The lowlanders in search of land to cultivate brought their lowland cultivation practices to the upland thus creating rapid resource depletion.³⁰

Fabro's historical analysis of farm diversification in an upland community of 182 families, 1,000 population, and 296 ha also found the history of farm fragmentation. A typical example is a one-family farm of 16 ha parcels now subdivided among 24 families. More than 70 types of both annual and perennial

crops were reported to have been planted by farmers from the early 1920s to date. In the process of trial and error in determining what best crops or crop mixes would best fit their ecology, some 20 traditional crops notably rice and corn were gradually replaced until finally dropped out by the farmers for reasons of low/declining productivity, high risks and the comparative advantages offered by alternative permanent crops. At present, highly diversified farms had about 33 to 44 types of crops plus two to four types of livestock in an average area of 2.61 ha. From 22 to 32 types of intercrops plus two or more kinds of livestock in about a hectare of owned or partly-owned land comprise the farming system of moderately diversified farms. Less diversified farmers had only 12 to 21 intercrops and one or more types of farm animals. Smaller farms had higher crop density and land use intensity. Backyards and home lots are intensively utilized for traditional vegetable crops. The available spaces between the permanent crops are devoted to ginger, cassava, and other root crops.

One notable fact about these farmers is their minimal availment of assistance from extensionists or any other information dissemination program. They learned improved farming practices through old knowledgeable persons, co-farmers, friends, and by observing more innovative practices of other farmers.³¹

Even the coastal areas have not been spared of population pressure. Lim reports three fishing municipalities of San Miguel, Bay which increased from a total of 1,336 households in 1977 to 2,342 in 1980. Majority of the fishermen are no longer fishing in the same area where they were fishing five years ago. Fishing effort has become more intense over a longer period of time and farther distances with less catch. A migration survey of the Bay area's 22 fishing communities showed that 16 experienced net in-migration from 1959 to 1979. Migration out of the area is associated with higher education, larger family size; and more skills.³²

In this country, which is host to the International Rice Research Institute, 90% of total rice production comes from HYV plantings. Despite this impressive record of adoption of new rice varieties over a period of 20 years, in terms of per capita rough rice available, we have not progressed much farther from 1948 when the figure was 2.88 (sacks of 44 kg) to 3.20 sacks in 1984. This year, we are back to being a rice importer in a major way.

Quite interesting is the Hayami et al. report on the "Transformation of a Laguna Village in the Two Decades of Green Revolution." Among their findings are:

(1) Average population per hectare of rice area increased from 1.8 persons in 1903, to 3.8 persons in 1966 and further to 8.9 persons in 1987; this was paralleled by increases in economically active population per hectare from 1.7 persons in 1966 to 5.6 persons in 1987. (2) Total population in the village increased from 393 in 1966; to 549 in 1974; 644 in 1976; 698 in 1980 and 816 in 1987. The increase in total number of households largely paralleled the growth in population; it increased from 66 in 1966 to 95 in 1974 and further to 156 in 1987. One consequence of the strong population pressure on land was an increase in the number of landless laborers who have no farm to operate, either owned or rented. The share of landless households in the total number of households has increased from 30% in 1966 to 50% in 1976 and further to 66% in 1987. (4) Average farm size declined from 2.3 hectares in 1966 progressively down to 1.7 hectares in 1987.³³

Needless to say, the cases cited earlier demonstrate that people make a difference on the state of the natural resource base. Regardless of agroecological setting we cannot escape from population pressure. In the food-population equation, the denominator deserves as much science, policy, and implementation as the numerator.

Health -- the "Unfactored" Capital

For very understandable reasons the health and agricultural research communities, very rarely, if ever, intersect and even when we argue for human capital development, the most common reference is training and education, and not health. The health-agriculture-productivity connection comes in at least two ways: (1) health of the agricultural manpower and (2) health impacts of agriculture which comes positively through food and nutrition and negatively by way of agriculture-related illnesses.

Saburo Okita in his argument for the investment character of health expenditures says: "Health, like education, is often perceived as a "soft" consumption sector which will only follow advances in "harder" sectors like industry and agriculture. The converse, we argue, is equally true. Investing wisely in health will build human capital, enabling people on a more equitable basis to contribute to and gain from economic pro-

ductivity. Unlike investments in factories and roads, investments in health can generate returns that do not depreciate and that can bring significant social benefits for a lifetime and into the next generation."

Furthermore, he points out that "health is a key factor in stabilizing population growth." Experience has shown that improved child survival influences families' decisions to limit their number of children.³⁴

Loewenson in a comparative study in health status of four occupational groups in Zimbabwe; commercial farm labor, peasant farmers in communal lands, mine workers and peri-urban workers found most unsatisfactory health status among the commercial farm laborers, followed by mines and communal areas and lowest in urban areas. The quality of food intake was poorest in the commercial farming areas, improving in the mines and in urban areas. All groups used commercial food sources with only communal areas stating that farming was their major source of food (94% of households). In wage labor areas, farming increased in frequency from mines and urban areas to commercial farms, although up to 40% of urban households still reported some family involvement in farming.³⁵ This study points out once again, the important contribution of own-grown foods to the household diet.

The poor health-vicious cycle is dramatically portrayed by Evans in his analysis of the impact of river blindness at different stages of household development. The progression of the disease within the young developing household leads to the following consequences:

Increasing dependency ratios; decreasing health and nutritional status of all household members and increasing vulnerability to other diseases; decreasing labor input measured by equivalent active units; decreasing ability to participate in traditional labor exchange systems; decreasing area under cultivation; decreasing ability of household food production to feed household members; increasing duration of food shortage; increasing severity of food shortage; decreasing ability to undertake food shortage coping strategies; increasing expenditure of scarce household resources on health problems, particularly blindness; decreasing household viability; increasing stress and household disunity; and increasing reliance on the village welfare system and the extended family.³⁶

Nur and Mahran in their study on the effect of health on agricultural labor supply among Gezira tenants in the Sudan estimate that:

Malaria alone caused a loss of roughly 9,741 work hours, 62 percent of which has been compensated for by unaffected but unspecialized family members. A negative shadow effect of malaria emerged in the form of taking women away from household activities and children away from schools. Malaria also reduced tenants' efficiency by 50 percent during seasons of peak labour demand."³⁷

Maiga's findings with respect to consequences of schistosomiasis among peasant farmers of Niger show that they measure the harmful consequences in terms of financial expenditures. Disease constitutes a serious obstacle to production because weakened physical resistance can lead to dismissal from work. Ninety-five percent believe that the disease affects their self-sufficiency in food or the security of their food supply. As a matter of fact, poor health tops the farmers' list of obstacles to their economic growth and well-being.³⁸

It is not a coincidence that peaks of labor demand and of food scarcity occur at the same time as peaks of malaria transmission. Silva et al. reported that although labor mobilization for vector control creates an ideal environment for educating the community about malaria transmission and control, the peak demand for communal labor (shramadana) is also the peak demand for agricultural labor in Sri Lanka.³⁹ Furthermore, Mwabu found that: "the rise in the value of time in the wet season raises time costs of medical services and thus, other things being equal, the rate of their utilization falls. The drop in utilization rates impairs the program's ability to control diseases and again its effectiveness falls."⁴⁰

In the Philippines, Salazar reported that after the global resurgence of malaria in the 1970s, morbidity rates increased from 66.8 in 1971 to 202.1 in 1984. Mortality rates also reflected an upward trend. Furthermore, her maps show the malaria zones and geographic distribution of mosquito vectors in many parts of the country. But more germane to the theme of this paper is the horizontal and vertical distribution of these vectors which can be found from the sea coastal zone, the coastal plains, to the foot hills, to hilly zones and forest edges up to the mountain range -- ecosystems which are also under stress.⁴¹

Blas et al. reported that the overall prevalence of schistosomiasis as of 1987 in 24 affected provinces is 6.6% but farmers as an occupational group showed the highest infection rate of 74.1%, followed by fishermen with over 60%. An average of 45.4 mandays is lost per year per infected person.⁴²

The complexity of rice cultivation-vector relationships and the difficulty of managing the problem is evident in the following statement:

"Intermittent soil drying, prolonged water deficits, flash flooding, and deepwater are detrimental to mosquito and snail reproduction as well as to rice growth."⁴³

In other words, what is bad for the vectors, is also bad for the rice plant, hence, in many instances, considerations of productivity prevail over health concerns.

A similar situation occurs in pesticide use. Rola's study on pesticides, health risks, and farm productivity found no correlation between pesticide expenditures and yields suggesting that farmers are overusing pesticides. Most of them believe that reducing pesticides would reduce yields. Although practically all of them know that pesticides are hazardous to health and environment, they tend to continue using them because they believe that chemicals are necessary for maintaining an economic level of production. However, to minimize the exposure of farm-operators to the hazards of pesticide poisoning, there is a growing tendency to hire labor for spraying. Those hired are younger and come from the poorer landless farm labor group who are also poorly paid.⁴⁴

Loevinsohn, in an analysis of pesticide use, cropping patterns and mortality statistics in Central Luzon, a major rice-growing area of the Philippines found that: widespread adoption of insecticides by farmers on smallholdings was followed by a 27% increase in mortality from causes other than trauma among economically active men. Several factors analyzed suggest a causal link.⁴⁵

The above illustrations show that productivity could have a human cost in terms of health. This cost needs to be "factored in".

Emerging and Surviving Institutions in a Changing Resource Base

With increasing population pressure on the natural resource base and the changes in technology, the institutions which govern the control, use, and management of these resources change. Even the beneficiaries and nature of benefits from

resource use change. For example, from artisanal fisheries to trawlers means a change not just in technology and fishing grounds but in ownership (could be multinational); who actually fishes; efficiency of catch; wages and/or sharing of catch. It is impossible to conceive of sustainable agriculture and household food security without a consideration of land and labor relations; household kindship, and other social networks involved in the food system; modes of production, distribution, and consumption which determine access to food or purchasing power. Changing land use patterns, farm fragmentation or concentration, agricultural and residential landlessness have their corresponding resource management implications.

Riddle regards land tenure as a "bundle of rights" with at least three dimensions: people, time, and space.

All rights that make up the bundle are the result of human interaction and . . . since land survives any holder of rights in land, all social systems have mechanisms for the transfer of rights and for determining how long these rights last . . . Each right in the bundle also defines just what are the spatial dimensions of use . . . Throughout the developing world, two countervailing trends are evident. In terms of production decisions, tenure is becoming more individualized, even on communally held lands. On the other hand, new governmental institutions, both at local and national levels, are showing themselves increasingly willing to assume tenorial roles in order to stimulate development, to protect natural resources such as forests, or to stimulate regional development by changing the use of land. Pure or pristine tenure types, such as freehold private tenure at one end of the continuum or strictly communal tenure at the other end, no longer exist if they ever did. Rather it is the case everywhere that tenure forms are mixed. In almost all communal tenure regions, one finds private land-ownership and land sales.⁴⁶

Fortmann also says that even trees have tenure considerations which include right to own or inherit; right to plant; right to use, and the right of disposal. Programs which introduce intercropping between trees almost always lead to issues of "right to use produce under the tree."⁴⁷

Indicative of the worsening access to land and jobs is a form of tenured labor, where landless workers contract to do the weeding on designated plots for free or without immediate

remuneration in exchange for the exclusive right to harvest the crop on their weeded portions for a percentage share of the harvest. Their "bodies" can also be mortgaged in the sense that food can be obtained now with an "I OWE YOU" to be repaid with labor in the future.

But more directly related to the issue of sustainability is the assumption often made that security of tenure on the use of the land leads to the adoption of productivity increasing and conservation-enhancing measure. Regarding the former, green revolution studies have shown that new technologies were adopted regardless of tenure status and farm size.⁴⁸ However, the empirical evidence linking security of tenure with adoption of conservation practices is pretty thin. W. Rola provides us such source:

The immediate consequence of the legal entitlement to the land (via the Certificate of Stewardship Contract) is the more active participation in tree-growing activities and other soil conservation practices. Tree planting has increased the vegetative cover of the farm which helps minimize the impact of rain on the soil and hence, less erosion. In addition, increased vegetation on the farm has resulted in an increased amount of litter in the soil . . . Rock-terracing on the other hand, has a direct impact on reducing the rate of soil erosion on the farm.⁴⁹

Besides security of tenure, participatory approaches have also been advocated for sustainable development. So far, the rhetoric far outweighs the evidence.⁵⁰ Perhaps, it is a question of time. One of the few well-documented studies in irrigation development has shown that after 10 years: -- The participatory approach to irrigation development achieved most of the intended results -- larger areas, greater productivity, stronger associations, improved water distribution, better compliance with government policy and improved relationship between farmers and the government.⁵¹

Improving access to land through land reform is also supposed to improve food security but apparently the problem is much more intractable than what -- "land-to-the-tiller" slogans suggest. Lopez-Gonzaga describes the sugar hacienda system and the perennial food shortage as follows:

Sugarlandia may be described as a social and ecological problem. . . It is also clear that for as long as the hacienda system exists, the hunger problem

will remain . . . The main entry point . . . is the realignment of ownership and control of the means of production, mainly land. With less than one percent of the total population of Negros Occidental Province controlling this key factor of production up to this time, food shortage remains a yearly occurrence, especially during the off-milling season. Total dependency on wage labor which has only a seasonal demand, spells outright lack of food upon cessation of work and pay by March or April of each year. Yet data from an on-going process documentation of the agrarian reform process in Negros Occidental shows that transfer of land alone will not solve the food security problem. A case study of former sugarcane workers who were among the pioneering agrarian reform beneficiaries show that acquisition of land did not encourage them to go to outright food production. Instead, they have been absorbed into the prevailing social system as petty cane producers. Forced to operate under a system which demands provision for crop loan and cash to sustain one's household during the growing and maturation period of cane, these beneficiaries have fallen under the exploitative non-formal type of agricultural credit . . . Forced to commit their standing sugarcane at 50 percent less than the market price of sugar, these workers turned small farmers end up with similar problems of cash and food shortage which they faced when they were yet plain sugarcane workers . . . The problem of low productivity is also due to lack of knowledge in the cultivation of other crops and adaptive farm technology, . . . absence of physical infrastructure like irrigation and almost nil inputs (i.e. fertilizer and pesticides).⁵²

Speaking about food crisis, Nerfin cites the Image of Africa Project which reports that while Europeans viewed the food crisis as a catastrophic event, the Africans perceived it as a process over an extended period of time. Some of the findings reported are:

- In a food crisis the impression is given that most, if not all, the food which local families need is provided by the outside. This, often, is not the case. The Zimbabwe report quotes figures demonstrating that families on food aid after total crop failure received only

10-30 percent of their food requirements from outside aid.

- According to peasants interviewed in the context of the Senegal study, "If we had to count only on the aid given by government and NGOs we wouldn't be here today. Too much noise is made about official aid. In fact, it is thanks to ourselves and to relatives in the city that we managed to survive."
- All the African reports emphasize the importance of solidarity within villages, not only as a pragmatic reaction to crisis but above all, as a deep social value. A peasant group in Burkina Faso notes that solidarity is the rule in the village. Those who had sufficient stocks offered them spontaneously to those who suffered. More formally, there are social institutions designed precisely as mechanisms for mutual help in times of need.
- In Ethiopia, the *idir* acts in situations of famine by providing a modality for sharing whatever is available among its members.
- The Senegal report describes various systems of mutual support evolved by different ethnic groups involving collective fields and stocks, supplemented by crops grown by the women to help meet the groups needs in lean periods.
- Solidarity also operates strongly in the form of exchanges between the village and the cities in the context of extended families. These mechanisms include support in the form of cash, food or providing hospitality for relatives from the villages. Their deepest motivation is the sense of belonging to the same group and the consciousness of interdependence."⁵³

All these traditional social institutions which depend on reciprocity and mutuality of benefit are very crucial to survival particularly under conditions of scarcity. Traditional exchange labor arrangements in favorable environments tend to give way to hired labor at specified rates. However, in the uplands, exchange labor is still practiced because agriculture in these areas is labor intensive but cash-short. We need to monitor the erosion of old ones and the emergence of new institutional arrangements because they tell us how things get done.

One of the most interesting scenarios in the variety of organizational schemes for managing land can be found in

Zimbabwe particularly after independence. Loewenson describes this scenario as follows:⁵⁴

- Large scale farms devoted to industrial crops like sugar, cotton and tobacco. Total number of farm units have diminished and average farm size has increased. By 1986, this sector was documented to have land utilization rates of 15-39 percent but because they were under private control, these areas are not made available for production despite land hunger in peasant areas. Besides a rapid decline in employment, there was a shifting of workers to seasonal, contractual, casual, and other non-permanent forms of labor.
- Estates which are privately owned but foreign . . . cultivates one major crop; high use of agrochemicals and mechanization.
- Household food consumption was lowest in nonpermanent households particularly with respect to foods purchased for cash. These households relied to a greater extent on grown or forage foods, but also had lesser access to such foods due to lack of plots for cultivation, lack of time and less household members for food foraging. This food insecurity was most intense in the estates where monocropping has seriously reduced wild foods and no land is allocated to workers for cultivation. Lack of home tenure also means that nonpermanent workers do not participate in social programs available in other parts of the country.

Cousins, on the other hand, highlighted the different grazing schemes being promoted in Communal Land Production Systems in order to prevent what could be a classical case of the "Tragedy of the Commons." But there are many controversies in these grazing schemes which illustrate for us the important institutional issues in sustainable development. Among these issues are:

The definition of *community* and *community membership*, the alignment of village and grazing scheme boundaries; the economic and technical viability of schemes; the question of what constitutes 'overgrazing' and what the carrying capacity of communal land grazing land really is; the need for control of stock numbers or conversely, the need to expand stock holdings to provide sufficient draught for all; appropriate institutional mechanisms for management of communal resources; and the equity implications

of grazing schemes given the uneven distribution of livestock holdings among rural households. These controversies arise because livestock ownership and the use of communal grazing land are central components of peasant agricultural production, but are also a source of intra-community differentiation. They are critically important resources for development but are also potential sources of community conflict and stratification.⁵⁵

SCIENCE AND POLICY IMPLICATIONS OF THE MICROSCENARIOS

Each of the above microscenarios carries with it a research and policy agenda – some of which are easier than others but nevertheless require doing. By way of a summary agenda, the following are suggested.

- (1) We need to revisit agricultural development project loans for a sustainability analysis. This should be a scientific undertaking with results subject to public scrutiny so that the lessons can be learned. The loan development and approval process must be made transparent so that actors can be held more accountable for outcomes.
- (2) The value of subsistence agriculture *et cetera* must be subjected to more creative methods of economic and nutritional valuation. But even more important is research on how to maintain and enhance the sustainability of these sources of subsistence since they represent survival for millions of poor people.
- (3) The best of science must be applied toward making better quality germplasm available at the grass roots level whether these be traditional, improved or new seeds and planting materials. The capacity to do this must be found and/or developed at the local level as has been shown in the cases cited.
- (4) Conferences are not substituted for field projects. We need to nurture and support not only the traditional R&D institutions but also the nontraditional individuals, farmers, women's groups, schools, subregional experiment stations, nongovernment organization, communities, etc. who are currently engaged or are interested in activities germane to sustainable agriculture. For this problem we cannot rely on a trickle-down technology development process from IARCs to NARS (national agricultural research systems), to

national extension agencies, to farmers. We need a lot of R&D initiatives on as many fronts as possible because of the location-specific nature of problem and solution. At any rate, as Barco suggests: "For a country with a weak research infrastructure, it is not only difficult but (often) impossible to participate in the benefits of international technology generation."⁵⁸

The developing world should not and does not wait for technology promises, even expensive ones.

- (5) In monitoring developments in physical and biological sustainability, the "people" component must be equally highlighted. Micro situations in specific places can communicate the message of population pressure more effectively than global or even national figures which local people cannot identify with.
- (6) Research on health and agriculture must be promoted interdependently rather than separately in order to mitigate negative health impacts of agriculture.
- (7) The institutional aspects of sustainable development have not received much attention. And yet the erosion of social institutions responsible for managing natural resources is as important as soil erosion. Often, the erosion of one contributes to erosion of the other.

SUSTAINABILITY BEYOND "MY" SECTOR

Despite the microscenarios which have been portrayed, sustainability cannot just be a local and micro concern. We must answer the question: "sustainability for whom" at what level; for how long?" Sustainable development has a built-in time dimension. Some projects may be judged as failure because they have not had a chance to succeed and some may be considered a success because they have not had a chance to fail. Furthermore, if our world were truly ONE WORLD, there will be no problem of sustainability for someone at the expense of somebody else's unsustainability. As it is, in seeking alternative pathways to sustainability, one sector "passes the buck" to another. Examples of this tendency are as follows:

- "Greater employment opportunities outside the rice sector are necessary to absorb rice farmers and laborers who will eventually be released as technical change lowers the total resources needed to produce domestic rice requirements." (Cristina David, Economist, International Rice Research Institute)

- " Upland development should be part of an overall integrated rural development program to pull people away from the fragile uplands to the more ecologically stable lowland areas." (Percy Sajise, Institute of Environmental Science and Management, University of the Philippines)
- " Fishing usually is not a full-time activity and fishermen and family members supplement their meager fishing income with other income-generating activities. Programs to encourage alternative income sources are therefore important. Policies must recognize the totality of the environment of the fishermen and the complementarity between fishing and other aspects of this environment, including agriculture and other non-fishing activities. Unless there is some unexploited resource deeper or further offshore that becomes accessible . . . the solution to poverty in the fishery sector should be found outside fisheries." (Aida Resources Research and Development)

On the population front, it has been argued that pills and condoms are not the solution; increased productivity and employment, are. If we are going to achieve sustainable development, "the buck must stop here." Every sector must be mindful of what their respective technologies and policies can do to other sectors. For the first time, concepts like systems, holistic approach, integrated development have acquired a very practical meaning for our everyday life. They are not concepts "made in heaven."

SUSTAINABLE DEVELOPMENT IN SEARCH OF "HEROES"

This paper has cited scenarios in other countries because as a people we are so prone to thinking the worst of ourselves that it leads to self-fulfilling prophecies. As National Scientist Umali asked the U.P. graduating class of 1990: "Be the heroes we never were -- and live." But are there really no role-models for the young to emulate? The winning poster on Environment Day at UPLB reads: "Ngayon ang Bukas." (Today is tomorrow). Although policies and actions to protect future generations are an ethical imperative, we cannot escape the consequent question: "What force will represent the future in the present?"⁵⁷

It is in trying to answer this question that I have turned to the science community. Being a nobody who thrives on the heroism of others, it was not difficult to find what I was looking for. Let me name a few of the heroes from the science community who have been working on problems of sustainable development long before the subject became "sexy". This is by no means an exhaustive list for it is intended to be illustrative.

Since rice is our lifeblood, we cannot escape P. Escuro's good eating-quality lowland rice and three upland varieties, all of which have been around for 15 to 20 years. More than that, he has espoused a very concrete approach to making rice seeds available at the local level throughout the country. J. V. Pancho and C. Baltazar have devoted their lives to taxonomic work in plants and insects, respectively, not infrequently spending their own money. With the current concern about maintaining biodiversity, taxonomy moves up front. Otherwise, how can we tell what is happening to biodiversity? D. Rabor was a wild life enthusiast ahead of his time.

Field-based ecosystem studies were pursued seriously more than 15 years ago with the Upland Hydroecology Program. Now, we can point to research leaders such as: P. Sajise and associates in forest ecosystems; C. Barril and M. Zafaralla in Laguna Lake; E. Gomez in coral reefs; P. Zamora in mangroves; M. Fortes in seagrass, and R. Baldevarona in aquaculture ecosystem studies. For more than a decade there has been an Upland Development Working Group while A. Revilla, Jr. and the Forestry Development Center were doing forest policy and planning exercises. Integrated Social Forestry also emerged at that time. Without the outputs from all these undertakings, the Philippine Strategy for Sustainable Development will have had to start from scratch.

At this point, we should stop thinking of basic research as work destined for the shelves. Our ecosystem experts wish those shelves carried more baseline information on how nature functions so we could have a sound ecological basis for managing our natural resources. If the Sahel has shown resilience evidenced by bumper crops in 1989,⁵⁸ could we expect a similar phenomenon?

Biological control of pests has been the research thrust of R. Davide, A. Barrion, A. Alfiler and associates. C. Adalla and M. Hoque et al. are trying to make Integrated Pest Management (IPM) more implementable and acceptable to farmers. After years of calendar spraying and M-99 chemicals, there is much unlearning to do on the part of farmers. In the meantime,

A. Rola is examining the economics of pesticide misuse. T. Quimio's mushrooms provide additional household income while using available substrates at the farm. F. Rivera reminds us that hand-watering agriculture remains a very significant sector outside the mainstream of irrigation.

IPB's varietal improvement program including R. Maghirang's work on indigenous vegetables and the tissue culture of many crops demonstrates what science can do to multiply planting materials.

In agroforestry, mycorrhizal tablets produced by R. de la Cruz et al. have increased survival of inoculated trees in adverse sites of marginal fertility. V. Cuevas through the *Trichoderma* fungus compost activator shortened the composting process from more than four months to only three to five weeks. E. Paterno's group has been developing rhizobium inoculation and fertilizer applications to maximize yields of food legumes following paddy rice and planted in acidic upland soils.

Farmer-participation in upland farming systems research and development has been tried with promising results in several places including Visayas State College of Agriculture (VISCA), Department of Agriculture, Region VIII, Bukidnon, Benguet, Central Visayas, Camarines Sur, etc. Dozens of studies on farm and household systems provide clues on how the livelihood systems of resource-poor households are sustained in location-specific circumstances. T. Paris has shown that taking women into account makes a difference in technology generation and adoption.

Land tenure-related researches conducted by V. Miralao, R. de los Reyes, A. Quisumbing, L. Adriano, V. Lopez-Gonzaga, etc. show that there's more to agrarian reform than Comprehensive Agrarian Reform Program (CARP). Poverty and inequality were the passionate concerns of Mahar Mangahas as he insisted that the nation must adopt specific target reductions in both. The Agricultural Policy Working Group prepared the greenbook for the Department of Agriculture. With courage and competence, the UP School of Economics staff produced the "white paper" on the Philippine economy toward the end of the previous regime and have also done, together with the Philippine Institute for Development Studies, an assessment of the performance of the Aquino government in selected policy areas including external debt management and natural resource and environmental management. M. de los Angeles has been a leading light in the latter's for many years now.

Incidentally, our Filipino economists are as good as we can find anywhere in the world.

The Food and Nutrition Research Institute (FNRI) has persistently kept track of nutritional status even if at times there had been "pressure" to instantly "eliminate" malnutrition. For three decades the UP Population Institute has endeavored to keep the population problem in the national agenda despite attempts by powerful sectors to wash it away.

In the health-agriculture field, schistosomiasis has been a major research interest of E. Garcia, E. O. Domingo, B. Blas *et al.*, W. Tiu, etc. N. Salazar's analysis of the malaria situation in the country tells us that malaria is not yet through with us. M. Dayrit's field epidemiology and surveillance activities plus his leadership in community health beyond medicine represent the new breed of doctors.

For more than 20 years, the Philippine Business for Social Progress (PBSP) has applied the social development approach in reaching low-income groups through grass roots organizations which have helped in giving the poor, an identity, a name, and an address. Because evaluative research is built into their projects, many lessons have been learned from the process. Their staff and trainees have spread far and wide in their practice of social development. The Institute of Philippine Culture (IPC) has empirically demonstrated the value of the participatory approach. All these research-based experiences are terribly important because we are pinning our hopes on community-based local approaches to sustainable development.

Finally, the most enduring symbol of the Philippine countryside, the carabao, which has been reported to be degenerating in both number and size is on its way back to its majestic place. Scientists in the Philippine Carabao Research and Development Center (PCRDC) have broken through the "silent heat," and have upgraded the "natives" into bigger and heavier animals; and produced more than 5,000 caracalves for breeding purposes.

Let me conclude by saying that the science community has nothing to apologize for. It has achieved far and beyond the support it has received from government. What is missing is a galvanizing force which will unite the best of the Filipino in us toward a "Common Present." The science community has the continuing obligation to provide the empirical and knowledge base for our faith in "Our Common Future." This could also be our best contribution to the integrity and responsiveness of our political system.

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