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SOME PROMISING/USABLE FARMING SYSTEMS TECHNOLOGIES FOR THE RAINFED AREAS IN ILOCOS REGION[1]

by

AMADO R. MAGLINAO and CARLOS J. ANDAM[2]

INTRODUCTION

The updated Philippine Development Plan for 1984-1987 stipulates that regional development will be pursued based on the balanced agro-industrial development strategy. This means that our efforts will be directed towards modernizing agriculture to increase its productivity while at the same time encouraging agro-based small and medium industries. While it is true that the Ilocos Region in particular has attained self-sufficiency in rice and vegetable, it is still difficient in other basic food commodities. And in as much as the region is known to possess a relatively limited supply of prime agricultural lands, the thrust of agricultural activities to complementarily or fully support the balanced agro-industrial development strategy therefore should be directed towards increasing production through the application of improved and progressive farming systems technologies. This has been known to be the better if not the best approach to increase productivity. It does not only addresses farm-level problems by focusing on improving production but also issues of sustainability and conservation of available resources. Hence, the present report revolves around available farming systems technologies that we feel are applicable in the region. Equally important that we indicated in this paper are technologies supportive to a productive farming systems.

AN OVERVIEW OF ILOCOS REGION

The Ilocos Region is composed of 7 provinces, namely: Ilocos Norte, Ilocos Sur, Abra, Benguet, La Union, Pangasinan, and Mountain Prov-

[1] Paper presented during the Rainfed Resources Development Project (RRDP) regional consultation workshop meeting on April 18-20, 1985 at the Long Beach Resort, Bauang, La Union.

[2] Director and Senior Science Research Specialist, respectively, Farm Resources and Systems Research Department, PCARRD, Los Baños, Laguna.

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ince. The total land area is 2,160,000 ha. with only 6.3% arable. About 50% of its agricultural lands is under rainfed condition.

The Ilocos plain is a narrow coastal strip, not wider than 20 km in most parts, occupying much of the provinces of La Union and Ilocos Sur and part of Ilocos Norte. Raised coral and alluvia covering old sediment compose most of the plain. San Manuel and San Fernando are the commonly found soil series in the region. The former is considered the best agricultural soil in the country because of its adaptibility to a wide range of crops. The latter is deep fine textured, fairly fertile, and heavier than San Manuel. The principal problems in these series are excessive run-off and soil erosion.

With the exception of the Mt. Province whose temperature is much cooler than the rest of the country, the regional climate is relatively mild. Generally, the climate of the region is of the first type, that is, with two pronounced seasons; dry from November to April and wet during the rest of the year.

Notwithstanding the relative scarcity of suitable land for cultivation, Northwestern Luzon is primarily an agricultural region. Rice is the leading cash crop. The region produces most of the Virginia tobacco leaf in the country. The specialized climate of the Mt. Province and Benguet allows for the growing of many varieties of mid-latitude vegetables which account for most of the regions export earnings. Livestock raising is scattered in the hills and valleys of Abra.

Generally, the Ilocos provinces have a very profitable pattern of rice-garlic and tobacco in areas with supplementary irrigation. Because the water requirement of the two upland crops is lower, and the economic returns are higher than rice, a rice-rice-upland crop or rice-rice-dry fallow will not be very attractive to farmers.

THE FARMING SYSTEMS TECHNOLOGIES

A. Rainfed Lowland Rice-based Farming Systems

Cropping intensity in the rainfed lowland rice-based farms where usually only a single crop of rice is grown throughout the year can be done through the KABSAKA Technology. Developed in Iloilo, KABSAKA is an acronym for an Ilongo phrase "Kabusugan sa kaumahan" or abundance in the farm. This technology actually refers to the growing of 2 crops of rice during the wet season plus an upland crop like mungo, peanut, cowpea, corn or sorghum after the second rice crop to make use of the residual moisture in the soil. This is made possible with suitable early maturing crop varieties and the manipulation or adjustments of cultural operations like zero or minimum tillage, direct seeding or broadcasting and timely application of pre-emergence herbicide for effective weed control.

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Melons, watermelons or onions are planted after rice towards the end of the wet season in other parts of Luzon and these may be tried in the region. Similarly, the present practice of growing tobacco, garlic or cotton followed by corn or legume could also be expanded in other rainfed areas with only one rice cropping per year. Intercropping corn and tobacco with short season crops to further boost farm productivity will be discussed in the succeeding section.

B. Upland Crop-based Farming Systems

1. *Tobacco intercropping system.* The Ilocos region is known for its aromatic type of tobacco. Since its introduction into the country, tobacco had been grown in monoculture system largely because of the very favorable price of its cured leaves in previous years. However, things had started to change in recent years when the price started to deteriorate making its production uneconomic for the farmers. With the creation of the Philippine Tobacco Research and Training Center (PTRTC) at Batac, Ilocos Norte, farming systems research was initiated and envisioned to accelerate the development of the industry including the tobacco farmers.

In Ilocos Norte, farms are predominantly tenanted and the average area planted to tobacco is 0.68 ha. Farmers usually employ the tobacco-rice-tobacco cropping pattern in the lowland areas and the tobacco-corn-tobacco sequence in the upland farms. Other than these systems, the following are the technological developments in increasing the income of the tobacco farmers.

a. *Intercropping with leguminous crops.* Mungo, peanut, soybean, cowpea, bush sitao and indigo have been tried as intercrops of either Virginia or Burley tobacco farms with encouraging results. Though there are instances that the experiments indicated reduction in the yield of tobacco, generally intercropping leguminous crops provided greater net returns as compared to net returns from tobacco monoculture. Here are some of the specific findings: (1) Yield of soybean intercropped with North Caroline Bright Yellow tobacco compensated for the reduction in yield of tobacco; (2) Soybean intercropped within the rows of tobacco and application of 300 kg 6-9-15 fertilizer/ha produced the best results; (3) Intercropping peanut did not produce differences in tobacco height and number of harvestable leaves/plant, however, with 300 kg urea, the system produced the most number of harvestable leaves; (4) Intercropping with peanut had the heaviest weight of fresh leaves or cured leaves; (5) Best time of intercropping is 2 weeks from tobacco planting; (6) Tobacco and mungbean intercropping at 7 days after transplanting

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(DAT) gave the highest net returns and the greatest volume of quality (Class A = 43.5%) leaf tobacco; (7) Tobacco significantly produced heavier leaves when intercropped with mungbean between rows than with mungbean between hills. however, grades of tobacco were not affected by any of the two systems; (8) Tobacco + indigo ranked next to monoculture tobacco in terms of tobacco yield but the intercrop did not affect the grade index of flue-cured leaves; (9) Intercropping mungbean with Burley tobacco followed by intercropping with soybean outperformed monoculture tobacco in terms of yield; and finally (10) Intercropping any legumes (cowpea, mungo and peanut) resulted in higher net return.

b. *Intercropping with cucurbits.* Squash, watermelon, cantaloupe, dishrag gourd and bitter gourd were tried as intercrops with tobacco but the results were not all successful. Nevertheless, some of these cucurbits may have potentials as intercrops considering the following spceific findings in the region: (1) Tobacco + dishrag gourd or cantaloupe intercropping systems obtained higher net returns compared to the tobacco monoculture system; (2) Tobacco + cucurbit intercropping systems did not significantly affect plant height at the first priming, number of harvestable leaves per plant, cured yield and quality index of tobacco.

c. *Intercropping with bulb crops.* Trials have been conducted to intercrop garlic with tobacco with very promising results to wit: (1) Early transplanted Virginia tobacco and relay cropped with garlic exhibited better agronomic characters, yield and quality of flue cured tobacco compared with late transplanted ones; (2) Plant height and economic yield increased when tobacco was intercropped with garlic; (3) The system is advantageous for weed control; and (4) It induced deeper root formation in tobacco.

2. *Multiple cropping with vegetables.* While it is true that in early years, multiple cropping was used in diversifying agricultural production to satisfy the needs of subsistence farming, recent research findings have proven its potential for increasing farm productivity and consequently income among market oriented farms. For instance, it has been reported that in Hongkong and Vietnam, as many as 9 crops per year were raised by vegetable farmers.

It has been reported in 1963 that even roses were intercropped with vegetables like cabbage, cauliflower, celery, mustard and green peas in a 3-ha farm in Baguio City. The advantages derive from the system aside from the additional income are: (a) roses serve as windbreaks for the succulent vegetables;

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(2) soil erosion and weed growth are checked; (3) excess water and plant food are profitably used by the intercrops; and (4) chemical spraying of the roses also protects the vegetables from insect pests.

In a dissertation of an MSAC faculty member at UPLB, it has been found out that intercroppring experiments of tomato and green onion, in contrast with cabbage produced more in the dry season than in the rainy season in the lowland area. Moreover, cabbage was not favored by the presence of tomato and the 3-crop system on both seasons. On the other hand, the 3-crop system favored tomato during the rainy season, in both lowland and highland areas. During the dry season, cabbage, tomato and bush sitao produced more than during the rainy season while green onion had the same yield in both seasons.

Although slightly infested with pests, tomato planted after white potato produced the highest mean of 29.04 kg/ha. This is followed by tomatoes planted after cucumber and after Chinese cabbage.

Cabbage may be best planted after cabbage, Chinese cabbage, sweet pepper, white potato and cucumber. Cabbage planted after cabbage gave the highest mean yield amounting to 19.91 t/ha. On the other hand, the best crop to rotate with cabbage, white potato and cucumber would be carrot. Planted after cabbage, carrot yielded the highest mean weight of 30.20 t/ha. This is followed by carrot planted after white potato and after cucumber.

Chinese cabbage rotated after cucumber and bush bean gave the highest mean yield amounting to 15.88 and 15.13 t/ha, respectively. Next to this are those planted after tomato and after white potato.

Bush bean planted after bush bean, sweet pepper, Chinese cabbage and carrot produced remarkable yields compared to bush bean after white potato.

In 1982, a Benguet Technoguide recommends vegetable cropping systems for potato production such as successive planting/crop rotation and intercropping. The former system considers the following:

1. Corn rotated with potato lessens the occurrence of soil-borne pests and diseases. Cereals also develop deep roots that improve soil friability and aeration. Corn can be profitably rotated with potato in the Loo Valley, La Trinidad, and Bauko, Mt. Province.
2. Legumes like bush beans and sweet peas should be grown considering their market value, ability to retain soil fertility and ease of culture at low input cost. The foliage decomposes quickly, making it also ideal for green manuring.

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Cauliflower, broccoli, lettuce and carrot are good rotation crops for potato. Table 1 shows the cropping pattern and calendar adopted by many Benguet farmers.

On the other hand, intercropping potato with lettuce, green onion, celery, and carrot revealed that extra tubers are most likely the outcomes of intercroppign with green onions alone. Potato can also be intercropped with corn, bush beans, sweet peas and cabbage.

TABLE 1. SUGGESTED CROPPING PATTERN AND PLANTING CALENDAR BENGUET*

First Crop March-April	*Second Crop September-November*	*Third Crop December-January*
Potato	Potato	Potato
Potato	Cabbage	Other vegetable crops
Potato	Other vegetable crops	Potato
Cabbage	Cabbage	Potato
Cabbage	Potato	Other vegetable crops
Cabbage	Other vegetable crops	Cabbage

* From the Benguet Technoguide for Potato.

3. *Corn-based cropping systems.* Intensive cropping is one way of bolstering the productivity of the corn-based farms. It does not only give the farmer added income but also provides him with feeds for his animals and protects his main crop from certain pests and diseases. Aside from these benefits, it also improves the productivity of the soil and permits a more economical management of the land. In addition, it could somehow alleviate scarcity in food supply by providing a wider variety of food products with a greater marketing potential.

Leguminous crops such as mungo, peanut and soybean have been tried as intercrops by the Don Mariano Marcos Memorial State College (DMMMSC) and found out not to affect the yield of the main crop. The corn + peanut intercropping system produced the highest net profit. In a separate report, the combined yields of the intercrop are usually 25-50% more than the monoculture of either corn or mungo. Despite the reduction in the individual yields of both corn and mungo when intercropped, the combined yield from the two crops in the system gives the farmer higher income per hectare.

The UPLB technology on relay cropping may also be adopted in the region considering the importance they attached to vegetables (as relay crops). The system involves the relay planting of eggplant, okra, tomato, sweet potato, melons, squash, cowpea, bush sitao, bush patani and vegetable soybean as early as 30-40 days before corn harvest do not affect the yield of corn. However, the yield of eggplant and okra are higher when relay planted 30 days before harvest; sweet potato, tomato and squash, 20 days while cowpea and bush sitao, 10 days before harvest.

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4. *Cotton intercropping system.* Unless new arable lands are opened which is impossible considering the limited supply of prime agricultural land in the region 1 expansion of the production of cotton by increasing the physical land area alone would decrease the area devoted to other crops particularly upland crops. To avoid this, the cotton intercropping technology developed by the Cotton Research and Development Institute (CRDI) should be integrated into the normal farming activities of the production system of cotton.

   Intercropping with mungbean, peanut and soybean produced higher yields compared to cotton monoculture. A planting scheme of 1:1 row proved convenient for this type of intercropping system.

C. Hillyland Farming Systems

Any farming systems development in the hilly areas should consider soil erosion — the most pressing environmental problem of the country. Six provinces of the region are identified with more than half the areas eroded (Table 2). Specifically, there are 676,000 ha of hillyland in the region that are susceptible to erosion. Because of their natural rough terrain that makes them sensitive to erosion if cultivated intensively, it is imperative that the farming systems be oriented towards soil management and conservation of the land resources.

There is no definite pattern of cropping system in the hilly areas of the region after the kaingin except planting of sweet potato or corn with banana planted along farm boundaries. In most cases, the kaingin is followed by sitao bean, mungo, and sweet potato in the wet season. After the kaingin, the semi-temperate vegetables like potato, cabbage, beans and sometimes sweet potato are planted in the terraced mountain slopes of Benguet and Mountain Province.

Essentially, there are at least three minimum requirements that a farming systems must satisfy in order to be considered acceptable for small farmers in hilly areas. These include: (1) must conserve the soil; (2) must not require substantial investment: and (3) must produce soon after initiation. With these, the following can be tried in the region 1.

TABLE 2. EXTENT OF SOIL EROSION IN REGION 1.*

PROVINCE	AREA ERODED	
	AREA (HA.)	% OF PROVINCE
Ilocos Sur	198,225	73.8
La Union	96,565	70.3
Abra	248,102	65.1
Ilocos Norte	158,196	46.7
Pangasinan	241,667	46.2
Mountain Province	600,731	42.5

* National Environmental Protection Council.

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1. *Corn and ipil-ipil farming systems for hilly areas.* This is a low cost production technology whereby the ipil-ipil is utilized as source of fertilizer. All that is involved is planting the ipil-ipil along the contour line cutting them every 45-60 days so that the leaves falling on the ground will provide nutrients to the growing corn plant, which depletes soil nutrients faster than many crops.

2. *Agro-forestry.* This is a new name for an old practice of land management system. It addresses farm-level problems by focusing on improving agricultural production coupled with sustainability and conservation of available land, water, natural vegetation and wildlife by focusing on the forest tree components of land-use systems. Actually, it complements and assists efforts of increasing agricultural productivity by providing unique additional benefits in the form of long-term rational management of the limited available resources.

   Probably the most developed land management system is the Ifugao's agroecosystem in the Cordillera mountain range of the north. While agroforestry was coined just within the last decade, this system has been time-tested for centuries for its stability. The Ifugao system is not just terraces. As Sharon L Codamon of the Forest Research Institute and a member of the tribe and who made a documentation about this system puts it "the entire mountainous region is practically a scenario of hydraulic and agronomic performance, a highly arranged set-up developed primarily out of sheer necessity". Indeed, there is no doubt about the system's stability and we wonder how we could duplicate this in other places.

D. Integrated Crop-Animal Farming System

Integration of animals to crop farming has been practiced in the Philippines for quite a long time already. The state-of-the-art on farming systems research shows that it is not unusual to find a traditional farmer in the country who raises, besides the main crop, some vegetables or fruit trees, a few chickens or ducks, and 2 or 3 pigs, goats or other ruminants altogether in his piece of land and keeps wild fish trapped in rice paddies for family consumption. While the traditional farmer may be contented with what he produces for subsistence and a little added income, the more progressive ones have diversified and expanded their operations to increase their profits.

The "CLSU Farm of the Future" is a recent innovation in multi-commodity farming systems. Actually, this was conceived and materialized by a farmer, Mr. Francisco Carbonel, who has 11 children from Muñoz, Nueva Ecija. He proved the profitability of

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using a one-hectare farm in the production of rice, fish, edible snails, vegetables, fruits, aquatic and semi-aquatic plants, poultry and livestocks. To fully document and demonstrate the farmer's feat, CLSU hired him to help develop a similar pilot farm in the university. Though capital intensive, this type of farming has been considered to suit the common farmer who either own or lease 1-2 ha of land.

Another system that is found viable is the UPLB model on multi-commodity recycyling systems. The system not only produces pork, rice, vegetables, fish and biogas, but also pig and fish feeds as well as vegetable fertilizer from chlorella, a high protein algae.

On a commercial scale, the Maya Farms' integrated crop-livestock-meat processing system is an outstanding success in waste recycling. The recycling of pig manure and other farm waste for its energy requirement completely made the farm independent from the Meralco supply. The farm produces bacon, meatloaf, sausage, corned beef, duck ham, soup, and other meat products. Besides, the processed sludge is used as feed ingredient and fertilizer for its swine and crops and fishpond sub-systems, respectively.

OTHER TECHNOLOGIES SUPPORTIVE OF FARMING SYSTEMS

There are other technologies that may be adopted in the region to enhance the development of the present farming systems to a more progressive one. These include indigenous fertilizer sources, farm machineries or implements and source of irrigation water.

A. Indigenous fertilizer sources

1. *Rhizobial inoculation.* This is the process of applying sufficient rhizobial bacteria on the seeds' surface to initiate root nodule formation in legumes. Under field conditions, inoculation of soybeans with the appropriate strain of *Rhizobium japonicum* could increase the yield by 19-683% depending on soil type. This is useful as a substitute for nitrogen fertilization equivalent to 30 kg N/ha. Likewise, inoculation of mungo could substitute for fertilization equivalent to 30 kg N/ha. In peanut, it could increase yield by 71-387 kg/ha or an average of 159%.
2. *Algalization.* Application of *Glocotrichia* — a blue-green algae at the rate of 123 kg/ha in lowland rice paddies during the wet season increases grain yield by as much as 19%. This is the most effective nitrogen fixer in lowland rice culture. It is also a good feed, supplement for fish culture. In rice-fish culture, however, it affects fish yield but not that of rice. The increase in fish yield is about 40%.
3. *Use of Compost.* Probably, this is the oldest technology ever known to exist as a substitute for inorganic fertilizer. We

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should take a second look on its value considering that agricultural wastes are bountiful in the country.

4. *Guano and phosphate rock deposits.* In 1976, the Bureau of Mines identified the region to have some deposits of guano and phosphate rock particularly in the provinces of Pangasinan and Ilocos Norte. These should be explored as these are excellent sources of plant nutrients.

B. Farm Machineries/Implements or Equipment

Except for the Philippine Tobacco Research and Training Center (PTRTC) and the Cotton Research and Development Institute (CRDI), no other agency is assigned in the region to develop agricultural engineering technologies. However, we have not received report on any farm machinery technology developed by them that is ready for dissemination. The following implements with simple design, low cost and for small scale operation are developed either by the Bureau of Plant Industry Central Office and the Philippine Root Crops Research and Training Center (PRCRTC) and which we feel to be usable in the region:

1. *Animal-drawn potato planter.* This is a single-row planter mounted to an animal drawn plow. It has a field capacity of 0.25 ha/day. This can totally replace the back-breaking hand-dropping method of planting seed potato. It is best suited to low and medium elevations where the growing areas are, more or less flat.
2. *Seed and fertilizer applicator.* This is a single application, animal-drawn seeder with a capacity of about 0.25 ha/day. It makes a furrow and applies fertilizer and seeds and covers the seeds.
3. *Rolling Injection Planter (RIP).* Operated by one person, it has a capacity of 6,000-16,000 hills/ha with a row spacing of 18 or 25 cm. It is designed for seeding in zero tillage.
4. *Multi-purpose plow with replaceable bottom.* It can be used in level and rolling land under lowland and upland conditions. The average field capacity is about ¼ ha/day in level and and slightly lower in rolling land. Harvesting sweet potato using this plow is five times faster than with the use of bolo.
5. *Tooth harrow.* This can be used for lowland and upland conditions. Field capacity is 0.8-1.3 ha/day without extension teeth and 1.5-1.8 ha/day with extension teeth.
6. *Weeding tools.* Six weeding tools were developed recently which includes the following: Z-blade push/pull weeder, plane blade push/pull weeder, scraping hoe, sharp-crested weeder, dentate weeder and serrate weeder. All are easy to operate and it is possible to weed the plants while standing.

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7. *Hand wheel cultivator.* The wheel in the front of the frame increases its mobility. With this, the operator can cultivate the field in a standing manner. It can be used in making small furrows for peanut production and even for planting sweet potato. Field capacity averaged 1/5 ha/day at an average walking speed.

8. *Off-barring plow.* The share and the moldboard are mounted facing each other to allow the plowed soil to converge in the center thereby covering the weeds growing in the furrow. It has an average weight of 19 kg.

9. *Single wheel fertilizer/corn seeder.* It is best used for pre-planting application of fertilizer. It is convertible to function as a corn seeder by simply changing its metering device.

10. *Cutter/rake.* Use for cutting and rolling sweet potato vines to the sides of the field before the sweet potato harvester/digger, an attachment of PRCRTC plow, can be used in digging the tubers.

There are also a number of improved hand tools and other labor saving devices developed by BPI. Among these implements are variations of hoe, weeder, furrower, hiller, trowel, sickle, grass cutter, and hay lifting fork.

C. Small Water Impounding

The premier small water impounding project (SWIP) in Bohol is considered a success considering that it dramatically increased production in its service areas. For instance, the average harvest of rice without the use of the technology was 50 cav/ha/yr. With SWIP, yield increased to 180 cav/ha/yr. Big landowners with greater financial capability for improved management, obtained yield as high as 270 cav/ha/yr.

In 1980, the Bureau of Soils had proposed the construction of a small water impounding project in the region particularly in Cabatiw, Sarrat, Ilocos Norte.

CONCLUDING REMARKS

Adopting the balanced agro-industrial development strategy for regional development is anchored on a strong agricultural foundation. Indeed, this would'nt proceed without the provision or satisfaction of its agricultural requirements. For the region to have a sustainable agricultural supply, it is imperative to fully develop the present farming systems to a much more progressive one since increasing productivity through area expension is not reasonable because of the finiteness of the region's agricultural lands.

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GEOGRAPHY IN THE PHILIPPINES AND IN THE UNITED STATES: SOME PARALLEL DEVELOPMENT PATTERNS, CURRENT LINKAGES, AND FUTURE PROSPECTS

by

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INTRODUCTION

The discipline of geography, often referred to as "the mother of sciences," has developed distinct national patterns and expressions reflecting the interests, training, and values of its leading practitioners. Given the historically close educational relationship between the Philippines and the United States, it is appropriate to contemplate some of the similarities and linkages in the past and present development of geography in the two nations and to consider alternative growth strategies to meet the anticipated increased demand for geographic education in the future.

GEOGRAPHY FROM ANTIQUITY THROUGH THE AGE OF EXPLORATION

The term "geography", among the early Greek scholars, meant the description or study of the earth. The scope of geographic inquiry was thus literally unlimited. The earth's features can be divided into two general categories, physical and cultural. Physical components include weather, climate, soils, landforms, water bodies, and animal and plant life. Culture manifests itself in economic activities, settlement patterns, political and belief systems, and racial and linguistic patterns. One cannot study the physical and cultural features of the earth in any depth. however, without soon coming to the realization that each influences the other. Geography therefore addressed itself to the interrelationships between the physical and cultural realms. It was this holistic perspective that distinguished geography from other disciplines which tended to

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specialize in the study of just one of the earth's cultural or physical aspects.

A second distinguishing characteristic of geography was its spatial perspective. After early man had learned what he could of his local environment, he instinctively felt a desire to explore and observe conditions in other regions, both near and far, and to compare those conditions with those with which he was already familiar. Was the distant land hotter or colder? Were its mountains and rivers larger or longer? How did the foreign peoples differ in their livelihood, diet, language, dress, political and religious systems? The question of space or location became central to geographic inquiry. The tool utilized by geographers to portray spatial relationships, be they physical or cultural, was the map. Geography thus focused from its very beginnings on the spatial analysis and portrayal of the earth's features and the study of their interrelationships.

This regional analysis tended to be primarily descriptive and was often content with the development of seemingly endless inventories and lists, such as the names of all the countries or provinces of an area, of their capital cities, of the highest mountains and most important rivers, of the leading agricultural and mineral products, and of the major cities. Geography was understandably regarded until recently by many educators as a useful but simplistic subject best suited to the liberal education of elementary and perhaps secondary students but not deserving of a place among the rigorous scientific disciplines of higher education. Unfortunately, this form of geographic instruction, where the rote memorization of countless facts is substituted by largely untrained teachers for the selective incorporation of those facts into the meaningful analysis of relevant issues based on geographic principles and concepts, continues to characterize to a considerable degree geographic education throughout the world.

GEOGRAPHY IN THE MODERN PERIOD

The emergence of geography as a respected member of the scientific community has been characterized by many parallel developments in the United States and in the Philippines.

Initial Association with and Subsequent Separation from Allied Disciplines

In 1900, there were only three professors of geography in American universities: William Morris Davis at Harvard, Ralph S. Tarr at Cornell, and William Libbey, Jr. at Princeton.[2] There were, of course, many teachers' or normal colleges around the country that offered courses in geography, but the majority of the instructors had no formal training in the discipline. The first department of geography in the United States

[2] Preston E. James and Geoffrey J. Martin, *All Possible Worlds: A History of Geographical Ideas*, 2nd ed. (New York: John Wiley and Sons, 1981), p. 294.

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was founded at the University of Chicago in 1903, and it was in the following year that the first scholarly, research-oriented professional organization, the Association of American Geographers (AAG), was established. A brief review of these developments both illustrates how modern American geography was born and clarifies some of the growth issues currently facing geography in the Philippines.

Davis graduated with the Master of Engineering degree in 1870 and left shortly thereafter for Cordoba, Argentina, where he was employed for three years as an assistant at the National Meteorological Observatory.[3] He then returned to Harvard for further study. Although keenly interested by then in meteorology, climatology, and geomorphology — all branches of physical geography — there was at Harvard no designated professor of geography. So Davis did the next-best thing and took a master's degree in geology under Nathaniel S. Shaler. Shaler was interested not only in landforms but also in the utilization of the earth's resources by man. His professional interests were such that he has been described as "a geologist by training but a geographer by instinct."[4] Davis, in turn, came to favor increasingly the holistic, geographical approach and in 1878 was appointed instructor in physical geography within the Harvard geology department. In 1885 he was promoted to assistant professor of geography and finally, in 1899, was appointed Sturgis Hooper Professor of Geology, which chair he occupied until his retirement in 1912.[5] Thus, while recognized as one of the founding and leading geographers of his age, Davis operated out of the geology department throughout his entire career.

A second important strand in the development of American geography was the establishment of the first department of geography at the University of Chicago. Here, again, geography evolved out of geology. When the University of Chicago was founded in 1891 under the generous financial support of John D. Rockefeller, it immediately was perceived to be a most prestigious institution. Of the 103 original faculty members, eight were former university presidents. One of those eight was Thomas C. Chamberlin who resigned the presidency of the University of Wisconsin in order to accept an appointment as chairman of the department of geology at Chicago. Chamberlin brought with him Rollin D. Salisbury, a colleague from Wisconsin. Salisbury's initial appointment at Chicago was a "professor of geographic geology."[6] In 1903, Salisbury was asked to organize the first department of geography in the country and quickly assembled a distinguished faculty of other geographically-inclined scholars. Other departments of geography were soon established at leading educational institutions throughout the country and the new discipline began to prosper.

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[3] *Ibid.*, pp. 281-282.
[4] *Ibid.*, p. 282.
[5] *Ibid.*, pp. 281-282.
[6] *Ibid.*, pp. 310-311.

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Geography in the Philippines also had its origins in the allied disciplines of the sister sciences. Geography was taught at the University of the Philippines (UP) as early as the 1920s through the College of Education. It was later transferred to the then College of Liberal Arts and made a program within the newly created Department of Geology.[7]

As in America, the earliest leaders among the practicing geographers in the Philippines were geographers by instinct but not by training. Dominador Z. Rosell, one of geography's early pioneers, was trained in agriculture at the University of the Philippines, Los Baños, with a focus on soil technology and later received a second bachelors degree from the University of the Philippines, Manila, in geography and geology. He spent much of his subsequent career in government service as a soil scientist and administrator and developed through the years a strong interest in environmental, conservation, and agricultural geography.[8]

Dr. Domingo C. Salita, another past and present leader within Philippine Geography, followed an educational path parallel in many respects to Davis, receiving bachelors degrees in engineering and following up with a masters degree in geography and geology and a doctorate in economics with a heavy geographical content. He later served for many years as professor and chairman of the Department of Geology before becoming Dean of the College of Arts and Sciences and Assistant to the President, University of the Philippines.[9]

It is important to note that it was after the initial geographers in the Philippines had joined the discipline by what might be termed "adoption" that the current generation of geographers obtained advanced degrees almost exclusively in geography. Furthermore, it was only long after this second generation of faculty established careers at the University of the Philippines that a separate geography department was finally established in 1983 within the College of Social Sciences and Philosophy. It was two years later that the department achieved separate physical quarters in Palma Hall. Heading these efforts has been Dr. Telesforo W. Luna, Jr., who obtained his Ph.D. in economic and urban geography from Clark University in 1957 and undertook postdoctoral studies in geography at the University of Pennsylvania from 1964-1965.[10]

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[7] Richard Ulack, "Geography in the Philippines," *Philippine Geographical Journal* 27 (July-December, 1983), p. 151; Domingo C. Salita, "The Development of Geography as a Discipline at the University of the Philippines," paper presented at the First National Conference on Geographic Education and Research in the Philippines, Diliman, Quezon City, 10-12 July 1985.

[8] Dominador Z. Rosell, personal communication, June, 1985. See also Feliciano M. Lapid, Dorotea M. Corpuz, and Manuel P. Poliquit, "Members Forum," *Philippine Geographical Journal* 26 (October-December 1982), pp. 191-192; and "Fellows: Philippine Geographical Society," *Philippine Geographical Journal* 25 (January-March 1981), pp. 26-27.

[9] Domingo C. Salita, personal communication, June, 1985.

[10] Telesforo W. Luna, Jr., personal communication, June, 1985.

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Elitist-Populist Schisms

No sooner did professional geography begin to establish itself in America than there arose a great division among those who wanted to popularize geography in order to expand its influence and those who felt that the interests of the discipline would be best served by restricting membership to a limited number of selected academics with advanced degrees and extensive scholarly publication records. This schism focused around the mission and goals of the National Geographic Society (NGS) which was founded in 1888 and the Association of American Geographers which was organized in 1904.

The National Geographic Society was organized "on a cold winter night at the Cosmos Club in Washington, D.C." Among its 33 founding members were "geographers and mathematicians, teachers, explorers, lawyers, officers, financiers, engineers."[11] Among the early leaders were Gilbert Grosvenor and William Morris Davis. Grosvenor was convinced that geography should be built on a broad popular base if it was to thrive. Davis was just as adamant that membership in the NGS be restricted to the intellectual elites. Frustrated at the direction being taken by the Society, Davis resigned from the board in 1904 and a few weeks later founded the AAG in Philadelphia.

Since that event American geography has, to its own detriment, followed two divergent paths, each bringing its successes and failures. The National Geographic Society publication, **National Geographic**, has far outstripped influence any other geographic medium, inculcating an interest in and a love for geography. The millions of copies distributed monthly throughout the world touch, through beautiful color photographs and interestingly written text, our inherent human interest in our fellow men and in nature. While the effect of **National Geographic** has been to greatly increase the visibility of the discipline, it has unfortunately also contributed to an identity crisis among many of its readers who are led to believe that geography is merely entertaining description, the research for much of which is conducted by anthropologists, zoologists, historians, and others.

For many years following its establishment, the AAG maintained an elitist posture, admitting by invitation only a very limited number of new elected scholars. An open admissions policy was adopted following World War II and has resulted in a greatly expanded membership.[12] The insistence of the AAG on scholarly activities has contributed much to the maintenance of geography as an academic discipline but has done

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[11] Gilbert M. Grosvenor, "The Society and the Discipline," *Journal of Geography* 84 (March-April, 1985), p. 52.

[12] See Preston E. James and Geoffrey J. Martin, *The Association of American Geographers: The First Seventy-Five Years*, 1904-1979 (Washington, D.C.: Association of American Geographers, 1978; also James and Martin, "On AAG History," *The Professional Geographer* 31 (1979), pp. 353-357.

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little to strengthen its public image. Recognition of the many benefits to the discipline that could result from more cooperative endeavors between the AAG and the NGS has resulted recently in increased communciation between the two institutions.[13]

The elitist-populist division has not impacted Philippine geography as much as American owing in part, perhaps, to the smaller membership of the former. What gulf exists, however, appears to manifest itself in the limited interaction between the faculty of the UP Department of Geography and the editorial staff and general membership of the Philippine Geographical Society, which was established in 1950.[14] The department has, as a whole, promoted the strict scholarly standards of academic research and teaching. The Society, on the other hand, while maintaining rigorous publication standards, has reached out to geographers by instinct but not training. It is possible that one of the best options for strengthening the discipline in the future will be to increase the level of interaction and cooperation between the two entities.

Small Student Enrollment and Association Memberships

A third common characteristic of geography in the United States and in the Philippines is the relatively small number of departments of geography, full time faculty, student enrollments, and memberships in scholarly associations. In the United States in 1985-1986, geography courses were offered at 648 institutions of higher learning. Of these, 149 departments offered a masters degree in geography and 53 a doctorate. Those institutions employed 2,304 full-time geography faculty and attracted 464,980 geography student enrollments. Membership in the Association of American Geographers totalled 5,438 (Table 1).

The University of the Philippines, Diliman, is the only institution in the Philippines with a separate department of geography. Geography courses, but not degrees, are offered at thirteen other institutions of higher learning, most of which are found within greater Manila.[15] The only operational graduate degree-granting program is the masteral at the UP. There are only six full-time geography faculty in the country, again all employed at the UP. Total student enrollments in the Philippines

[13] Gilbert M. Grosvenor, president of the National Geographic Society, addressed the topic of increased cooperation between the NGS and the AAG in a speech before the annual convention of the Association of American Geographers held at Washington, D.C., on April 23, 1984. Several joint initiatives between the two institutions are currently under way or under consideration.

[14] See Dorotea M. Corpuz, "Brief Report of the Philippine Geographical Society and the Philippine Geographical Journal," *Philippine Geographical Journal* 29 (October-December, 1982), pp. 188-190.

[15] Other institutions of higher learning which offer regularly one or more courses in geography are: The University of the East, University of Santo Tomas, University of Manila, La Consolacion College, College of Holy Spirit, Far Eastern University, Philippine Women's University, National Teachers' College, Philippine Normal College, Ateneo de Manila University, Maryknoll College, San Sebastian College, and Centro Escolar University.

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average around 1100 annually, with the majority of those at the UP (Table 1).

TABLE 1. NUMERICAL INDICATORS OF THE STRENGTH OF GEOGRAPHY IN THE PHILIPPINES AND IN THE UNITED STATES, 1985-1986

Category	Philippines	United States
Institutions of higher education offering geography courses	14	648
Full time faculty	6	2,304
Geography enrollments	1,082	464,980
Members of the Philippine Geographical Society and the Association of American Geographers	143	5,438
Number of departments offering a Ph.D. in geography	1*	53
Number of departments offering a masters degree in geography	1	149
Total national population (estimated in millions)	56	239

*A Ph.D. program in geography was authorized at the UP, Diliman, in 1953, but is currently not operational owing to insufficient student enrollment.

Sources: Philippine data is from the UP, Diliman, departmental records, the Philippine Geographical Society membership list, and a survey of other institutions offering geography courses.

Data for the United States was compiled from the *Association of American Geographers Newsletter*, Vol. 21, No. 3, March 1, 1986 p. 4; Dale R. Monsebroten, ed. *Schwendeman's Directory of College Geography in the United States* (Richmond Kentucky: Geographical Studies and Research Center, Eastern Kentucky University, 1985); Andrew R. Bond and Salvatore J. Natoli, *1985 AAG Survey of Departments of Geography in the U.S. and Canada* (Washington, D.C.: Association of American Geographers, 1986); and *Guide to Departments of Geography in the United States and Canada 1985-1986* (Washington, D.C.: Association of American Geographers, 1986).

The statistics on geography in the United States appear strong and, indeed, are when compared to those of the Philippines. It must be recognized, however, that geography in America remains considerably smaller than such allied disciplines as geology, biology, history, sociology, and political science. It should also be noted that the low figures for the Philippines tend to obscure the strong performance of the department at the UP which has accomplished a great deal within its budgetary constraints. Overall, it appears that most indicators reflect a modest, consistent growth of geography in both nations. One of the most encouraging indicators in this regard has been the remarkable increase in geography majors at the UP where the number increased from the low-to-mid twenties in 1982 to 75 in 1985.[16] The only negative growth

[16] The 1982 data is from Richard Ulack, "Geography in the Philippines," *The Professional Geographer* 36 (November, 1984), pp. 480-482. The 1985 data was obtained from departmental data for the first semester, 1985-1986, July 1985.

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indicator in Philippine geography has been the recent decline in membership in the Philippine Geographical Society from 224 in 1982 to 143 in 1985.[17]

Geography in the Elementary and Secondary Schools

The place of geography in the elementary and secondary school curricula has developed along broadly similar lines since the American colonial period. Geography was widely taught as a separate subject at both levels throughout the early-to-mid-twentieth century.[18] The 1960s and 1970s brought a deemphasis of traditional subject matter in both Filipino and American education. Geography was a frequent identity victim having much of its cultural content assimilated into broad, often vague, "social studies" courses and its physical content absorbed into physical or environmental studies texts.

The current trend in both nations is to return to the teaching of geography as a separate subject. The resurgence of interest in America has been sparked by numerous survey results indicating that Americans are rapidly becoming one of the most geographically illiterate and parochial peoples on earth.[19] The potential ramifications of this ignorance on American international business and affairs are great. Recently, geography has been reintroduced into the secondary curricula in Texas, California, Louisiana, and Tennessee and numerous other states are considering implementing similar policies. Many colleges and universities, among them the University of Colorado, will shortly require geography of all incoming students.[20]

The move back to a separate geography in the Philippines was given strong impetus by the decision of Minister of Education Onofre D. Corpuz in 1981 to "reintroduce geography as a separate subject... in the elementary and also... in the high school."[21] This policy is being implemented in a planned, phased manner under the direction of the successors to Minister Corpuz.[22] The accomplishment of this program should do much, over time, to reduce the number of Filipino citizens described by Benedicto David as "lost in space."[23]

University of Research Interests

True to its holistic heritage, geography programs in both the Philippines and in the United States require training in both the physical

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[17] The 1982 data is from Corpuz, *op. cit.*, footnote 14. The 1985 data is from a membership list of the Philippine Geographical Society provided by Aurora S. Tolentino on 24 June 1985.

[18] See Ulack, *op. cit.*, footnotes 16 and 7.

[19] Salvatore J. Natoli, "The Invisible Geography Teachers and the Profession," *The Professional Geographer* 36 (February, 1984), pp. 89-92.

[20] *Ibid.*

[21] Onofre D. Corpuz, "Geography and Its Development in the 80s: A Challenge," *Philippine Geographical Journal* 25 (January-March, 1981), pp. 4-7.

[22] Meliton B. Juanico, personal communication, June, 1985.

[23] Benedicto David, "Facing Reality," *The Bulletin Today*, March 28, 1985.

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and social sciences as well as in cartography and statistics. Beyond these common unifying bonds, however, geographers in both nations have developed specialized research programs in an amazingly wide spectrum of subfields (Tables 2 and 3). As one initially surveys these topics, one might question whether geography is a coherent, identifiable subject matter or whether it is not, instead, a varied collection of eccentric academic interests. The answer comes in the recognition that geography is not distinguished by what it studies but rather by its spatial **method** of analysis.

TABLE 2. RESEARCH INTERESTS AND TEACHING SPECIALIZATIONS OF THE FACULTY OF GEOGRAPHY, UNIVERSITY OF THE PHILIPPINES, DILIMAN

Subfield	Number
Conservation and management of natural resources	4
Urban and regional development	3
Economic geography	2
Natural hazards and environmental perceptions	2
Cartography	2
Quantitative methods	2
Population geography	2
Transportation systems and networks	1
Medical geography	1
Philippine regional geography	1
Political geography	1

Source: Survey of 9 full and part time faculty, July 3, 1985. Respondents were permitted to list up to three subfields.

TABLE 3. LEADING TOPICAL PROFICIENCIES OF MEMBERS OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS

Subfield	Number
Urban geography	982
Cultural geography	808
Cartography	786
Physical geography	720
Economic geography	683
Environmental studies (conservation)	650
Historical geography	616
Remote sensing	510
Geomorphology	482
Quantitative methods	428
Regional planning	427
Urban planning	422
Political geography	413
Climatology	397
Population	371

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Land use	353
Applied geography	333
Water resources	326
Economic development	325
Regional geography	318
Social geography	307
Resource geography	284
Transportation and communication	275
Agricultural geography	256
Biogeography	237

Source: *Association of American Geographers Newsletter*, Vol. 20, No. 8 (October 1, 1985), p. 9. Based on 5708 respondents, each of which was permitted to list up to three subfields.

Mutual Educational Exchanges

Geographic development in both the Philippines and in the United States has benefited greatly from the mutual exchange of students and faculty. Of the nine full and part-time geography faculty at the UP, two have completed their Ph.D. programs in American universities. Two others have completed a masters degree in the United States. Additional enrollments in American graduate geography are possible.

TABLE 4. AMERICAN GEOGRAPHERS WITH EXTENSIVE TEACHING OR RESEARCH EXPERIENCE IN THE PHILIPPINES

	Name	Years	Institution
Fulbright Lecturers:	Wallace McIntyre	1952-1953	UP, Diliman
	Robert Huke	1955-1956	UP, Diliman
		1962-1963	UP, Diliman
	Alden Cutshall	1957-1958	UP, Diliman
	Arthur Doerr	1958-1959 (2nd semester)	UP, Diliman
	Donald Bennett	1963-1964	Far Eastern Univ.
	Richard Ulack	1982-1983	UP, Diliman
	David Clawson	1984-1985	UP, Diliman
Other American Researchers in Geography in the Philippines:	Daniel Doeppers		
	Donald Fisher		
	Robert Reed		
	Joseph Spencer		
	William Thomas		
	Canute Vandermeer		
	Frederick Wernstedt		

Source: UP Department of Geography records.

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The American geographical viewpoint has also been implanted in the Philippines through the financial support of the bi-national Mutual Educational Exchange Program which was signed on March 23, 1948. The program, more commonly known as Fulbright-Hays, has been administered since 1969 by the Philippine-American Educational Foundation (PAEF).[24] Six of the seven American geographers who taught courses in Philippine universities have been stationed at the UP, Diliman. In addition, numerous other American geographers have conducted extended research in the Philippines (Table 4).

FUTURE PROSPECTS

The growth potential for geography in both the Philippines and in the United States is excellent. The specialized training of geographers in their chosen subfields together with their broad holistic groundings and mastery of cartographic techniques enables them to make unique contributions to the solution of such major issues and challenges as international misunderstanding, environmental and natural resource management, and economic development, all of which are inherently interdisciplinary in nature. The need for increased geographic education in the elementary and secondary schools is self-evident.

As geography is reintroduced into the elementary and secondary curricula, the UP geography faculty may wish to prepare to train increased numbers of new, qualified teachers. Inservice seminars, workshops, and short courses will also be needed to update the knowledge and skills of experienced teachers. All of this suggests a need ultimately to expand and strengthen geography at other Filipino institutions of higher education.

In considering how most effectively to meet the need for establishing new geography programs in Philippine colleges and universities, two alternative strategies present themselves. The first is the traditional approach of bringing new majors up through existing programs and then placing them after graduation in positions at other institutions. The advantage of this approach is that it ensures to the greatest possible degree that the new instructors will be well grounded in their geographical knowledge. One of the disadvantages of this strategy is that it is likely to be extremely slow. Experience demonstrates that it can be a most difficult task to persuade a bright young UP graduate to accept a teaching position in the provinces. Rare, indeed is the student who can long resist the financial and cultural advantages of non-academic employment in Manila or overseas.

If one accepts the reality of the difficulty of achieving what might be termed "internal" growth, one is next brought to consider the

[24] *The Philippine Fulbright Program* (Manila: Philippine-American Educational Foundation, September, 1983, 8 pp.).

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"external" strategy option. This approach would focus on identifying, recruiting, and training many practicing educators, both in Manila and throughout the provinces, who are "geographers by instinct but not by training." The disadvantage of this approach is that it would result in geography being taught in many instances by instructors with only a limited knowledge of the subject matter. The advantage, however, is that it would greatly hasten the expansion of the discipline throughout the country. I have no doubt that while it would bring its share of problems, it would also result in numerous successes. Where, for example, would geography in the Philippines be presently without such "recruits" as Dominador Rosell and Domingo Salita? Perhaps the pattern of first "external" growth followed later by "internal" growth, as occurred both in America and at the UP, is a legitimate model to be followed in the Philippine provinces. Such a growth model will succeed to the degree that current geography faculty actively involve themselves in the program implementation. It is evident, further, that the two growth strategies are mutually compatible and can and should function together simultaneously as many externally generated geographers will likely seek advanced degrees in geography at the UP.

Experience in both the Philippines and in the United States teaches that geography, like all disciplines, is inherently neither strong nor weak. Its success and growth rises and falls everywhere with the level of effort exerted by its practitioners. We must never allow ourselves to be content with its current status. It is well to bear in mind that the quality of our work is just as important as the quantity, and that quality is a natural outgrowth of good organization and effective short- and long-term planning. If we plan well and work hard, geography will play an increasingly prominent role in the development of each nation.

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THE CROPPING INTENSITY IN A BOSERUPEAN SETTING

by

R.S. DUBE and REKHA JAIN*

INTRODUCTION

In a sharp contrast to the Malthusian propositions, Boserup, the leading exponent of a dynamic theory of population-resource equilibrium, states that population increase stimulates changes in agricultural techniques and intensity of production, so that more food could be produced to support the growing population.[1] The essence of her ideas on population-resource equilibrium is based on the examination of different land-use systems of the world, classified according to their intensity of production measured in terms of the frequency of cropping.[2] At the one extreme of the land-use systems are pointed out the forest fallows associated with shifting cultivation of least productive intensity with the multiple cropping systems which yield more than one harvest a year arranged at the other extreme. There is close connection between the agricultural techniques and the land-use systems.[3] The innovations in the agricultural techniques and resultant increase in agricultural productivity is suggested to occur under the impact of forces emanating from the sustained increase in population.[4] In fact, as population increases beyond a certain point, where no extra land is available for agricultural expansion, the length of fallows is shortened to maintain the previous level of per capita consumption. The diminution of the fallows and continuous use of the cultivated land for cropping causes decline in soil fertility and output per man hour.[5] The adoption of new techniques, however, becomes necessary and agricultural development and growth of food supply follows simultaneously with the growth of population in a territory.

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[1] Boserup, E. *Conditions of Agricultural Growth* (London: Allen and Unwin, 1965), pp. 11-14.

[2] *Ibid.*, pp. 15-16.

[3] *Ibid.*; pp. 26-27.

[4] *Ibid.*, pp. 65-69.

[5] *Ibid.*, p. 117.

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Madhya Pradesh affords an excellent example of a developing society where Boserupean forces are currently in operation.[6] It would be interesting to examine the cropping intensity in Madhya Pradesh in all of its aspect with a view to substantiate the validity of the Boserupean postulate and associated forces of population resource equilibrium. It would help highlighting the need for a speedier intensification of agricultural production lest resurgence of Malthusian forces should overcast the Boserupean population-resource balances in a region.

THE BOSERUPEAN SETTING IN MADHYA PRADESH

The Boserupean forces are presently in operation in Madhya Pradesh.[7] This is suggested by a close scrutiny of the demographic and agricultural setting of the state.

DEMOGRAPHIC SETTING

Demographic data for the pre-census period are not available for Madhya Pradesh. Indirect sources, however, suggest a sluggish but sustained increase in population during the whole extent of the historical period.[8] Though, the history of population growth in this part of the country has been frequently marked by the occurrence of such depopulating forces as draughts, famines, epidemics and political unrests, the overall trend during a longer period of time has been that of a sustained increase in population number.[9] The growth of population during the modern census taking history of the state is suggestive and needs a brief

TABLE 1. MADHYA PRADESH: TREND OF POPULATION GROWTH 1901-1981

Years	*Population (millions)*	*Density (per square kilometer of the cultivable area*
1901	16.86	65.8
1911	19.44	75.9
1921	19.17	74.8
1931	21.36	83.4
1941	24.00	93.6
1951	26.07	101.8
1961	32.37	126.4
1971	41.65	162.6
1981	52.13	203.5

SOURCE: Calculated from Census and land-use data 1901-1981.

[6] Dube, R.S. 'Innovations in the Farm Technology in Madhya Pradesh'. *Uttar Bharat Bhoogol Patrika* (Forthcoming).

[7] *Ibid.* and Dube, R.S. "The Anomalous Growth of following in Madhya Pradesh". Geog. Out. (Forthcoming).

[8] David, K. *The Population of India and Pakistan.* Princeton University Press, 1951.

[9] Dube, R.S. *'Population of the Rewa Plateau* (Rampur: Sahitya Ratnalay, 1979).

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mention here. The population has increased more than three-fold during the period 1901-1981 registering a down-trend only in 1921 when population decreased due to the widespread outbreak of devastating influenza epidemic in 1918 (Table 1).

The population has had a continuous uptrend since then and its rapid growth has been causing strains on the agricultural resources. The pressure on per square kilometer of the cultivable area has, infact, increased from 65.8 persons in 1901 to 203.5 persons in 1981. Such an increase in the pressure of population would exert significant impact on the land use system.

The population is unevenly distributed in Madhya Pradesh. The density map of the state prepared on the basis of the composite score of the Kendall's ranks of the district in respect of arithmetic density, rural density, agricultural density, and nutritional density (Map 1A) suggests that high density areas of the state are associated mainly with the northern part of the Madhya Bharat plateau, Orchha plain, Rewa plateau, parts of Narmada valley, Upper Winganga Basin and Chhattisgarh Basin. The Low density belt forms a continuous stretch from the Madhya Bharat plateau and Bundelkhand upland in the north to the Satpura-Maikal ranges in the south. The Bastar plateau is also classed under the Low category. It would be interesting to examine the **inter se** spatial correspondence between the density of population on the one hand and intensity of cropping on the other in an effort to identify existence of Boserupean forces of population-resource relationships.

THE LAND USE SYSTEM

Fragmentary archaeological and historical evidences suggest a change in the agrarian system of the state ever since the introduction of cropping in the neolithic period.[11] The information show that land-use systems have registered significant changes from the old forest fallowing phase to the present annual cropping phase through the intervening phases of fallowing and short-fallow cultivation systems.[12] The availability of data on recent changes in land use are restricted for the period 1956-1981, but the trend of change revealed by them is suggestive to the existence of the operation of Boserupean sequence of population-resource changes.

It may be seen from the Table 2 that fallows (9.46 per. cent) and wastes (16.73 per cent) occupied quite a substantial part of the cultivable

[10] Kendall.

[11] Dhavalikar, M.K. and Gregory, L.P. 'Subsistence Pattern of an Early Farming Community of Western India'. Puratattva, No. 7, 1974.

[12] Dube, R.S. "The Anomalous Growth of Fallowing in Madhaya Pradesh'. Geog. Out. (Forthcoming).

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area of the state in 1956-57. Their share has gradually declined in 1980-81 suggesting that simultaneous increase in population necessitates shortening of the wastes and the fallows to permit horizontal expansion of the cultivated area for fetching more agricultural production. Correspondingly, the net sown area has registered significant improvement from 62.19 per cent in 1956-57 to 73.45 per cent in 1980-81.[13]

TABLE 2. MADHYA PRADESH: GROWTH OF FALLOWS AND WASTELANDS 1956-1981
(PERCENTAGE OF THE CULTIVABLE AREA)

Year	*Cultivable land*	*Fallows*	*Cultivable wastes*	*Net sown area*
1956-57		9.46	16.73	62.19
1957-58		10.73	15.06	60.43
1958-59		9.44	14.39	69.91
1959-60		9.53	13.45	63.11
1960-61		11.23	12.30	63.60
1961-62		8.13	11.35	64.86
1962-63		7.42	9.77	60.23
1963-64		7.83	9.73	66.01
1964-65		7.06	9.82	66.43
1965-66		7.97	9.27	66.45
1966-67		8.25	9.22	68.29
1967-68		7.01	9.10	70.52
1968-69		6.43	9.04	71.54
1969-70		6.09	8.89	72.65
1970-71		6.22	8.34	72.66
1971-72		6.12	8.12	73.07
1972-73		6.46	8.14	72.97
1973-74		6.50	8.35	73.02
1974-75		6.78	7.80	72.90
1975-76		6.40	7.94	73.56
1976-77		7.33	8.11	72.94
1977-78		6.93	7.54	74.19
1978-79		7.06	7.29	74.30
1979-80		8.76	7.53	72.40
1980-81		7.92	7.44	73.45

SOURCE: Directories of Agriculture Madhya Pradesh, Agricultural Statistics, 1981.

The changes in the farm techniques also suggest the continuation of Boserupean dynamism in Madhya Pradesh.[14] Though, information on the previous technological changes are difficult to find the present spatial ramifications of technological innovations suggest a complete

[13] Dube, R.S. *op. cit.*
[14] Dube, R.S. *op. cit.*

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sequence of changes in agricultural techniques. It has been observed[15] that the present farm operations are predominantly based on the plough cultivation system, with the use of such old implements as digging sticks and hoe in some of the tribal and hilly enclaves of the state. The present innovations[16] bringing out transition from the ploughing phase to the tractorization and intensification phase also manifest the change in agricultural techniques necessitated by increasing pressure of population on the farm resources.

It may, therefore, be concluded that Madhya Pradesh is currently evidencing a transition in the Boserupean land use system and analysis of the cropping intensity may bring out such facts on the population resource relations which may illuminate the changing relations between population and land uso systems.

AGRICULTURAL EXPANSION

Expansion of the cultivated area is an important measure for enhancing agricultural intensity in the early phases of the Boserupean setting of the population-resource equilibrium. We do not have precise and reliable data on the ancient forest and bush fallowing phase in Madhya Pradesh. Conjectural conclusions may help in concluding that frequency of cropping was successively increasing with the growth of population in different parts of the state and also that the rapid shortening of the fallows was occurring with the acceleration of population. Expansion of the cultivated area for creation of new fields at the so-called extensive margins[17] of the cropland for accommodating the growing pressure of population has been evidenced during the period 1956-1981 for which reliable land use statistics are available. In the year 1956-57 cultivated area comprised about 71.65 per cent of the total cultivable area with an extensive scope for expansion of agriculture on about 75.37 thousand hectares of the wastes and other uncultivable lands (or about 25 per cent of the cultivable area). The cultivated area has registered significant increase since then (Table 2).

With the result it now occupies about 81.36 per cent of the total cultivable area. The culturable wastes have registered considerable shortening. They have been reduced to 7.44 per cent of the cultivable area in 1981 from 16.73 per cent in 1956-57. Such a rapid reduction in the wastes and simultaneous in the cultivated area would suggest an occurrence of rapid agricultural expansion as an important measure of

[15] Dube, R.S., *op. cit.*
[16] Dube, R.S., *op. cit.*
[17] Boserup, E., *op. cit.*, p.12.

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increasing agricultural production to support the stupendously growing population of the state.

An observation of Map 1-B would suggest that share of cultivated area is higher than the national average in 37 districts of the state. The proportion of cultivated area ranges from 62.7 per cent in Shivpuri district to 90.7 per cent in Bhind district suggesting a wide-range of spatial variation in the operation of Boserupean forces responsible for agricultural expansion in this state. The areas where share of cultivated area is relatively higher (more than 85.41 per cent) include Lashkar plain, Rewa plateau, eastern fringes of the Malwa, Western margins of the state, Satpura region and some parts of the Chhattisgarh region. There is no close connection between the degree of population concentration and degree of agricultural expansion in different parts of the state. The densely peopled Chhattisgarh region (Map 1-A) has registered a relatively lower incidence of expansion of the cultivated area (Map 1-B) and some sparsely peopled areas (Satpura region) have registered higher incidence of agricultural expansion as a measure of increasing agricultural intensity. Existence of such a spatial anomaly between population concentration and agricultural growth may suggest that the Boserupean postulates are dubious in respect of **inter se** relation between agricultural expansion and population growth in Madhya Pradesh.

CHANGES IN NET SOWN AREA AND FALLOWING

In consonance with the occurrence of agricultural expansion under the sustained increase of population pressure, the net sown area has registered rapid improvement and fallowing has evidenced substantial reduction in Madhya Pradesh during the period 1956-1981 (Table 2). With minor fluctuations, the share of net sown area in the cultivable area has increased from 62.19 per cent in 1956-57 to 73.45 per cent in 1980-81 registering a change of about 120.50 per cent. The increase in the share of net sown area during the period 1956-1981 was, however, greater than that of the cultivated area, suggesting reduction of the fallowing activity. The fallows have been reduced to 7.92 per cent in 1980-81 from about 9.46 per cent in 1956-57. The expansion of annual cropping and reduction of fallowing may result in the rapid exhaustion of soil fertility in the absence of a quick improvement in agricultural techniques. In fact, such a situation seems developing in Madhya Pradesh for some time causing retrogration of the fallowing activity.[19] The share of fallows which had a declining trend up to the year 1972 started increasing subsequently (Table 2) perhaps due to the exhaustion

[18] The regional nomenclature adopted in this paper are based on the physical plates of the National Atlas organization, Calcutta.

[19] Dube, R.S., *op. cit.*

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of soil fertility or depletion of farm labor.[20] Such an inverse trend of fallowing is peculiar and has remained unknown and unreported in geographical literature. This may suggest a debilitating operation of Boserupean forces which gives way to the Malthusian forces in Madhya Pradesh, since a retrograde growth of fallowing is difficult to envisage in the boserupean setting. A quick adoption of the process of agricultural intensification would be necessary to avert the collapse of Boserupean forces in Madhya Pradesh.

Over a greater part of the state the share of net sown area in the cultivable area is greater than the national average of 64.37 per cent (Map 1-C). The share of net sown area is high (more than 83.64 per cent

TABLE 3. MADHYA PRADESH: GROWTH OF MULTICROPPING 1956-1981 (PERCENTAGE OF NSA)

Year	*Multi-cropped area (%)*
1956-57	13.61
1957-58	8.78
1958-59	12.95
1959-60	13.59
1960-61	12.97
1961-62	13.87
1962-63	12.55
1963-64	13.44
1964-65	13.31
1965-66	7.60
1966-67	6.57
1967-68	10.31
1968-69	10.61
1969-70	11.11
1970-71	12.04
1971-72	13.15
1972-73	12.14
1973-74	14.28
1974-75	10.77
1975-76	14.11
1976-77	12.53
1977-78	14.41
1978-79	15.38
1979-80	13.18
1980-81	14.43

SOURCE: Directorate of Agriculture, Madhya Pradesh, *Agricultural Statistics*, 1981.

[20] Dube, R.S., *op. cit.*

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of the total cultivable area) in the parts of Malwa and adjoining tracts. It is relatively lower in other parts of the state. There is again no evident correspondence between percentage of the net sown area (Map 1-C) and degree of population concentration (Map 1-A). In fact many more densely peopled areas, e.g., Lashker, Narmada, Chhattisgarh and Rewa regions support a relatively smaller share of the net sown area. This again appears disproving the relevance of Boserupean propositions in Madhya Pradesh.

AGRICULTURAL INTENSIFICATION

Intensification of cultivation or the land-use efficiency which measures the extent to which the net sown area is cropped,[21] is one of the essential pre-requisites for the sustenance of the Boserupean population-resource equilibrium. Failure in agricultural intensification is bound to cause collapse of the Boserupean system to give way to the resurgence of Malthusian forces to endanger the survival of mankind.

There is only modest scope now for expansion of cultivation by creation of new farms at the outer margins of the existing croplands of the state. The cultivable wastes now occupy barely 7.44 per cent of the total cultivable area of the state (Table 2), and the increase of population number in future would necessitate intensification of cropping rather than expansion of cultivation. Presently multicropping is restricted to only 14.43 per cent of the total net sown area (NSA) of the state. An observation of Table 3 would suggest that there has been considerable temporal interruptions in the growth of multicropping and there has been little change in the share of multicropped area in 1980-81 as compared with that in 1956-57. Multicropping included about 13.61 per cent of the net sown area in 1956-57. After evidencing considerable fluctuations it now occupies about 14.43 per cent of the net sown area in 1980-81. This would suggest that: (i) the multicropping activity has not yet stabilized even in the areas where it is practised, (ii) the multicropping activity has yet to expand to overtake the agricultural system from the annual cropping system, and (iii) absence of swift transition from annual cropping to multi-cropping under a state of sustained population growth, as being evidenced in Madhya Pradesh, may disprove the Boserupean contentions on intensity of cropping.

The areas of higher cropping intensity in Madhya Pradesh are found in the Chhattisgarh basin, Rewa plateau, Orchia plain and Mandsaur region. A comparison of the Map 1-D with 1-A would suggest absence of any close relation between degree of population concentration and cropping intensity, since some of the densely peopled parts, e.g., Lashkar plain in the north, have registered very low cropping intensity. The

[21] Sing, J. *An Agricultural Geography of Haryana* (Kurukshetra Vishal Publication, 1976), p. 235.

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spatial variations of the cropping intensity seem giving increased correlation with the size of land holdings. The spatial ramifications of the cropping intensity in the state also seem failing to provide full support to the Boserupean propositions.[22]

AGRICULTURAL PRODUCTIVITY

There has been net increase, on average, in agricultural output from about 9,059 thousand tones of food crops in 1956-57 to 13,020 thousand tones in 1980-81 in consonance with the uptrend of demographic growth. The per hectare price-weighted agricultural productivity, however, shows no increase during the period 1956-1981 suggesting that emphasis of

TABLE 4. MADHYA PRADESH: TREND OF PRICE-WEIGHTED AGRICULTURAL OUTPUT 1956-1981 (AT THE STATIC RATE OF 1980-81)

Year	*Per hectare output in Rs.*
1956-57	1148.5
1957-58	953.1
1958-59	1259.2
1959-60	1200.4
1960-61	1155.3
1961-62	1184.8
1962-63	1077.9
1963-64	1109.6
1964-65	1189.3
1965-66	925.2
1966-67	779.6
1967-68	1005.2
1968-69	969.3
1969-70	1070.3
1970-71	1156.8
1971-72	1199.1
1972-73	1090.2
1973-74	1114.4
1974-75	923.3
1975-76	1299.5
1976-77	1017.0
1977-78	1224.0
1978-79	1151.44
1979-80	803.7
1980-81	1183.6

SOURCE: Directorate of Agriculture Madhya Pradesh: *Agricultural Statistics*, 1981.

[22] Dube, R.S., *op. cit.*

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farming in this period has been on raising agricultural output by expansion of cultivated area rather than from agricultural intensification. The trend of price-weighted per hectare agricultural output during the period 1956-81 measured at the static price rates of 1980-81 are summarized in Table 4. For the evaluation of price-weighted agricultural productivity eighteen crops have been considered. These are rice, jowar, bajra, barley, wheat, maize, gram, tur, urd, moong, masoor, ground nut, sesamum, rape and mustard, linseed, castor, cotton and sugarcane. Two important features seem emerging from the data recorded in this table: (i) the agricultural productivity has had a serrated growth characterized by frequent rise and fall in the growth curve. This has been caused, perhaps, because of fluctuations in the weather conditions and because of frequent changes in the composition of crops produced; and (ii) there has been no change in the price-weighted per hectare productivity of crops. It was Rs. 1148.50 per hectare in 1956-57 which has registered very little increase in 1980-81 when it was Rs. 1183-60 per hectare. Such a temporal change would suggest, therefore, absence of any demographic relevance with the growth of agricultural productivity.

Similar conclusions also emerge from spatial ramifications of agricultural productivity, measured in terms of Singh's crop yield and concentration indices coefficient,[23] which show sharp regional variations (Map 2). The method involves the calculation of crop yield index (formula $Yi = \frac{Ya_c}{Ya_r} \times 100$, where yi is the crop yield Index, Ya is the average yield of 'a' in the component enumeration unit and $^{Ya}_{r}$ is the average yield of the crop 'a' in the entire state and crop concentration index (Formula $^{C}_{1} = \frac{Pa_e}{Pa_r} \times 100$, Where $^{C}_{1}$ is the crop concentration index, $^{Pa}_{e}$ is the percentage strength of the crop 'a' in the total harvested area in the enumeration unit, and $^{Pa}_{r}$ is the percentage strength of the crop 'a' in the entire state) for all the individual crops of the districts. Rank of a district in respect of crop yield index and crop concentration index of a crop have been, then, summed and averaged to give the crop yield and concentration indices Ranking coefficient for a crop. The Ranking coefficients of all the crops have been summed and averaged to give a composite ranking coefficient for a district. The districts have been, then, ranked and mapped to give the regional pattern shown in Map 1-E. Cereals, pulses and oil seeds have been involved in the determination of composite Ranking coefficients for different districts of the state.

A careful look on the Map 1-E, would reveal that the areas of higher crop production extend in parts of Malwa, Bundelkhand and Madhya Bharat

[23] Dube, R.S., *op. cit.*

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Plateau, essentially north of the Narmada. Rest of the state east of the Ken and south of the Narmada is classed under different classes of Medium and Low categories adopted for regionalization of the Ranking coefficients.

A comparative study of this map with Map 1-A would suggest absence of any spatial correspondence of agricultural productivity with degree of population concentration, since such densely populated regions as Rewa plateau, upper Wainganga basin and Chhattisgarh basin are classed under different categories ranging from conspicuously low to low medium productivity and relatively less density areas of Malwa and southern Madhya Bharat plateau are classed in high to conspicuously high classes of agricultural productivity.[24]

CONCLUSIONS

The preceding discussion on the Boserupean setting studied in respect of temporal and spatial ramifications of the intensity of production lead to the following conclusions:

1. The increase of population seems affecting the temporal trends in agricultural expansion in Madhya Pradesh, since significant horizontal expansion of the cultivated area has occurred during the period 1956-1981. Temporal trends confirm the Boserupean pastulate but spatial pattern disprove it. Correspondingly, significant increase in the net sown area and reduction in fallowing and wastelands has also taken place. The spatial patterns of the share of cultivated and net sown area, however, give no spatial correspondence with the degree of population concentration.

2. The agricultural intensification measured in terms of the cropping intensity has not increased in parallel succession with the growth of population during the period 1956-81. The state has not yet made sufficient changes from the present annual cropping system to the multicropping phase. The spatial variations of the cropping intensity also fail to show its close relation with spatial patterns of the degree of population concentration.

3. The emphasis of farming in Madhya Pradesh during the period 1956-1981 has been mainly on increasing agricultural output by agricultural expansion of the cultivated area and there has been little change in the level of agricultural intensification as suggested

[24] Sing, J. *An Agricultural Geography of Haryana* (Kurukshetra Vishal Publication, 1976), pp. 318-319.

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from absence of any substantial increase in the share of multi-cropping area and price-weighted per hectare agricultural output during the period 1956-1981. The spatial variations of price-weighted productivity have no close relation with spatial changes of population density.

4. The failure of the agricultural intensification to increase in parallel succession with population growth during the period 1956-1981 may seem to be exerting a debilitating influence on the operation of Boserupean system of population-resource equilibrium in Madhya Pradesh. The agricultural planners may be advised to take note of the trend since this may accelerate the Malthusian forces which may operate to regulate population size.
5. The agricultural conditions in Madhya Pradesh seem to suggest that there has been significant increase in the share of cultivated area and net sown area with simultaneous reduction in the wastes and fallows during the period 1956-1981. The agricultural output has consequently increased confirming the validity of Boserupean propositions at the temporal scale. Their spatial variations, however, show little inter se correspondence with the degree of population concentration exemplifying failure of Boserupean postulate in the regional context in Madhya Pradesh.

LIST OF DISTRICTS: 1. Morena, 2. Bhind, 3. Gwalior, 4. Datia, 5. Shivpuri, 6. Guna, 7. Rajgarh, 8. Shajapur, 9. Mandsaur, 10. Ratlam, 11. Ujjain, 12. Bhopal, 13. Sehore, 14. Raisen, 15. Vidisha, 16. Betul, 17. Hoshangabad, 18. Khandwa, 19. Khargone, 20. Jhabua, 21. Dhar, 22. Indore, 23. Shahdol, 24. Satna, 25. Sidhi, 26. Rewa, 27. Chhatarpur, 28. Tikamgarh, 29. Panna, 30. Damoh, 31. Sagar, 32. Narsinghpur, 33. Mandla, 34. Seoni, 35. Shhindwara, 36. Balaghat, 37. Jabalpur, 38. Raigarh, 39. Surguja, 40. Bilaspur, 41. Bastar, 42. Dewas, 43. Rajnandgaon, 44. Durg, 45. Raipur.

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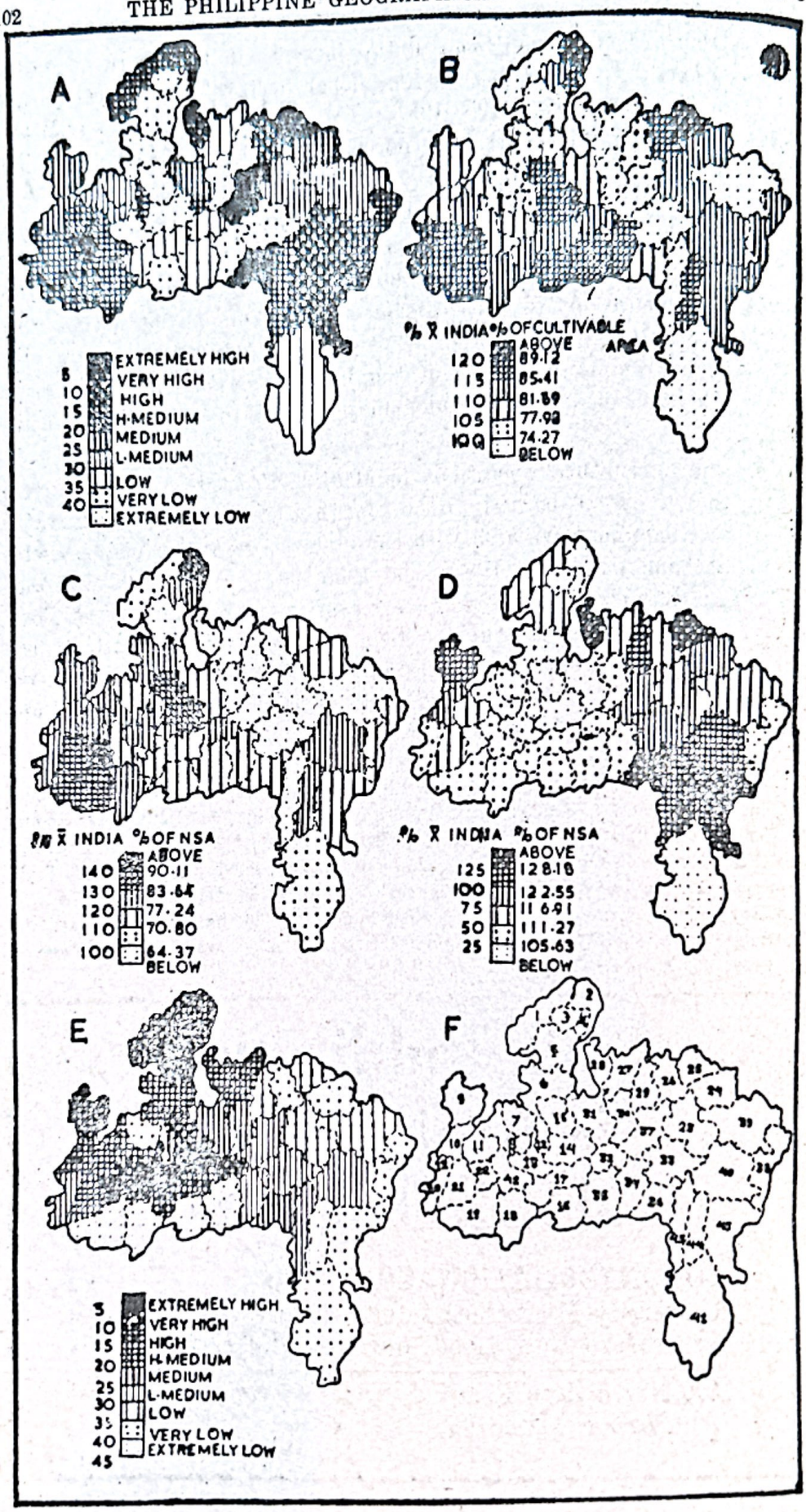

MAP 1 — Madhya Pradesh: A. Density Regions; B. Cultivated Area; C. Net sown Area; D. Cropping Intensity; E. Agricultural Productivity Regions; F. Administrative Divisions (Districts).

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FACTOR ANALYSIS AS A TECHNIQUE IN CLASSIFYING THE CITIES

by

TARA DEVI SINGH*

ABSTRACT

The dimensions of socio-economic structure of the 22 Class I cities (1971) of Uttar Pradesh, India (U.P.) have been isolated with the help of Factor Analysis, a latest sophisticated technique of handling multivariate data. Through the process of dimension reduction, the 21 x 21 correlation matrix, which show high, — ve or + ve, interrelationship varying between —.99 and +.90, has been reduced to 21 x 6 factor matrix, by eliminating the factors with eigen values less than one. Each factor, invariably, incorporates two dimensions or two groups of cities with juxtaposed characteristics. The relative significance of the factors can be explained on the basis of their percentage share in distribution of variance. The first factor alone accounts for 32.65% of the total variance, while the total variance, explained by all the factors, is 83.92%. The six emerged factors are named as Traditional Social Status (Trade and Commerce), Achieved Economic Status (M lit, F lit, other services), male concentration (male worker), dominant economic activities (manufacturing, transport, mining and quarrying, agriculture, etc.), migration and religious groups (Hindu, Muslims, Sikh, etc.). It is interesting to note that communalities of Muslims (.96), Hindus (.95), M lit (.94), MW trade and commerce (.93), F lit (.92), and MW (.91), show very high values, i.e. > .90, indicating that these attributes are very well explained, while the variables with lower communalities like Ag (.69) and SC/ST (.67), show that these are the least explained variables, presenting thereby, lesser dependence on urban functions in case of the cities of U.P.

On the basis of the dominant factor scores, 6 cities have been classed as single factor dominant, other 6 as bi-factor dominant and the rest 10 as multi-factor dominant cities.

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INTRODUCTION

From urban morphology and land-use to urban social structure or urban ecology has been the span during which scientists from various disciplines contributed to the urban studies with their own viewpoints. Here, the objective is to distinguish the cities** according to their total characteristics. In this context, one has to refer to the works related with classification of the cities, on the basis of the methods like the dominant functions, initiated by Harris,[1] by applying some statistical standards to the occupational structure of cities and Kneedler's[2] economic classification was nothing but a sort of modification over Harris' technique. Still another quantitative approach was applied by Nelson,[3] who used standard deviations to classify the cities as SD1, SD2 and SD3 in relation to certain occupations and could discern uni-functional, bi-functional and diversified cities, but the total neglect of insignificant occupations and placing of towns with Metropolitan and class IV to class V size in one category may be pointed out as its drawbacks. Moreover, the total variables, constituting the urban structure, are not considered. This method had its wide application by other workers in the field with some modifications in few cases. A purely qualitative approach of the type as Metropolitan, Super and Great cities[4] fails to visualize either the economic or occupational or social characteristics of a city. Therefore, a purely quantitative approach, which has the flexibility to include as many number of variables as one likes but at the same time gives due recognition to qualitative aspects of these variables, is applied here to group the class one cities of Uttar Pradesh, India (Fig. 1) on the basis of 1971 data. The other advantage is that it equally emphasizes the + ve and — ve associates of different variables. The whole analysis aims to discern the composite character, portrayed through three basic dimensions namely: economic status, family status and ethnicity, which are distinct from one another and can explain the complexity of urban society. Economic status, as Bell[5] applied to social rank, meant the changes in the occupational character of the industrial age including occupation, income and education. At the same time, family status (urbanization) meant the changing economic activities of the society. It viewed family as a social and economic unit, which was measured by fertility, women in labour force and single family dwellings. Ethnic status, commonly called segregation, referred to the changing composition of population due to mobility. There are no direct means of measuring the outcomes of these dimensions and so one must select various indicants of each, such as education and income for socio-economic status and so on. The hypothesis is that these variables are closely interrelated with other across a set of areas and separate from groups of indicants

** In the present study only class one cities, containing a population of more than 99,999 persons, defined according to Census of India, have been considered.

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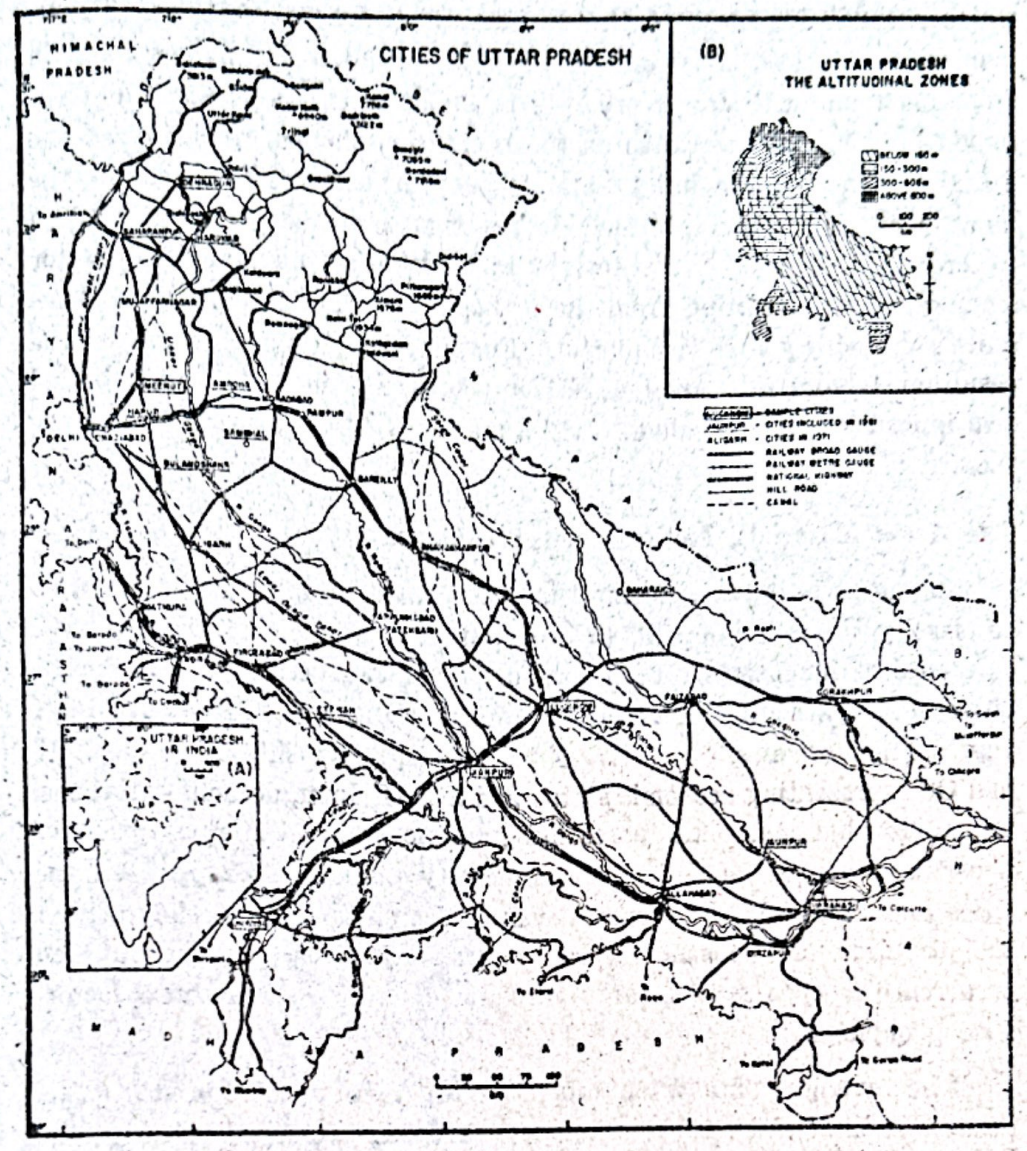

FIGURE 1. THE LOCATION AND PHYSIOGRAPHY

representing others. Existence of such groups has been tested to provide a composite index to each concept, i.e., in such an approach, the combination of a number of variables, composing each of the factors, gives a good deal of additional insight, through the interrelationships, which are existing among a set of individual variables. It is observed by some scholars (Schmid and Tagashira)[6] that matrices based on different subset of variables produce the same three basic dimensions, whether a full set of 42 variables or (by progressively reducing the variables) as few as 10 are used. 'The output from such analyses is a new set of variables, replacing the original set; the relationship between these two are the focus' (Johnston)[7]. That is, the rationale behind the factor analysis is the determination of the minimum number of independent dimensions

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which account for most of the variance in a set of variables. Hence, dimension reduction is by far the most important and fundamental gain from such an analysis. Moreover, it is also possible to isolate most important diagnostic variates on the basis of explained proportion of the initial variance of the input data. Since varimax rotation reduces the number of distressing intermediate loadings and adds to interpretation by creating a set of easily interpretable factors, the simplified factor loading matrix, resulting from the orthogonal varimax rotation, becomes quite satisfactory and meaningful. Further, the transformation of the resultant factors into areal or factor scores, by allocating an unbiased real importance to the values, gives a meaningful spatial pattern of these factors.

The Area: Materials, Methods and Techniques

In the present case, attempt has been made to apply factor analysis to classify the cities of U.P. to bring out the inter city hierarchy with reference to dimensions. Data was compiled and processed for 22 Class I cities of U.P. selecting 21 variables; *M Lit, F Lit, SR, PPRH and PPHH representing social status, MW, FW, NW, Ag, MQ, Mf, TC, Cons., TT and OS representing economic status and SC/ST, Imm, decadal variations, Hindu, Muslim and Sikh representing ethnic status. The exclusion of a very common variable, the general density (as low as 32 ppa) for the cities like Varanasi, where ward densities are up to 429 ppa, may attract the attention of the scholars but on the city level, owing to uneven occurrence of open spaces, this figure would have produced false factor-wise groupings.

The arranged data when submitted to the computer, produced the desired results which could otherwise have been computed by rigorous mathematical derivations. The five steps involved in the operational procedure of the factor analysis included: (i) the calculation of statistical parameters like SD and Z scores, (ii) extraction of correlation matrices, (iii) dimension reduction process associated with the development of the factor solution, (iv) rotation of the K factors to the normal varimax position in order to achieve simple factor structure of having highly significant factor loadings, and (v) the computation of factor scores to

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* PPRH = Persons per Residential House; PPHH = Persons per Household; Mf = Manufacturing; SR = Sex Ratio; OS = Other Services; FLit = Female Literates; MLit = Male Literates; MW = Male Workers; NW = Non-Workers; TT = Transport; Ag = Agriculture; FW = Female Workers; SC/ST = Scheduled Caste/Scheduled Tribes; MQ = Mining-Quarrying; Cons. = Construction; TC = Trade and Commerce; MC = Male Concentration; Imm = Immigrants; AES = Achieved Economic Status; TSS = Traditional Social Status; CF = Community Facilities; PPA = Persons per acre; Ps or ps = Persons.

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allocate appropriate scores for each of K factors for each of the centres (Fig. 2). The results of these five steps can be analyzed thus.

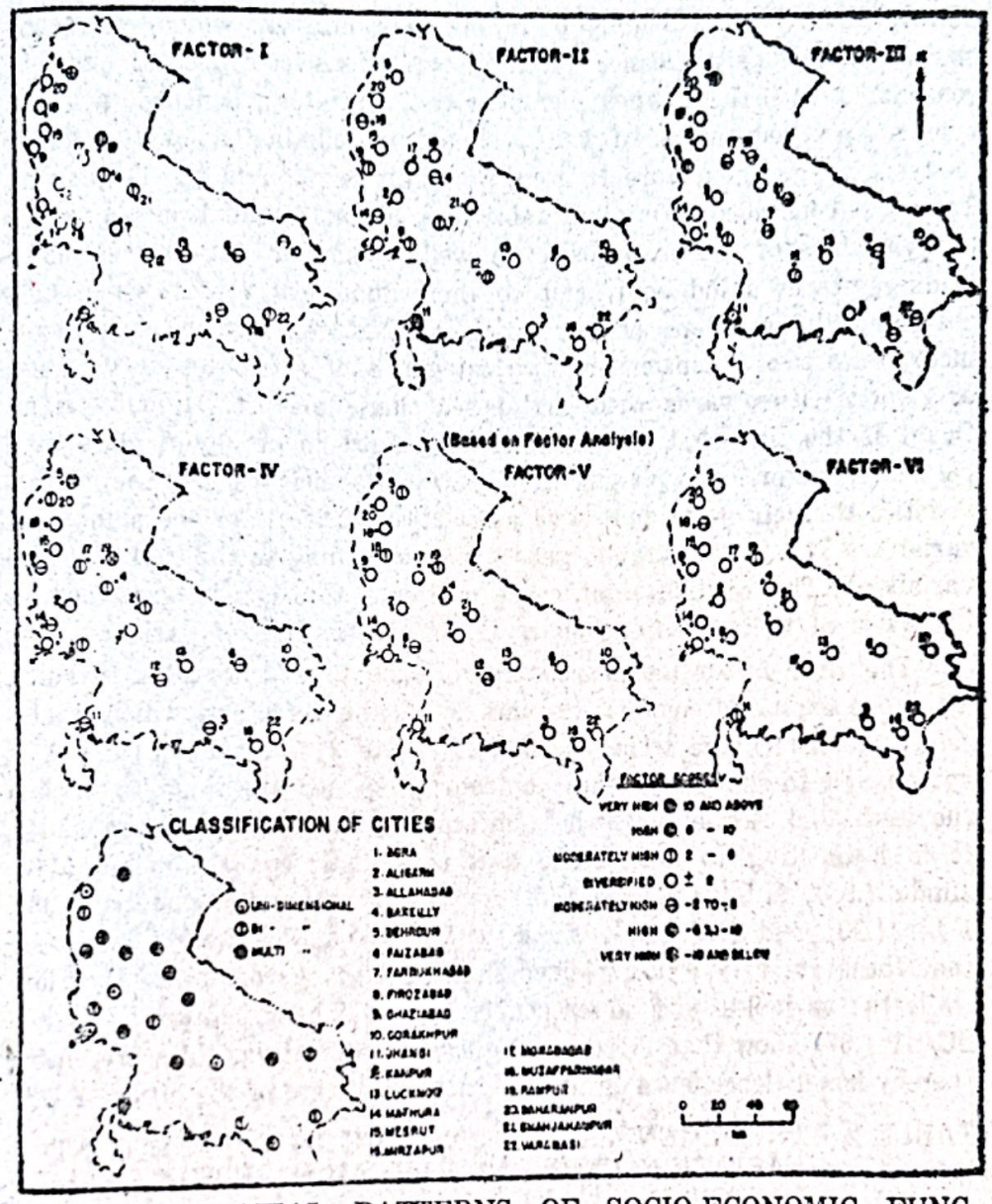

FIGURE 2. SPATIAL PATTERNS OF SOCIO-ECONOMIC FUNCTIONS IN THE CITIES OF UTTAR PRADESH, 1971

The Analysis

The resultant correlation matrix of 21 x 21 clearly reveals the interrelationships, — ve as well as + ve, among the variables which vary between —.99 and .90. Through the process of dimension reduction 21 variables have been grouped into 6 to produce 21 x 6 factor matrix by eliminating the factors with eigen values less than one. These extracted factors have been rotated to the normal varimax position in order to get the highly significant factor loadings which simplify the

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interpretation of the complexity of socio-economic structure of the cities of U.P. The F loadings helped in the identification of important variables corresponding to the 6 significant factors, tabulated therein. The basis, however, had been a loading more than absolute .42 which was based on the test of significance of the correlations coefficients, quite in consonance with the Haynes[8] comment that 'variables, which do not load over a specified minimum value, should be eliminated in the factor analysis to get a picture more representative of reality. As far as Table 1 is concerned, it is remarkable that, absolute limit brings together the variables of rather opposite as well as similar nature and factor loadings/scores stand equivalent to their numerical values which help assigning the positions of the variables. Naturally, then, each factor incorporate two dimensions or two categories of attributes or variables or regions/cities/wards with juxtaposed characteristics. Equally significant is the fact that, for a region/city/ward to occupy a place in a particular factor, is to possess the group characteristics, i.e., the characteristics of their + ve and — ve associates, rather than one significant variable. The factors are assigned names according to the highly loaded variables. The relative significance of the factors can be explained on the basis of the percentage share in the distribution of variance.

The first factor alone accounts for 32.65% of the total variance, while the explained common variance by all the 6 factors, which is also called the percentage trace, is 83.92% (Table 2). Further, Table 1 is apt enough to show, how these 6 factors together are going to explain the individual variables which is interpreted in terms of communality. It is interesting to note, now, that communalities of Muslim (.96), Hindu (.95), M Lit (.94), M Worker (.93) Trade and Commerce (.93), F Lit (.92) and NW (.91), show very high values (>.90), indicating that these are very well explained showing bearings on urban functions while the variables with lower communalities like agriculture (.77) and SC/ST (.67) show that these are the least explained variables presenting thereby lesser dependence on urban functions in case of the cities of U.P.

TABLE 2. THE EIGEN VALUES AND THE TOTAL PER CENT VARIATION EXPLAINED BY EACH OF THE FACTORS

Factors	Eigen values	% Variance
I	6.86	32.65
II	3.36	16.01
III	2.68	12.74
IV	2.12	10.09
V	1.43	6.81
VI	1.18	5.62
	17.63	83.92

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TABLE 1. THE CITIES PRIMARY VARIABLES OF FACTOR SOLUTION

V.S.C.	I.C.	L	L^2	C	%
Factor I					
02	PPRH	.82	.6724	.70	96.06
03	PPHH	.71	.5041	.86	58.62
17	Mf	.71	.5041	.89	56.64
01	SR	.53	.2809	.78	36.01
21	OS	—.80	.6400	.80	80.00
06	F Lit	—.71	.5041	.92	54.79
05	M Lit	—.70	.4900	.94	52.13
Factor II					
13	MW	.90	.8100	.93	87.09
17	Mf	.45	.2025	.89	22.75
12	NW	—.92	.8464	.91	93.01
20	TT	—.74	.5476	.84	65.19
01	SR	—.47	.2209	.78	28.32
Factor III					
08	Decade variation	.87	.7569	.88	86.0
07	Immi-grants	.73	.5329	.80	66.6
06	F Lit	.55	.3025	.92	32.8
11	Sikh	.45	.2025	.89	22.7
15	Ag	—.79	.6241	.67	93.1
Factor IV					
10	Muslim	.86	.7396	.96	77.04
03	PPHH	.41	.1681	.86	19.55
09	Hindu	—.87	.7569	.95	79.67
14	FW	—.74	.5476	.87	62.94
04	SC/ST	—.72	.5184	.67	77.37
05	M Lit	—.57	.3249	.94	34.56
Factor V					
16	MQ	.85	.7225	.75	96.33
18	Cons.	.72	.5184	.71	73.01
11	Sikh	.66	.4356	.89	48.94
17	Mf	—.27	.0729	.89	8.19
15	Ag	—.13	.0169	.67	2.52
04	SC/ST	—.13	.0169	.67	2.52
Factor VI					
20	TT	.47	.2209	.84	26.2
10	Muslim	.21	.0441	.96	4.5
14	FW	.25	.0625	.87	7.1
19	Trade & Commerce	—.95	.9025	.93	97.0

V.S.C. = Variables Serial Code
L = Factor loading
I.C. = Item Code
C = Communalities

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Table 1, with all its inherent qualities, fails to explain the spatial patterning of the attributes. This can very well be achieved through the analysis of factor scores of rotated factor matrix of six factors.

TABLE 3. THE CITIES FACTOR-SCORES OF ROTATED FACTOR-MATRIX OF 6 FACTORS

Cities	Factor I	Factor II	Factor III	Factor IV	Factor V	Factor VI
1. Agra	3.28	—11.65	1.45	— 1.66	— 0.19	— 1.32
2. Aligarh	2.20	— 0.73	0.53	1.00	— 0.28	— 0.39
3. Allahabad	— 5.33	0.61	— 0.35	— 3.72	— 0.52	— 0.30
4. Bareilly	3.87	— 3.01	— 1.56	3.89	1.58	0.37
5. Dehra Dun	—11.66	1.77	— 6.78	— 8.09	5.80	0.39
6. Faizabad	— 5.16	0.51	— 3.62	— 2.91	— 1.09	— 0.18
7. Farrukhabad	0.05	2.10	— 2.58	— 0.21	— 1.98	— 0.31
8. Firozabad	8.81	2.67	2.74	4.78	— 8.06	— 0.57
9. Ghaziabad	— 1.91	4.63	7.76	— 3.93	0.97	0.25
10. Gorakhpur	— 4.68	— 2.58	0.99	— 1.83	— 1.99	1.60
11. Jhansi	— 3.62	— 6.88	0.11	— 5.75	— 0.09	3.03
12. Kanpur	— 5.42	7.55	4.51	— 3.01	— 2.62	— 0.84
13. Lucknow	— 5.25	1.08	0.40	— 1.98	0.04	0.73
14. Mathura	— 0.47	— 3.37	— 0.42	— 2.02	0.74	— 1.79
15. Meerut	— 0.08	— 1.82	1.05	0.57	4.23	— 0.39
16. Mirzapur	1.35	1.61	— 4.55	— 1.44	— 1.20	— 1.11
17. Moradabad	4.79	0.34	— 2.25	5.94	— 1.33	1.00
18. Muzaffarnagar	0.08	— 3.46	1.40	0.82	1.00	— 3.62
19. Rampur	9.36	0.51	— 5.40	11.44	2.64	2.72
20. Saharanpur	1.32	0.37	1.01	3.07	0.34	— 0.34
21. Shahjahanpur	4.71	— 0.81	— 5.65	5.13	— 1.18	1.75
22. Varanasi	3.75	1.25	— 2.34	— 0.10	— 1.81	— 0.67
Average	3.96	2.24	2.32	3.33	1.58	1.07

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Factor I

The first factor, as already stated, alone accounts for the 32.65% of the total variance while the variance explained by all the 6 emerged factors is 83.92%.

The squares of loadings indicate that .82, .80, .71, .71, .71 and .70 proportions of the total variance of variables 02, 21, 03, 17, 06 and 05 and more than half of the common variances of each except of 01, are associated with this factor only.

The above grouping of factor one reveals that the variables PPRH, PPHH, Mf and sex ratio with + ve F loadings are directly associated with each other to the extent their factor loading show (.82, .71. .71 and .53 respectively) while other services, F Lit and M Lit which have negative scores are inversely associated with the former variables (to the extent —.80, —.71, —.70 respectively) although they have direct relationships within themselves. This indicates the absence of one group with the presence of the other in the same ratio (Table 1).

Thus factor I, as also the other factors, contains two different types of items: (i) dominant economic activity represented by manufacturing which shows that manufacturing dominated areas are characterized with higher PPRH, PPHH, i.e., density and, as a special case of household manufacturing, the high sex ratios and higher proportion of male workers. It may be explained through the following analysis based on the occupational structure of the cities of U.P. It reveals that Firozabad (58.36), Varanasi (36.48), Kanpur (35.99), Farrukhabad (33.72), Agra (33.29), Moradabad (33.13), Aligarh (32.94), Ghaziabad (34.43), Rampur (32.75), Saharanpur (31.34), and Meerut (30.54) have more than 30% of their workers engaged in manufacturing. But only Rampur factor score (9.36), Firozabad (8.82), Moradabad (4.79), Shahjahanpur (4.71), Bareilly (3.88), Varanasi (3.74), Agra (3.28) and Aligarh (2.19) with factor score 2.00 and above (Fig. 2), have been grouped in manufacturing dominated cities where other services, F Lit and M Lit are also not insignificant. Here, it is noticeable that Kanpur, Farrukhabad, Saharanpur and Meerut, better positioned in this function, have failed to emerge in factor one, while Shahjahanpur (27.05) and Bareilly (27.74) with lesser percentages have made their appearance in this factor. Quite obviously the group or combination of highly correlated variables, i.e., + ve associates, rather than the individual item is effective. The lower shares of the PPRH, PPHH and higher proportions of opposed variables (— ve associates) like M Lit, F Lit in Kanpur could restrict its entry whereas the reverse was helpful for Bareilly and Shahjahanpur. Farrukhabad, Saharanpur and Meerut, due to not very significant positions of combinations, have been classed as diversified.

Other services (nick-named as white-collar jobs) —.89 (.6400), F Lit —.71 (.50), M Lit —.70 (.49) constitute the other group of items

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(Table 1). The occupational structure of the cities of U.P. presents Lucknow (49.00), Dehra Dun (46.05) and Allahabad (40.75) possessing above 40% persons and Faizabad (34.60), Mathura (32.81), Farrukhabad (32.31), Jhansi (31.74) and Gorakhpur (30.98) with above 30% persons employed in other services.

The variables other services, male and female literacy (the constituents of Achieved Economic Status) together occur in factor I with significant factor scores (Table 3) in Dehra Dun (—.11.65), Kanpur (—5.42), Allahabad (—5.34), Lucknow (—5.25), Faizabad (—5.16), Gorakhpur (—4.68) and Jhansi (—3.61). Farrukhabad and Mathura with 32.31 and 32.81% workers engaged in other services, have not been grouped here in service class, i.e., they could not forge themselves as service class towns, because of the lower shares of the constituents M and F literacy rates (51.79, 56.23% M Lit and 34.56 and 36.69% F Lit respectively) while Kanpur, with only 29.29% workers in other services but comparatively high literacy rates (58.02 M Lit, 41.34 F Lit) emerges as a service class town.

Factor II

The squares of the loadings show that .85, .81 and .55 proportions of total variance of variables, NW, MW and TT and nearly 93, 87 and 65% of common variances, compared with their communality estimates, are concerned with this factor only. On the counts of the male dominance this factor may be termed as the factor of male concentration. It explains 16.01% of the variance. Male workers are associated positively with manufacturing, while the correlations are negative with non-workers, transport and sex ratios (Table 1). The cities having highest male concentrations (mostly in manufacturing) are Kanpur (with factor score 7.55), Ghaziabad (4.63), Firozabad (2.67) and Farrukhabad (2.09) with 28.38, 27.33, 26.24 and 26.38% male workers. Lucknow, Mirzapur, Rampur and Saharanpur have 26.25, 26.32, 26.93 and 26.35% male workers respectively, but have not been grouped in this factor for not having either of the two or both the characteristics: (a) association of male workers with manufacturing simultaneously, and (b) a negative correlation with transport and sex ratio. Lucknow and Mirzapur lack in the former while Rampur and Saharanpur in the latter. The cities having higher percentages of non-working population with most of them engaged in transport and characterized with high sex ratio are Jhansi (—6.68), Muzaffarnagar (—3.46), Mathura (—3.37), Bareilly (—3.00) and Gorakhpur (—2.58) (Fig. 2).

Factor III

Third factor accounts for 12.74% of the total variance (Table 2). In this factor per cent decade variation is highly associated with immigrants, while agriculture has a negative correlation with the attributes.

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More than half of the proportions of the total variance of variables decade variation, immigrants and agriculture and nearly 86, 66 and 93% of the common variances in comparison with their communalities, are associated with this factor. Female literacy and Sikh migration also show their association in a fairly good measure (Table 1). This underlines the fact that where population growth has occurred, migrants have played significant role and female literacy and Sikhs percentage have been found to be higher. Agriculture is not important in these areas. Where agriculture predominates all these variables will be absent in the same ratio. Obviously, industrially advanced urban areas exert a pull on not only the surrounding area but also on distant areas. The partition of the country in 1947 also contributed to it.

The cities receiving large number of migrants are Ghaziabad (factor score 7.76), Dehra Dun (6.77), Kanpur (4.50) and Firozabad (2.74). Their percentage variations from 1901 to 1971 had been 1032.59, 556.44, 528.83 and 694.49 respectively. The agriculture dominated cities could be put in decreasing order, as is obvious from the cases of Shahjahanpur, Rampur, Mirzapur, Varanasi and Moradabad which have respectively 13.29, 6.60, 10.30, 14.88, 7.75, 4.98 and 5.92% persons engaged in agriculture and have their factor scores of 5.65, 5.40, 4.55, 3.62, 2.58, 2.34 and 2.25 respectively.

Factor IV

The percentage of the variance associated with this factor is 10.09 (Table 2). The square of the loadings explain that .74, .75, .54 and .52 proportions of the total variance of Muslim, Hindu FW and SC/ST and, comparing the communalities estimates of these, nearly 77, 79, 62 and 77% of their common variances are associated with this factor (Table 1). This communal factor can well be named as segregation of religious groups. There are no better distinction among other communities than between these two. In case of Hindu, owing to vanishing **purdah** system with the dawn of independence the females came out to work accounting for high school association. SC/ST and male literacy is also associated with this variable. Ih general, Muslims have larger family sizes, with the result of PPHH's association with this factor, although not significantly. Hindus dominate in Dehra Dun (—8.09), Jhansi (—5.75), Ghaziabad (—3.93), Allahabad (—3.72), Kanpur (—3.00), Faziabad (—2.91) and Mathura (—2.02) where the percentage of Hindu population is 85.54, 80.05, 85.33, 75.36, 76.70, 78.58 and 84.75, respectively. The Muslims predominate at Rampur (71.93%), Moradabad (48.99), Shahjahanpur (43.88), Firozabad (40.02), Bareilly (33.49) and Saharanpur (38.60) with factor scores 11.44, 5.94, 5.13, 4.78, 3.89 and 3.07 in order.

It is significant to note that Aligarh, with 33.08% Muslims, has not been grouped in Muslim dominated areas because of its association with certain characteristics of Hindu population. The fading **purdah**

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system with the spread of literacy is an example in point. The literacy is higher due to the establishment of Aligarh Muslim University. It is also responsible for higher female literacy which has prompted them to go out to work.

Factor V

It explains only 6.81% of the variance. On an average, primary activities, namely MQ and Sikh are highly associated with construction, manufacturing, agriculture and SC and ST are negatively correlated with MQ, construction and Sikh variables, although with very low loadings. The square of the loading show that more than half of proportions of total variance of MQ and construction and 96 and 73% of their common variances, as compared with their communalities, are associated with this factor. Dehra Dun (factor score 5.80), Meerut (4.23) and Rampur (2.64) record 1.59, 2.12 and 1.47% workers in M and Q, 3.18, 2.92 and 4.65% in construction and 6.90, 2.90 and 1.09% Sikhs.

Kanpur and Firozabad are cities where manufacturing, agriculture and SC/ST population have negative loadings. These two cities have been grouped together containing above variables. Their percentages in respective variables are 35.99 and 58.36 in manufacturing 3.68 and 0.75 in agriculture and 14.23 and 9.87 in SC and ST. Obviously, exceptionally high percentage of persons engaged in manufacturing in Firozabad and 14.28% SC/ST in Kanpur, the highest in U.P., led to their grouping in this factor.

Factor VI

Factor VI, indicative of traditional social status, explains 5.62% of the variance. As the square of the loading indicates .90 proportion of the total variance of T and C and 96% of the common variance, in comparison to its communality estimates, is associated with this factor. Jhansi and Rampur with 27.89 (max.) and 14.48% workers in transport, 2.27 (max.) and .86% FW and 15.93 and 71.93% (max.) Muslims, have loaded this factor with the factor scores 3.03 and 2.64, respectively. Obviously, as seen in Chapter II, being the railway junction employing the highest percentage of workers under transport and highest FW in all the cities of U.P. Jhansi gets maximum loading and Rampur, owing to its highest proportion of Muslims have been drawn in this group. Muzaffarnagar, the only Mandi of U.P., employs maximum of 28.41% workers in trade and commerce as such, grouped in this factor with a loading of —3.62.

Inferences

After the analysis and synthesis of various aspects on the basis of factor analysis, it is worthwhile to assign particular classes/groups to the cities of U.P. To ascertain the character, more than the average of the respective factor scores (Table 3) have been considered to classify into uni, bi or multi-dimensional cities.

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Uni-Dimensional Cities

Out of the total of six cities occupying their berths in this group, Agra, Aligarh have been classified as manufacturing dominated; Lucknow is the lone representative of dimension high Achieved Economic Status (AES); Meerut is categorized as a city of primary activities, while Mirzapur as agricultural, and Saharanpur as uni-dimensional factor, Muslim dominated city.

Bi-Dimensional Cities

For categorizing these cities two dominant dimensions have been taken into account. Here again a total of six cities have emerged. The dimensions and cities are as follows: AES and Hindus in case of Allahabad, male concentration and agriculture in Farrukhabad, AES and transport in Gorakhpur, non-workers and Hindus in Mathura, non-workers and TSS in Muzaffarnagar, manufacturing and agriculture in Varanasi.

Multi-Dimensional Cities

Such cities have been identified on the basis of the dominance of more than 2 dimensions. In Moradabad and Shahjahanpur the 3 dimensions are manufacturing, agriculture and Muslims, in Faizabad AES, agriculture and Hindus and in Bareilly manufacturing, transport and Muslims. For Dehra Dun and Jhansi 4 dominant factors have emerged. They are AES, migration, Hindus and primary activities in Dehra Dun, and AES, non-workers, Hindus and transport in Jhansi. Further, in case of Kanpur, Firozabad and Rampur 5 dominant factors have emerged. As observed, the 5 dimensions are AES, high MC, migration, Hindus and manufacturing in Kanpur; manufacturing, MC, migration, Muslims and manufacturing in Firozabad and manufacturing, agriculture, Muslims, primary activities and transport in Ranpur.

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NEW APPROACHES TO THE COLLECTION OF PLANNING DATA: ON BIRTH AND DEATH AND ESTIMATION OF VITAL RATES

by

JOSEPH UYANGA*

INTRODUCTION

Population data is a vital input in plan preparation and even implementation. There are three approaches to population data collection — the single round, multi-round, and dual record surveys. There are also two approaches to vital rate estimation — direct estimation and indirect estimation. No single combination of these procedures is unambiguously preferrable in terms of resource, cost and time minimization or maximization of the expected reliability of vital rate estimates.

The salient characteristic of direct estimation is the collection of data pertaining to births and deaths which occur during a specified reference period. Basically, single round, multi-round and dual record surveys imply distinctly different data collection procedures. In theory they form a progression from the less to the more reliable. Even though the multi — and dual record surveys are more costly than single-round surveys, they do not always provide more reliable results in practice.

Indirect vital rate estimation is a relatively new approach to demographic research. It developed in response to the deficiencies typically found in data collected in single-round surveys. In such surveys, respondents frequently report reference period birth and death data inaccurately, but seem to be able to report other types of demographic data (e.g., characteristics of household members: are children ever born, children surviving, etc.) relatively accurately. The essence of indirect estimation is the transformation of those types of data which are relatively reliably reported into vital rate estimates.

There are a number of indirect techniques for estimating vital rates, the general characteristics of these techniques is the use of demographic models to transform observed data into vital rates estimates. The models provide the indirect techniques with their power, but they are also a potential source of weakness in that their use creates the possibility of modelling error. Modelling error arises when the recent demographic

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history of a population is inconsistent with the assumptions embedded in the model underlying a particular indirect technique. Thus, indirect estimation involves an explicit or implicit decision that a particular technique is suitable for the population under investigation. Unfortunately this decision is frequently made on the basis of whether or not results from the application of a technique are consistent with the expectations. This is an unsatisfactory procedure and represents a major shortcoming of the indirect approach.

Despite this limitation the indirect method has been applied in different developing countries. The comparability with data collected by the single round survey approach has narrowed the methodological superiority of multi-round and dual record surveys relative to the single-round survey. Therefore, as a basic strategy of measuring demographic rates the recently developed techniques use single-round surveys to collect the type of data needed for both direct and indirect estimation techniques. The technique acknowledges the paucity of survey resources in the developing countries and makes use of two types of questionnaires: The Basic Demographic Questionnaires and the Last Live Birth Questionnaire.

The Basic Demographic Questionnaire

This questionnaire (Fig. 1) collects data which can be used for both direct and indirect estimation of vital rates. Data for direct estimation of fertility are obtained by the questions in Block 22 which ask the date of the last live birth for all women in the child bearing ages. This question is considered superior to an inquiry about births during a reference period because, for most respondents, it eliminates the option of reporting no events. The data obtained are sufficient, from a methodological point of view, to estimate crude and age-specific birth rates — for a twelve-month period preceding the survey. Data for direct mortality estimation are collected in two sections of the questionnaire. In Block 25 respondents are asked to report all deaths in the last twenty-four months, while in Block 26 they are asked to report deaths in the last twenty-four months to births which occurred in that period. Essentially Block 26 is a probing mechanism designed to improve the completeness of birth and infant death reporting.

For indirect fertility estimation data appropriate to four techniques are obtained: The Cho own-children method, the Brass P/F method, the Brass P_1 +/ method, and the Coale — Trussel fertility technique. Indirect mortality estimation is possible with three procedures: the indirect likelihood model, the adult orphanhood model, the death distribution technique.

A fundamental strategy underlying the Basic Demographic Questionnaire is the use of several different procedures to estimate a single demographic rate. On the assumption that all or some subset of the

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FIGURE 1. DEMOGRAPHIC QUESTIONNAIRE

Item	MEMBERS OF HOUSEHOLD	RELATIONSHIP	RESIDENCE		SEX	AGE		EDUCATION		ORPHANHOOD		
	Give the names of everyone in this household: both usual members and visitors (starting with the head of the household)	What is the relationship of this person to the head of household?	Does this person usually live here?	Did this person sleep here last night?	What is the sex of this person?	How old is he/she? (age as of last birthday)	In what month and year was he/she born?	Has he/she ever attended school?	If yes, how many years of schooling were completed? (If none, enter 00)	Is his/her father still alive?	Is his/her mother still alive?	If mother alive for children under age 15 write number of mother (If mother not in household enter XX) (12)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Punch card col. nos. 19-20	-	21	22	23	25	25-26	No. 27-28 / Yr. 29-30	31	32-33	34	35	36-37
Line number 01												
										Yes-1 No -2	Yes-1 No -2	
			Yes-1 No -2	Yes-1 No -2	Male-1 Female -2			Yes-1 No -2		Yes-1 No -2		

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Fig. 1. Demographic Questionnaire Cont'd.

PERSONS AGED_____AND OVER					ALL EVER_MARRIED WOMEN AGED___AND OVER											
MARITAL STATUS					NUMBER OF LIVE BIRTHS										FACTS ABOUT HER MOST RECENT LIVE BIRTH	
Has	If ever married				Does (name) have any children of her own living with her? How many sons (S) and how many daughters (D)? (If none, enter 00)		Does she have any children of her own who do not live with her? How many sons and how many daughters? (If none, enter 00)		Has she ever given birth to a child who later died? How many sons and how many daughters have died? (If none, enter 00)		Just to make sure I have this correct, she has had (sum) births. Is this correct? (Enter sum below)	In what month and year did her last live birth occur? (If not applicable, draw horizontal line through 22 and 23)		What was the sex of this child? Male - 1 Female-2	Line number of persons responding to items 18-23
(name) ever been married? Yes - 1 No - 2 (If no, enter 2 and draw horizontal line through 14-17)	Is he/she now married (M) widowed (W) divorced(D) separated(S)?	Has he/she been married more than once? Yes - 1 No - 2	How old was he/she when he/she (first) married?	Is his/her (first) spouse alive? Yes - 1 No - 2												
(13)	(14)	(15)	(16)	(17)	(18)		(19)		(20)		(21)	(22)			(23)	(24)
38	39	40	41-42	43	S	D	S	D	S	D		Mo.	Yr.			
					44-45	46-47	48-49	50-51	52-53	54-55	56-57	58-59	60-61		62	63-64

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Fig. 1. Demographic Questionnaire Cont'd.

(25) During the past 24 months, has any member of this house died? ☐ YES ☐ NO
If yes, ask:

NAME	RELATIONSHIP TO THE HEAD OF HOUSEHOLD	SEX Male = 1 Female = 2	AGE DEAD	DATE OF DEATH	
				Month	Year

(26) During the past 28 months, has any member of this household given birth to a child who later died? (Yes/No) ☐ YES ☐ NO

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estimates will be tightly clustered around the true rate, it may then be possible to define a narrow range within which the true rate lies. This strategy avoids reliance on any simple estimate and requires that all estimates of a particular rate be as reliable as possible. Since international experience indicates that reference period birth and death data collected in single-round surveys are particularly unreliable, under the new approach a new questionnaire has been designed for collecting such data.

The Last Live Birth Questionnaire

Reference period birth and death data collected by the single-round survey approach are susceptible to two types of error: reference period error, and event omission. Reference period error arises when respondents mis-report the number of events occurring during a specified time period or when they misreport the dates of events. Events omission, on the other hand, arises when respondents forget about, lack knowledge of, or deliberately avoid reporting the occurrence of an event. Event omission is particularly a problem in the case of infant and early childhood deaths because of the sense of personal loss, and embarrassment associated with the death.

As shown in Figure 2, the Last Live Birth Questionnaire (LLB) attempts to obtain information on all births occurring to the members of surveyed population during a recent reference period. It is called the LLB Questionnaire because respondents, women in the childbearing ages, are first asked about their last live birth and then about other recent reproductive events. While the reporting of these events by women is not likely to be affected by forgetfulness, it can be affected by reference period error and by event omission associated with uncertainty about the termination status of a recent pregnancy or with deliberate event avoidance. The LLB approach is designed to minimize these sources of error. This objective is accomplished by structuring the questionnaire according to a rationale which distinguishes the completeness and accuracy of data collection.

Completeness is considered to be achieved if respondents report all births occurring within a reference period of one or two years preceding the survey. To obtain data on these births, respondents are asked a separate series of questions pertaining to: —

1. the pregnancy terminating in the Last Live Birth.
2. the penultimate pregnancy, and
3. any pregnancy which occurred after the reported Last Live Birth.

It is necessary to ask about penultimate pregnancies and pregnancies occurring after the reported Last Live Birth because, on the one hand, a penultimate birth can occur within some respondents may report the last surviving live birth as the last Last Live Birth.

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FIGURE 2A. LAST LIVE BIRTH QUESTIONNAIRE (ASK TO ALL WOMEN AGED 15-50)

LAST LIVE BIRTH

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	
Line Number of Woman In House-hold Listing	Have you ever had a live birth? (a birth showing any sign of life) 1. No 2. Yes-A5	Have you ever been pregnant? 1. No 2. Yes, still pregnant 3. Yes, mis-carriage 4. Yes, abor-tion 5. Yes, still-birth	Were there any signs of life? 1. No—STOP 2. Yes, breas-thing 3. Yes, cry-ing	FOR THE LAST LIVE BIRTH: Date of the birth? DA M YR	Was the birth after the Ind. Anniver-sary before last? (1 Oct. 1984) 1. Yes 2. No	Type of birth? 1. Single 2. Twin 3. Trip-let	Sex of birth? 1. Male 2. Fema-le	Is the child still alive? 1. Yes 2. No	If the child died, AGE AT DEATH? HRS if less than 24 / DAYS if less than 30 / MONTHS if more than 30 days	

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FIGURE 2B. PENULTIMATE PREGNANCY

B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Line Number of Woman In Household Listing	Were you pregnant before the pregnancy of the LIB? 1. No C1 2. Yes-B3	FOR THE PENULTIMATE PREGNANCY Pregnancy Outcome? 1.Miscarriage-C1 2.Abortion---C1 3.Stillbirth- B4 4.Livebirth - B5	Were there any signs of life? 1. No---C1 2. Yes,breathing 3. Yes, crying	Date of the birth? DA MON YR	Was the birth after the Ind. Anniversary before last? (1 Oct. 1984) 1. Yes 2. No	Type of birth? 1. Single 2. Twin 3. Triplet	Sex of birth? 1. Male 2. Female	Is the child still alive? 1. Yes 2. No	If the child died, AGE AT DEATH? HRS if less than 24 DAYS if less than 30 MONTHS if more than 30 days

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FIGURE 2C. PREGNANCY AFTER THE LAST LIVE BIRTH

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Line Number of Woman In Household Listing	Did you become pregnant since the LIB? 1. No-STOP 2. Yes, still pregnant-STOP 3. Yes, pregnancy terminated	FOR THE PREGNANCY AFTER THE LIB: Pregnancy Outcome? 1. Miscarriage-STOP 2. Abortion-STOP 3. Still-birth-C4 4. Live-birth-C5	Were there any signs of life? 1. No-STOP breathing 2. Yes, crying	Date of the birth? DA MONYR	Was the birth after the Ind. Anniversary before last? (1 Oct. 1984) 1. Yes 2. No	Type of birth? 1. Single 2. Twin 3. Triplet	Sex of birth? 1. Male 2. Female	Is the child still alive? 1. Yes 2. No	If the child died, AGE AT DEATH? HRS if less than 24 / DAYS if less than 30 / MONTHS if more than 30 days

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Accuracy is considered to be achieved if, for each pregnancy episode, the correct termination status is reported and if, for each live birth, its date of birth, multiplicity, (single or multiple event), and survival status are all correctly reported. To aid respondents in reporting pregnancy termination status, questions are asked about signs of life at pregnancy termination, (crying or breathing). Similarly, a question is asked about the multiplicity of each reported live birth. And finally to aid respondents in the reporting of dates of birth, a question is asked to determine if the birth occurred before or after a religious or civic holiday of common knowledge, as well as a question about the date of birth. Thus if a survey were conducted in a christian population during May of 1980, respondents may be asked if a reported birth occurred before or after Christmas 1978. If a respondent reports a date of birth prior to December 25, 1978, but indicates that the birth occurred after Christmas, the interviewer must reconcile the inconsistency.

The LLB Questionnaire follows a structure which resembles a truncated pregnancy history and employs probing questions which have been previously used in several demographic questionnaires. It differs from the usual pregnancy history format in that information on events is collected in a reverse chronological order. It brings multiple probing procedures into a single, logically-designated questionnaire, and those questions are asked of all respondents, thereby eliminating interviewer discretion in their application. A final innovative aspect of the questionnaire is the collection of mortality data only for reported births. Such data do not include all infant deaths during the reference period. Infant deaths to births born just prior to the reference period are omitted.

Comparison of Estimation Techniques

Several procedures can be used to estimate infant mortality rates (IMR) from statistics on the proportion dead of births occurring during a reference period. A powerful procedure is that which uses an infant mortality separation factor, a multiplier, the inverse of which is the ratio of all infant deaths to a calendar year birth cohort to the infant deaths occurring within the same calendar year as the births.

This approach which is an indirect technique of transforming these proportions into IMR estimates, does not require precise reporting of dates of birth and death, but only that births be accurately classified as occurring within or without a reference period. If the reference period covers exactly twelve months, infant mortality is estimated with an infant mortality separation factor which in the absence of more specific information, can be derived from existing models.

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The indirect estimation of infant mortality rates with reference period survivorship data is based on a rationale which is conceptually similar to that underlying the Brass indirect approach to childhood mortality estimation.

There are however, important differences between the two procedures. There are also some persuasive reasons for preferring the reference period approach to the Brass approach. The Brass approach involves a number of restrictive assumptions, the most important of which are:

(1) Accurate child survivorship data: namely, that respondents completely report data on children ever born (CEB) and children surviving (CS);

(2) Stationary demographic conditions: namely, that fertility and mortality have been constant for the past fifteen to twenty years;

(3) Homogenous mortality: namely, that all children in the population experience the same mortality risks;

(4) Knowledge of fertility and mortality patterns: namely, that age patterns of fertility and mortality are known.

The first advantage of reference period approach is that it is likely that the data required for its application can be collected more accurately in the developing countries than the data needed for the Brass approach. This is so because of the highly specific probing questions which can be employed when collecting the reference period data. The second advantage of the several of the assumptions underlying the Brass approach, i.e., the assumptions concerning stationary demographic conditions, knowledge of the age-pattern of fertility, and homogenous mortality risks for all children. The reference period approach is free of the problem of non-homogenous mortality because analysis can be performed for all births combined. Of course, analysis can be applied to subgroups of births defined by the mother's demographic or socio-economic characteristics and this procedure would permit identification of non-homogenous mortality conditions across subgroups.

Finally, the assumption about knowledge of the age-pattern of mortality, of critical importance to the Brass approach, is of only secondary importance to the reference period approach. To implement the reference period approach it is required to assume an age pattern of mortality over the first twelve or twenty-four months of life, whereas, the Brass approach requires an assumption about the age pattern of mortality over at least the first ten years of life.

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Because of the superior methodological basis of the reference period approach, estimates based on it can be accepted with greater confidence than estimates based on the Brass approach. Estimates based on both, however, can provide a richer understanding of conditions of mortality than can be derived from either approach in isolation.

Investigating the Determinants of Fertility

The new approaches have provisions for the estimation of the determinants of fertility, because of the interest most planners have about fertility, nuptiality, family planning economic and social characteristics of the household. Such estimates are good for developing some meaningful indicators of the standard of living under various rubrics such as "social indicators" and "basic needs". The collection of a wide-range of demographic, social, and economic information at the household level for measuring living standards is much more meaningful and reliable than using aggregate indicators such as the national economic accounts.

The new approach takes into account the vast and growing literature on the determinants of fertility, and that the effects of the many potential influences on fertility cannot be adequately investigated because data sets permitting their simultaneous investigation have not been available. Thus the new approaches aim at collecting information on a wider-range of variables than has been collected in the past population surveys. This is because fertility decision is recognized as a decision made by a woman and her companion in relation with a wide-range of other household decisions.

Alternative Theories of Fertility

In the new approach, the questionnaires on the determinants of fertility is not guided by a single theoretical approach but rather recommends the collection of data sufficient to permit comparative empirical assessments of each approach as well as the development and testing of new syntheses of the four approaches, namely:

(1) the micro-economic theory of fertility;

(2) the sociological theories based on status attainment and "intermediate variables" approaches;

(3) the "value of children" approach; and

(4) the "supply oriented" approach, focusing on family planning methods.

As shown in Fig. 3 the Determinants of fertility Questionnaire consists of five separate questionnaires. The first, a household questionnaire, then the woman's questionnaire, the husband's questionnaire,

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FIGURE 3. TOPIC COVERAGE IN THE QUESTIONNAIRES ON THE DETERMINANTS OF FERTILITY

I. Household Questionnaire

Household roster; materials of dwelling
Household facilities and assets

II. Woman's Questionnaire

W1. Background
W2. Fertility History
W3. Family Planning/Contraceptive Use
W4. Marriage/Union History
W5. Current Work and Earnings
W6. Birth Interval Information
W7. Activities of Children

III. Husband's Questionnaire

H1. Background
H2. Marriages and Children
H3. Family Planning
H4. Husband's Work; Other Household Income

IV. Household Enterprise Questionnaire

A. Income from Agriculture and Forestry

A1. Farm land
A2. Farm capital
A3. Crop growing
A4. Animal raising
A5. Farm expenses

B. Income from Non-farm Business

C. Future of the Farm/Business

IV. Community Questionnaire

1. **General community characteristics**
2. **Transportation**
3. **Community facilities**
4. **Community modernization**
5. **Employment**
6. **Agriculture (if relevant)**
7. **Family Planning**

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household enterprise questionnaire, and Community questionnaire. The Community questionnaire is meant for the collection of community level data useful in planning and formulating policies.

CONCLUSION

This paper was intended to elaborate on the recent innovative approaches to population data collection. The new advances focus on indirect techniques of data analysis; and provide techniques which can be applied to populations for which reliable direct data on fertility and mortality do not exist. The development of the new birth and death data collection questionnaire facilities the direct collection of reference period fertility and mortality data. The strength of the Last Live Birth Questionnaire is that it combines certain advantages of direct data collection and indirect analysis techniques, especially with respect to the estimation of infant mortality rates. This technique has also the merits which render it applicable in the developing countries where population data for planning are sometimes non-existing.

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TIN, OIL AND TOURISM IN MALAYSIA

by

BADAR ALAM IQBAL*

Malaysia is fortunate enough in natural resources in South East Asia. The present paper highlights the potentials of these natural resources.

TIN: Malaysia, Indonesia, Thailand and some economies of the African continent are the major producers of tin in the world. Out of these nations Malaysia is the biggest producer. Now-a-days these economies are not getting the remunerative prices of their metal. This is because growth rate in global production is higher than the rate of growth in global consumption. Trends in global output and consumption of tin from 1971 to 1981 can be observed from Table I.

TABLE I. TRENDS IN GLOBAL OUTPUT AND CONSUMPTION OF TIN 1971 AND 1981

Year	*World Output (100,000 tonnes)*	*% increase or decrease*	*World consumption (100,000 tonnes)*	*% increase or decrease*
1971	1.9	—	1.9	—
1972	2.0	+ 5.2	1.9	0.0
1973	1.9	— 0.0	2.1	+10.5
1974	1.8	— 5.2	1.7	—10.5
1975	1.8	— 5.2	1.9	0.0
1976	1.9	0.0	1.8	— 5.2
1977	1.9	0.0	1.9	0.0
1978	1.9	0.0	1.9	0.0
1979	2.0	+ 5.2	1.8	— 5.2
1980	1.9	0.0	1.7	—10.5
1981	2.0	+ 5.2	1.6	—15.8

Source: Tin Council (International).

Note: Excludes USSR, East Germany, China. Consumption also Excluded North Korea and Vietnam.

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Data set out in Table I show that between 1971 and 1981, global production has gone up by more than 5 per cent. Whereas world consumption of tin indicates an alarming decline of more than 15 per cent. The figures for both world production and consumption are disturbing. Fluctuations in regard to world consumption are more alarming as compared to fluctuations in world production of tin during the period under review. They are ranging between + 10.5 per cent and — 15.8 per cent. This has created a panic in world economy of tin. As a result of this, prices in international markets have gone down over the years. This has resulted in unremunerative unit value realization on the part of the major producing economies in general and Malaysia in particular.

In order to overcome this state of affairs, the Malaysian Government has taken a very bold step and has formed an association to have better gains. This association includes Indonesia as well as Thailand. Their main aim is to review the status of the Sixth International Tin Agreement and to follow up actions as the situation dictates. As the said economies constituted major proportion of the total votes (35.2 per cent, 19.2 per cent and 17.6 per cent) they have signed a new agreement at their will and wish. It has created a great feeling of concern among the consuming economies. This step could bring better economic gains if implemented in true perspective.

Another positive step which the Malaysian Government has taken in this direction, is 'Supply Rationalization and Production Control'. Due to this step Malaysia's share in total country's exports have come down considerably, i.e., by 10.8 per cent (19.6 per cent in 1970 to 8.8 per cent in 1980). There are indications that the share of tin in the country's total exports will continue to fall in years to come. Hence, it is high time for other major producing economies to follow the idea floated by Malaysian, i.e., rationality in supply and production control policy, if they want that they should be paid fair return on their metal. This is possible because there are no other outlets from where the consumer economies could get the metal and the global consumption has been rising at a faster rate. This is only possible when all the producing economies become united.

OIL: Petroleum industry is another vital aspect of Malaysian industrial economy which has greater potentials of growth and development if the same is put up on sound footing. In this regard, the Government of Malaysia has taken an important step by enacting the Petroleum Development Act (PDA) and Petroleum National Berhad (Petronas) in 1974. Due to this, Malaysia's total remaining oil and non-associated gas reserves went up from 1.5 barrels to 2.5 barrels and non-associate gas

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from 23 trillion to 36 trillion cu. feet between 1976 and 1981 — indicating an over all rise of 65 and 55 per cent, respectively. It is important to note here that so far, out of the vast continental shelf, nearly 230,000 sq. miles have been explored. This means the remaining area may also be a promising one and can add more to the country's total reserves of remaining oil as well as non-associated gas.

With the transformation of the ownership as well as control of petroleum industry in the hands of 'Petronas' there has been a real change in the basic structure of petroleum scene. Now Petronas has moved into new areas which were previously monopolized by foreign companies. It is now involved in oil exploration, crude exports as well as the transportation, distribution and marketing of petroleum products. In addition, two giant projects have been launched, i.e., the ING and Urea Fertilizer project in Bintulu.

Keeping in mind the policy of striking a balance between realizing more and more revenue from oil and oil products on the one hand and on the other hand to conserve the irreplaceable natural resources, the Government aims to strengthen the Petronas during the current plan. As a result, the Government of Malaysia has earmarked MS 4 billion for the purpose.

Because of the all out efforts on the part of Petronas, since 1977, there has been a continuous rise in the country's total remaining oil and non-associated gas which means a rise of 65 and 55 per cent, from 1.5 barrels to 2.5 barrels and 23 trillion cu. ft. to 36 trillion cu. ft., respectively.

Although it is likely that most of the large oil and gas fields in the Malaysia basin discovered, prospects for additional petroleum discoveries appear excellent. As Malaysia has a vast shelf, any step towards oil exploration will bring home good results and the petroleum industry will flourish like any thing in years to come.

TOURISM: Malaysia is considered as a land of pristine beauty, friendly people and natural attractions.[1] It has occupied a significant place in the Asian Continent so far as tourism is concerned. As a result, it is the seventh biggest economic activity of Malaysian economy.

Keeping in mind the vital importance of the said activity, the Government of Malaysia has earmarked a huge investment amounting to MS 28,528 million for the growth and development of this potential source of income. It is important to note that here nearly 72 per

[1] Shikha, B., All That Tourist Wants, The Eco. Times, New Delhi, April 15, 1982, p. 10.

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cent of the uncovered part of tourism will be looked after by the private sector. This means an increasing role assigned to private sector which is the primer objective of NEP.

During the last nine-year period (1972-1981) the country has registered a nearly 10 per cent growth in tourist traffic. The biggest proportion of tourist traffic comes from ASEAN, Japan, Hong Kong, Australia, New Zealand, Germany, France, U.K. and USA. Out of these nations, ASEAN alone accounts for nearly 60 per cent of the total tourists that arrived in Malaysia.

The basic reason for an increasing volume of tourist traffic in Malaysia is that it is cheaper as compared to other tourism spots in the world. Added to this Malaysia offers a lot to an average tourist as it has splendid beaches as well as it provides all necessary facilities to the tourist at a reasonable rate. Similarly, Malaysia is also well connected by roads and railways and tourists find easy to explore the spots of enjoyment in the country.

The Government of Malaysia has a firm stand to provide all possible facilities to tourists to enhance the revenue from this vital economic activity. Thus, prospects of growth and development of tourism in Malaysia are bright and this vital source of revenue needs an aggressive policy to take advantage from the existing potentials.

Notes and Observations

(from page 136)

secondary color, black, represents nature. There are seventeen flight feathers on each wing, eight tail feathers, and forty-five neck features, denoting 17 August 1945, the date of Independence Proclamation.

The motto "Bhinneka Tunggal Ika" means Unity in Diversity, signifying the unity of the people in spite of diverse ethnic and cultural origins.

The national flag is red (upper) and white (lower) of a rectangle, equally divided.

Fauna and Flora

The vast archipelago and innumerable islands have made Indonesia the home of a large variety of plant and animal life, both terrestial and aquatic. As the land mass is divided into islands, often mountainous, many terrestial species are endemic, originatnig and living in one particular island or part of a larger island.

Scientists divide Indonesia into three zones based on the theory that in the Ice Age, Sumatra, Java, and Kalimantan were joined to each other and shared the Sunda Shelf with the Asian mainland, while Irian Jaya lay on the Sahul Shelf with Australia. There are similarities of fauna with the continents they belonged to, while the region in-between has another type of fauna and even a marked difference in the flora and avifauna.

To protect the rare species from extinction, the Government has established nature reserves throughout the country. Among the rare animals are the *Orangutan* primates found in Sumatra and Kalimantan, the *Komodo* dragon (giant lizard) found on small islands of the west coast of Flores, the one-honored rhinocerous of West Java, the *Babirusa* pig deer and the *Anoa* dwarf buffalo of Sulawesi, and many different species of monkeys and birds.

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NOTES AND OBSERVATIONS ON THE REPUBLIC OF INDONESIA (RI)

by

F. M. LAPID*

Indonesia presents a wealth of information concerning its vast geographical extent as well as its long history of cultural development. Racial affinity of Indonesians and Filipinos magnify their neighborly brotherhood. This paper aims to present some interesting facts, figures and observations gathered by the writer during a recent visit to that country.

The Archipelago

Indonesia is the largest archipelago on earth with some 13,677 islands, of which over 6,000 are habitable. The area on the globe stretches 3,200 miles along the equator, dividing the Pacific and Indian Oceans. The same area separates two continents, Asia and Australia. The land area is 1,905,443 sq. km. (735,354 sq. m.). The north to south extends 1,770 kms. (1,100 m.) with latitude coordinates about 6°N and 11°S; longitude is about 95°E to 141°E or a total stretch of 46 degrees, necessitating three time zones covered.

The five largest islands are Sumatra, Kalimantan (Borneo, partly), Java, Irian Jaya (West Papua New Guinea), and Sulawesi (Celebes). The country is also divided into four geographical groups, namely: 1) the greater Sundas (Sumatra, Java, Kalimantan, and Sulawesi, 2) the lesser Sundas (also known as Nusa Tenggara, from Bali east to Timor), 3) the Moluccas (all the islands between Irian Jaya and Sulawesi), and 4) Irian Jaya. Java is the principal island in population and land use, while Bali Island, situated just east of Java, is the famous tourist spot.

Indonesia is the fifth most populous country in the world (after China, India, U.S.S.R., and U.S.A.). The 1980 census reported a population of 167.4 million, 70 percent of which live on the islands of Java, Bali and Madura. Urban population is concentrated on a few major cities which are mostly on the two islands of Java and Sumatra. Of the five cities with over one million (M) inhabitants, four — Jakarta (8M), Surabaya (2.4M) Bandung (1.7M), and Semarang (1.4M) are on Java territory. Only Medan (2.1M) is on the much larger island of Sumatra. Jakarta, the nation's capital, is on the northeastern coast of Java and is the center of government and economic activity. Half of the total population is under 20 years old and over 80 percent still live and work as peasants in small towns (desas) and villages (kampungs), primarily raising rice.

Indonesians, basically of Malay stock, are divided into approximately 300 ethnic groups which speak 365 languages and dialects. The major languages spoken (with the percentage of population) are: Javanese (40), Sundanese (15.2), Indonesian (12), Madurese (4.8), Minang (2.5), Batak (2.1), Balinese (2.1), Bugis (1.9) and Banjar (1.3). *Bahasa Indonesia* is the national language, based on Indonesian (12) above which is originally spoken in Sumatra and also known as Malayan language.

Islam is the predominant religion and Muslims constitute 87 percent of the total population. Those of different faith are Christian Protestants 6%, Catholics 3%, Hindus 2% and Buddhists 1%.

The climate is tropical with heavy rainfall. Daily temperature varies from 20° to 30°C or 68°-86°F; while humidity ranges from 60% to 90%. Rainfall is heaviest along the equatorial belt — Sumatra, Kalimantan, Sulawesi, and Halmahera — during the months of November to February. Driest periods are from June to September.

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* Mr. Lapid, editorial consultant and assistant manager, P.G.J., was a recent visitor (April-June '86) to Jakarta and Bali, Indonesia.

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Early History

Kingdoms of Java and Sumatra (700-1775 AD). Java and Sumatra, for over 1,000 years, hosted a series of kingdoms noted for their advanced learning, architecture, culture, and agriculture. A number of factors contributed to this development. A favorable climate and fertile soil derived from volcanic ejections supported the population. Moreover, the geographical location of Java being at the sea routes between two more advanced civilizations of India and China, exposed this island in the course of trade and commercial exchanges — thus benefiting in the arts and skills of stone carving, architecture, dance, literature, the introduction of their religions — Hinduism and Buddhism, their agricultural skills in wet rice farming, terrace building and irrigation. At the time, colonization and/or subjugation were not in vogue, but rather, gentle exchange, acceptance, and adaptation of new ideas by the Javanese.

The first kingdom, Taruma Negara (500-600 AD) had its base at the eastern edge of what is now Jakarta. A few relics of Hinan and Chinese trade dealings are all that were of record. The second kingdom, Sriwijaya (700-1100) based in Palembang, Sumatra, was noted for its Buddhist learning. About the same time (700 AD) in the Central Java, the kingdom of Shailendra, also Buddhist, flourished to the extent of building the Borobudur temple. Also during this same period (732 AD) rose the first short-lived Mataram Kingdom, Hindu oriented, which produced the temple complex at Prambanan, near Yogyakarta, Central Java. Some four hundred years later (1135), the Kediri Kingdom flourished in East Java, which introduced into the Javanese literature, the "Bharatayudha" or "War of the Bharatas". The Kediri dynasty faded soon due to internal fighting. At the close of the 12th century (1200) the Singhasari Kingdom in Central Java rose to prominence but lasted only for 70 years due to family squabbles for power. However, this dynasty was able to build some of the finest temples in Central Java and developed a unique style of architecture.

The last and most famous of the Hindu-Buddhist kingdoms was that of Majapahit (1293-1389). The unification of all Java and other areas under this kingdom was mainly due to the energies and determination of its famous prime minister, Gadja Mada..

The following century (15th) saw the spread and power of Islam in the archipelago. Also during this period rose the last great Javanese kingdom, Mataram II (1600), founded by Senapati and expanded by Sultan Agung. However, in 1775 the Dutch overpowered the Sultanate when they destroyed the old Mataram empire and divided into royal houses of Surakarta, Mangkunegaran, and Yogyakarta.

Colonial Period (1500-1945)

Traders from the West, particularly the Portuguese, found their way in the early 1500's to the Southeast Asian region in search of trade on spices. By 1511 they took hold and conquered Malacca, a trading post in the Malaysian peninsula. They then proceeded eastward and established trading bases and forts in Java, Flores, Timor, Sulawesi (Celebes) and the Moluccas islands. By 1570 they held a strong grip of the spice trade, having fortified strongholds both in the western and eastern ends of the archipelago. This lasted into the 1600's.

Another European group of traders, the Dutch, wanting to profit from the lucrative spice trade and having developed their maritime power to buttress such adventure, were able to wrest control from the Portuguese the western part of Malacca as well as the spice port of Makassar by 1667. Batavia (old name of Jakarta) was made the headquarters of the United Dutch East India Company from 1602 to 1799. The Dutch expanded their influence beyond trade and in 1678 armed units marched into Central Java to aid the Mataram King against Madurese forces. From this aid the Dutch maneuvered to acquire political concessions which eventually succeeded in easing local administrators' powers.

Due to European conflicts, the Indies control passed briefly (1811-1815) to the British, but was regained in 1816. By 1849 the Dutch controlled Bali, and in 1904, Banda Aceh in Sumatra.

Dutch occupation from 1830 to 1942 were divided into three categories: the "Cultivation System" (1830-1870) forced peasants to cultivate/grow plantation crops for delivery to the government, rather than pay taxes; then the "Liberal Period" (1870-1900) which marked the growth of private plantations instead of those belonging to the State. The last was the "Ethical Period" (1900-1942) which gave greater emphasis on the welfare of the Indonesian people.

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The Republic of Indonesia (1945-1965)

Indonesian Independence was proclaimed by nationalistic leaders Sukarno and Mohamad Hatta on 17 August 1945, soon after the Japanese surrender to the American Armed Forces (August 15, 1945).

The 1945 Constitution set up a parliamentary government with a strong President. The 1950 Provisional Constitution with a weak President, took hold till 1957 when Sukarno, beset with economic and political problems, reverted to the 1950 Constitution to assume greater powers, leading to a period of "Guided Democracy". Indonesian control of West Irian was obtained by Sukarno with international recognition under the conditions of "Act of Free Choice", which finally in 1969 was settled in favor of Indonesia — thus consolidating Indonesian sovereignty over all former Dutch territory.

Under "Guided Democracy" President Sukarno had to wrestle with serious problems, both domestic and foreign. In the domestic front: economic decline, inflation; political power instability: 3-cornered fight — communist party, the Army, and the President; rebellion in Sumatra and North Sulawesi broke in 1958. In foreign affairs, Sukarno launched his "Confrontation" against the newly British-sponsored Federation in Malaysia in 1962. There were border clashes in Kalimantan; he rejected American aid; withdrew participation in the United Nations in 1965, and seemed more influenced by communist dealings.

The New Order: 1965-Present (1986)

On September 30, 1965 communist elements staged an attempted coup to take over the government by killing six army generals and a captain. The plot was neutralized by General Suharto who was then in command of the Army's Strategic reserve forces. Anti-communist support was mobilized and bloody encounters between communist and anti-communist factions raged. President Sukarno's powers were gradually eased cut. By mid-1966 order had been restored and the power of PKI (communist party) had been crushed.

The "New Order" of the Suharto-led government started rehabilitation: end rampant inflation by late 1968, encourage foreign investment, strive for self-sufficiency in rice production, and in 1969 started the first Five-Year Plan for Indonesian industrialization program.

The Indonesian government now under the 1945 Constitution provides: 1) a strong president, 2) a 460-member Parliament (DPR), and 3) a 920-member higher legislative body — the Peoples Consultative Congress (MPR) which includes DPR and additional member.

The MPR sets state policies and elects the President for a 5-year term. President Suharto has won four endorsements by the MPR in 1967, 1972, 1978 and 1983.

The State Ideology, PANCASILA

Pancasila means five principles and is the state philosophy of the Indonesian people. It is also the doctrine upon which their government is based. The 1945 Constitution preamble identifies these five principles as: (1) belief in one God, (2) a just and civilized humanity, (3) unity of Indonesia, (4) sovereignty of the people, and (5) social justice.

These principles are represented on the shield of the Coat of Arms of Indonesia. At the center is a star (gold on black background) representing belief in one God. Clockwise, at the top right, is the banyan tree representing national consciousness; below the tree is an unbroken chain which depicts the continuity of human generations, the round links for woman and the square ones for man — symbolizing democracy; social justice is symbolized by rice grains and cotton (gold on white) representing food and clothing which are the basic needs of the people; and on top left is the head of the *banteng* or native buffalo, black on red background, representing the sovereignty of the people.

The shield, a weapon of self-defense, symbolizes both struggle and protection. Its main background colors, red and white, are those of the national flag. The bar across its center represents the equator which passes through the islands of Sumatra, Kalimantan, Sulawesi, and Halmahera.

The carrier of the shield is the Garuda, a mythical golden eagle symbolizing creative energy; its principal color, gold, suggest the greatness of the nation, the *(See: NOTES AND OBSERVATION on page 133)*

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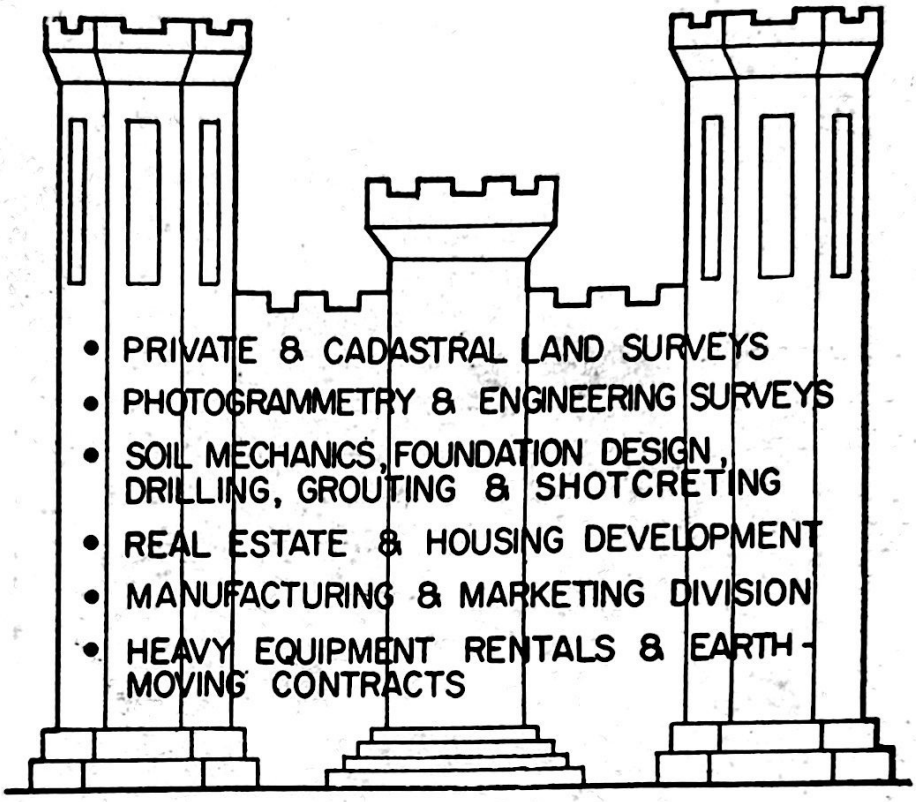

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