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THE HYDRAULIC CIVILIZATIONS

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THE HYDRAULIC CIVILIZATIONS

THE HYDRAULIC AND THE URBAN REVOLUTION

A great deal has recently been said about the "urban revolution"--a process of differentiation that split and orginally village--centered agrarian society into an urban a rural sector: town and village. The distinction between town and village considerably interested certain classical economists (Smith, 1937, pp. 373 ff), including Marx (1953, pp. 381, 382 ff.; 1919, I, 317; III, Part I, 318.). Properly employed, it opens up important sociohistorical vistas.

However, those who use it today, either as part of a general developmental scheme or as a means for juxtaposing urban and rural ("folk") culture, tend to disregard two essential methodological precautions. Stress on the revolutionary character of the rise of the town one-sidedly accents what at the most is only one among several features of cultural change. For instance, Childe, who is eager to accustom his readers to the idea of revolution (1952, p. 19), thus promotes historical views that are highly problematic. And his unqualified emphasis on urbanization as a developmental feature bulwarks the thesis of a general evolution in agrarian civilization that is manifestly false. This thesis, which culminates in the concept of a unlinear and necessarily progressive development of society, clearly contradicts the facts of history. It also contradicts the views of the classical economists, who with varying consistency recognized that the higher agrarian civlization of the "Orient" and their urban and rural conditions followed a pattern of development decidedly unlike that of the West.

A juxtaposition or rural and urban institutions will promote our analysis of agrarian history to the extent to which we realize that there are at least to major types of rural-urban agrarian civilization--hydraulic and non-hydraulic--and that the primitive farmers who started on an agrohydraulic course initiated a

revolution that, structurally and for a whole epoch, split the higher civilizations into two different parts. Prior to the urban revolution and with extraordinary consequences, the fate of agricultural man was profoundly shaped by what may be suitably called the "hydraulic revolution."

MAJOR EFFECTS OF THE HYDRAULIC REVOLUTION

HYDRAULIC AGRICULTURE

The peculiarities of agrohydraulic civilization become apparent as soon as we realize the role that the management of water has played in the subsistence economy of certain agrarian societies. To be sure, water is no more essential to agriculture than several other basic factors, such as temperature, the lay of the land, the fertility of the soil, and the character of the cultivable plants. But water is specific in that, among the manipulative essentials, it is the only element which tends to agglomerate in bulk (Wittfogel, 1956, chapt. ii). In its agriculturally most precious occurrence --as the water of rivers and large streams in arid or semiarid regions--it therefore defied the small-scale approach which, under preindustrial conditions, was so effective in the treatment of soil and plants. In order to bring fertility to large water-deficient areas by the management of substantial sources of water supply, man had to create large-scale enterprises that usually were operated by the government. The emergence of big protective water work (for irrigation) was frequently accompanied by the emergence of big protective water works (for flood control), and at times the latter even surpassed the former in magnitude and urgency. I suggest that this type of agrarian economy be called "hydraulic agriculture" to distinguish it from rainfall farming and hydroagriculture.

It is customary to apply the term "rainfall agriculture" to a situation in which a favorable climate permits cultivation on the

basis of natural precipitation. The term "hydroagriculture" may be applied to a situation in which the members of a farming community resort to irrigation but, because of the scarcity and fragmentation of the available moisture, to irrigation on a small scale only. The term "hydraulic agriculture" may be applied to a situation in which the dimension of the available water supply leads to the creation of large productive and protective water works that are managed by the government.

INSTITUTIONAL ESSENCE OF HYDRAULIC CIVILIZATION.-

Irrigation was practiced in parts of Greece to compensate for the deficiencies of a semiarid climate and in Japan for the cultivation of an aquatic plan-rice. But in both countries a broken terrain oermitted the growth of only small irrigation works, which could be handled without government direction. This fact has had far-reaching socio historical consequences. Japan established a simple variant of the same feudal society which, in a more complex form, emerged in medieval Europe (Wittfogel, 1956, chap. x). And Greece, prior to the Hellenistic period, developed aristocratic and democratic ways of life. In each case hydroagriculture encouraged the evolution of a multicentered society, an institutional conformation that assumed great significance in the rainfall-based civilizations of feudal Europe.

The contrast between this development and that of the agro-hydraulic world is striking. Where agriculture required substantial and centralized works of water control, the representatives of the government monopolized political power and societal leadership, and they dominated their country's economy. By preventing the growth of strong competitive forces, such as a feudal knighthood, an autonomous church, or self-governing guild cities, they were able to make themselves the sole masters of their society. It is this combination of a hydraulic agriculture, a hydraulic government, and a single - centered society that

constitutes the institutional essence of hydraulic civilization.

DIFFERENTIATIONS.-

Within the orbit of hydraulic civilization immense cultural differences occur; but this essay cannot elaborate on them. An inquiry dealing with man's impact upon his natural environment may content itself with discussing certain subdivisions of the general institutional order that concerns this man-nature relation.

Development in political structure is most consequential when the primitive governments of hydraulic tribes, managed largely by part-time functionaries, evolve into statelike organizations, managed by a body of full-time officials. The hydraulic state provides more comprehensive opportunities for imposing hydraulic installations upon the natural environment, but it also gives the men of the state apparatus the oppotunity to neglect water works which will benefit the people, in order to build huge palaces and tombs and process precious organic and inorganic materials which will benefit the rulers.

Development in the patterns of property may lead from a predominance of state control over land and over professional handicraft and trade (simple hydraulic society) to a configuration in which mobile property in industry and trade is largely private, while land remains government controlled (semi-complex hydraulic society). or to a configuration in which private property in land is also widespread (complex hydraulic society). The rise of a semicomplex hydraulic order tends to differentiate the individual producer's interaction with nature; and it furthers the processes of locomotion which overcome difficulties of space and terrain. The rise of private property in land (tenancy

as well as ownership) tends to stimulate careful agriculture. The intensive farmers of the ancient Near East were mainly tenants of public (state and temple) lands or of private estates. In China the transition to private land-ownership evoked the comment that the peasants worked less carefully on the public fields than on their own land (Lü, 1936, ch. 17). Chinese peasant farming, which for over two thousand years has been based on private property of land, represents perhaps the most advanced form of intensive agriculture prior to the machine age.

Development in the spatial expansion of the hydraulic state is equally consequential. It is a historical fact that certain non-hydraulic constructional patterns and the major organizational and acquisitive patterns of hydraulic ("Oriental") despotism advanced far beyond the area of hydraulic economy proper. In "loose" hydraulic civilizations, such as China, India, and pre-Spanish Mexico, the monopolistic state apparatus controlled wide areas that had no comprehensive water works and in some cases not even small-scale irrigation.

This aspect was readily accepted by earlier analysts of "Asiatic" society, from the classical economists to Max Weber. But little effort has been made to explain the underlying mechanics of power. Still less analytic attention has been given to the fact that, either through a breakoff from a hydraulic regime proper (later Byzantium) or through institutional transfer, (Mongol and post-Mongol Russia and probably Maya society), there may be governments which fulfil few or no agrophy-draulic functions but which utilize the organizational methods of hydraulic depotism (such as record-keeping, census-taking, centralized armies, a state system of post and intelligence) as well as its acquisitive methods (such as general labor service, general and heavy taxation, and periodic confiscations) and its legal and political methods (such

as fragmentative laws of inheritance and the suppression of independent political organizations) to keep private property weak and the non-bureaucratic forces of society politically impotent.

In fact, so strong were the devises of hydraulic statecraft and social control that they operated successfully in "marginal" areas without those large-scale water works which persisted in the hydraulic core areas and which appararently were an essential feature in the genesis of all historically relevant agrarian monopoly despotisms. From the standpoint of man's relation to man, the instutitional periphery of the hydraulic world has been important in that it enormously widened the range of this man's relation to nature, it has been important in that, like the hydraulic core area, it frustrated the development of a big mechanized industry--the most profound recent change in man's attitude toward his natural environment.

MAN AND NATURE IN HYDRAULIC CIVILIZATION

Having considered the insitutional setting of hydraulic civilization, we are now ready to contemplate more closely the specific relations. These relations involve a peculiar system of mass labor in one segment of the economic order and a peculiar system of intensive work in another.

Government-directed Preparatory Operations: Division of Labor and Co-operation, Bureaucracy, Astronomical and Mathematical Sciences.

Hydraulic civilization came into being not through a technological but through an organizational revolution. Its rise necessitated the establishment of a new system of division of labor and co-operation.

Economic historians, when dealing with this matter, frequently assert that until the recent times agriculture, in contrast to

industry, involved little division of labor and no significant co-operation (Seligman, 1914, p. 350; Sombart, 1927, II, 825ff.; Marshall, 1946, p. 290; for pioneer formulations see Smith, 1937, p. 6, and Marx, 1919, I, 300, 322 ff.). By and large, this view is justified with regard to the conditions of non-hydraulic farming. But it does not fit the operational pattern of hydraulic agriculture. A major separation between "preparatory labor" (for this term see Mill, 1909, p. 31) and production proper is held to have occurred first in the industrial revolution. Actually, it took place much earlier and on an enourmous scale in the hydraulic revolution.

Comprehensive preparatory activities were necessary to make cultivation either possible (in arid areas) or safe and rewarding (in semiarid areas) or specific (in humid areas suitable for the growth of aquatic plants, such as rice and wet taro). The difference between this type of preparatory labor and the preparatory labor employed in modern industry is obvious. In industry preparatory labor provides the ultimate producer with raw material, with auxiliary material (e.g., coal for fuel and oil for lubrucation), and also with special tools (machinery). In hydraulic economy preparatory labor consisted essentially in the gathering, conducting, and distributing of one auxiliary material--water. In modern industry the workers who engage in preparatory activities, such as mining, the making of machinery, etc., tend to work full time at their various jobs. In agrohydraulic economy division of labor proceeded differently. The great mass of the men who made and maintained the canals and dikes and who watched for floods did not do so full time and for the greater part of the year but part time and for as short a period as possible. In their overwhelming majority they were farmers, and the very authorities who mobilized them for hydraulic and other corvée duties were eager to have them return in good time to their villages to attend properly to the cultivation of their fields.

Thus, like modern industry, hydraulic agriculture involves significant division of labor; but, unlike modern industry, it involves no significant division of laborers. And while the organizes of preparatory work in industry endeavor to achieve their pupose with as small a labor force as possible, the organizers of the hydraulic corvée are interested in mobilizing as large a labor force as circumstances permit.

In hydraulic tribes, such as the Suk and Chagga of East Africa and the Pueblo Indians of New Mexico, all ablebodied males participated as a matter of course in the ditch work. In small, state-centered hydraulic civilization, such as Bali and the early Mesopotamian and Indian city-states, the same mobilization pattern seems to have been customary (Wittfogel, 1956, chap. ii). A list of canal workers in ancient Lagash includes one corviable person from each commoner family (Shneider, 1920, pp. 108 ff.). In an irrigation conflict which, according to a pious legend, led to the Buddha's personal interference, the whole laboring population of the towns involved is said to have engaged in the hydraulic work (Anonymous, n.d., Jatakam, p. 441). Even clusters of territorial states may, at times, have gathered their combined populations to execute a big hydraulic task. This appears to have been the case in the Mexican federation prior to the arrival of the Spaniards. And it may have been a recurring trend in countries such as Egypt, where all villages depended on one huge source of irrigation water and where, therefore, their labor forces could be called up, either simultaneously or in shifts, to dig, dam, and watch for floods (Wittfogel, 1956, chap. ii).

In larger hydraulic civilizations varying regional conditions suggested varying patterns of state-directed corvée labor, but its mass character remained unchanged. The underlying mobilization principle is drastically formulated by a historian of Mogul economy, Pant (1930, p. 70): "The King by his firman (order) could

collect any number of men he liked. There was no limit to his massing of labourers, save the number of people in his Empire." Pant was speaking of Mogul India, but his statement is valid for all analogous periods and countries. In hydraulic economy man extended his power over the arid, the semiarid, and certain humid parts of the globe through a government-directed division of labor and a mode of co-operation not practiced in agrarian civilizations of the non-hydraulic type.

The development of such a work pattern meant more than the agglomeration of large numbers of men. To have many persons co-operate periodically and effectively, there had to be planning, record-keeping, communication, and supervision. There had to be organization in depth. And above the tribal level this involved permanent offices and officials to man them--bureaucrats.

Of course, there were scribes in the city-states of ancient Greece and Rome and on the manorial estates, at the courts, and in the church centers of medieval Europe. But there was no national managerial network. In the great Oriental civilizations a hydraulic bureaucracy (Wasserbau-Bureaukratie 'Weber, 1921-22, pp. 117') emerged together with the new type of organization in depth.

It was in these same Oriental (hydraulic) civilizations that man, in seeking a more rational approach to nature, laid the foundations for several sciences: astronomy, algebra, and geometry. Significantly, Greek mathematics and astronomy drew their early inspiration from the Oriental Near East, and they reached their climax under Euclid, Heron, and Ptolemy, not in Greece, but in one of the foremost centers of hydraulic culture--Egypt (Wittfogel, 1931, p. 682).

To be sure, neither the bureaucratic nor the scientific possibilities of hydraulic civilization were always exhausted.

Some simpler hydraulic civilizations did not advance far. But the major hydraulic centers created elaborate administrations, and their astronomical and mathematical accomplishments were impressive. Thus any attempt to define hydraulic man's relation to nature must also consider the organizational (bureaucratic) and the scientific aspects of hydraulic economy.

Irrigation Farming with Intensive Labor and Special Operations of Tillage

Government management of the great hydraulic works is supplemented by intensive farming based on irrigation. As stated above, irrigation farming also occurs in certain non-hydraulic societies, and to this extent the subsequent statements have validity beyond the borders of hydraulic civilization. But, while irrigation farming occurs occasionally in the non-hydraulic agricultural world, it is essential in the core areas of hydraulic civilization.

Irrigation demands a treatment of soil and water that is not customary in rainfall farming. The typical irrigation peasant has (1) to gid and re-dig ditches and furrows: (2) to terrace the land if it is uneven; (3) to raise the moisture if the level of the water supply is below the surface of the fields; and (4) to regulate the flow of the water from the source to the goal, directing its ultimate application to the crop. Tasks (1) and (4) are essential to all irrigation farming proper (inundation farming requires damming rather than ditching). Task (3) is also a frequent one, for, except at the time of high floods, the level of water tends to lie below that of the cultivated fields.

The type and amount of work involved in these operations become clear when we contrast the labor budget of an Oriental irrigation farmer with that of a rainfall farmer of medieval Europe. The medieval peasant usually plowed his field one or twice, then he sowed (Parain, 1942;

page, 142 ; cf, Maitland, 1921, pp. 398 ff.; Lamprecht, 1886, p. 557), and he harvested his crop at the end of the season. As a rule he spent no time watering.

The irrigation farmer, who, of course, plows, sows, and harvest, is in addition burdened with a number of other chores. In regions like Egypt, which depended mainly on innundation, these activities were insignificant, yet such regions were not very numerous. In others, such as ancient Mesopotamia, innundation was supplemented by canal irrigation. In this case a considerable amount of time was devoted to the watering of the fields (Meissner, 1920, pp. 192, 194). In modern India the husbandmen of a Punjab village spend much time irrigating their crops, wheat receiving three to four waterings in January, February, and March during more than twenty days. This work period is the most time-consuming item listed in the year's agricultural calendar (Singh, 1928, pp. 33-36, 38). Sugar cane is an old Indian crop, requiring a great deal of water. In certain Deccan villages favoring its cultivation, the total cost of plowing, harrowing, planting, harvesting, and related operations is about 97 rupees as against 157 rupees for watering (Mann and Kanitkar, 1920 p. 86.). In a South Gujarat village, studied by Mukhtyar (1930, p. 96), watering is by far the heaviest expense item in the labor budget of the grower of sugar cane.

Concerning Chinese traditional irrigation economy, Buck has provided us with valuable numerical data. In 1923, 152 farms in Pinghsiang (in present Hopeh Province) grew wheat as their main crop. Of the time devoted to this crop, the peasant spent 10.2 per cent in plowing, 1.7 per cent in harrowing, 9.2 per cent in harvesting, or altogether 21.1 per cent, as against 58.5 per cent in irrigating (Buck, 1930, p. 306). In 1924 two groups of farmers in Kiangsu Province spent 21 and 25.1 per cent, respectively, in plowing, harrowing, and harvesting their main rice crop, as against 18.1 and 39.6 per cent in its irrigation (ibid.,

p. 310). As may be expected, the labor budgets show great variation in detail, but they all reveal that the amount of work involved in watering operations is commonly far in excees of the combined operations of a non-irrigation farmer.

Repeated preparatory tillage--plowing or hoeing--was also undertaken by the rainfall farmers of feudal Europe (Cole and Mathews, 1938, pp. 324 ff.). But it was primarily on the manorial domain that the fields were "worked" three or four times, while the "poor" peasants could often only work their land once to the detriment of the yield" (Parain, 1942, p. 141; cf. Lamprecht, 1886, p. 557).

Except for some cutting of thistles (Parain, 1942, pp. 144 ff.; Kulischer, 1928, p. 160), intertillage was then, as now, technically impossible for grain crops, because, under conditions of rainfall farming, these "can be grown satisfactorily and most economically by planting them in solid stands so that they cover all the ground equally." As a rule, they are today "given no tillage while they are growing" (Cole and Mathews, 1938, p. 327).

Plants grown in rows are easily approached and easily cultivated. But the most important of these, corn and potatoes, appeared in Europe only after the discovery of America, and even after the sixteenth century their economic importance remained definitely secondary to that of the cereals. In the West the modern dry farmer still hesitates to cultivate grain crops in rows. After an early harrowing he frequently lets nature take its course (Widtsoe, 1913. pp. 163 ff.).

Irrigation agriculture requires a rowlike arrangement of the seeds not only for crops such as corn and potatoes but also for cereals. Plants can be watered by ditches only if proper space for the distributing furrows is provided. The layout of the fields differes in accordance with economic experience, crops, and terrain, but all patterns aim at making the plants accessible

to the irrigation farmer, who may work the soil and the crop as thoroughly as he wishes.

Intensive techniques are not limited to the period between sowing and harvesting. Frequently the soil is plowed or harrowed several times before the sowing. Nor are these techniques limited to the fields for which irrigation water is available. In semiarid areas (under conditions of full aridity cultivation ends where the water supply ends) the farmers are eager to grow not only crops which they can water but also crops which may mature without the benefit of irrigation.

Chinese farmers in the provice of Kiangsu who had sufficient water for two main crops only, rice and vegetables, used to grow wheat and barley without irrigation. However, they treated the last two as intensively as the first two. Of all labor devoted to wheat, intertillage accounted for over 20 per cent; in the case of barley, it accounted for almost 33 per cent; and in the case of kaoliang, which in some partsof Hopeh is grown without irrigation, it accounted for more than 40 per cent (Buck, 1930, p. 306).

In India certain Deccan villages grow their main cereal crop, bajri, also without irrigation. But, like the irrigated cereals, it is planted in rows and intensively cultivated. It gets one plowing and four harrowings before sowing and further treatment after sowing (Mann and Kanitkar, 1920, pp. 72 ff.).

The good Aztec farmer made beds for his corn, pulverized the soil, and kept his crop free of weeds (Sahagun, 1938, p. 39). He irrigated whenever this was possible, but he obviously was expected to farm intensively under any circumstances. The Mayan peasants of Yucatán, who did not water their crops, weeded them as carefully as did the inhabitants of the highland regions in which irrigation farming was customary.

Thus, as the political patterns of hydraulic civilization spread far beyond the areas of hydraulic economy, so the techniques of irrigation farming spread far beyond the irrigated fields. These techniques established an agronomical relation among man, soil, and plants that, in terms of a given amount of land, was much more rewarding than the agriculture of pre-industrial Europe. Early in the twentieth century a European agronomist found the Indian peasants, who by and large followed their traditional pattern of cultivation, quite as good as the average modern British farmer and in some respects better (anonymous, 1909, p. 6). The father of organic chemistry, Justrus von Liebig, in comparing nineteenth-century German agriculture with contemporary Chinese farming, viewed the former as the procedure of "a child compared to that of a mature and experienced man" (Liebig, 1878, p. 453).

Demographic Consequences.-

In some ways Liebig's statement touches upon problems that lie outside the concern of the biochemist. But he was quite right in noting the greater refinement--and better results-of hydraulic agriculture as practiced in China. Whatever its deficiencies, this method of farming produced great quantities of food on a given acreage, and it permitted the individual peasant to support his family on a very small farmstead. For this reason the areas of intensive hydraulic farming came to support extremely dense populations.

In preconquest America relatively small hydraulic regions comprised about 75 per cent of America's total population (Kroeber, 1939, p. 166; Rosenblat, 1945, pp. 188 ff.; 202 ff.; Kubler, 1946, p 339; for a considerably higher estimate of the population of the Inca Empire see Rowe, 1946, p. 185). Beloch's classical estimates (1886, p. 507) for the time of Augustus assume a much greater density for the Asian provinces of the

Roman Empire (thirty persons per square kilometer) than for the European provinces (ten persons per square kilometer). The contrast becomes even more spectacular when we juxtapose his figures for Augustan Greece (eleven) and Italy (twenty-four) with those of Egypt (one hundred and seventy-nine). More recent studies (Premerstein, 1936, p. 56; Rostovtzeff, 1941, II, 1138; III, 1605) suggest a still higher figure for Egypt, namely, about two hundred and eighty persons per square kilometer.

The population distribution in contemporary Han China was not unlike that of the Roman Empire. The old Chinese territories of the north seemd to have been as densely populated as Rome's eastern provinces, while the hydraulic core areas of the Han world showed demographic trends similar to those of their western counterparts, Egypt and Babulonia (Lao, 1935, pp. 216 ff.).

The dimension of the Oriental cities expresses both the productivity of hydraulic agriculture and the acquisitive power of its administrative centers. While, in classical days, Athens may have had 120,000 inhabitants, Corinth 70,000, and the majority of all Greek cities between 5,000 and 10,000 persons (Beloch, 1886, p. 478), Hellenistic Ephesus may have harbored 225,000 people (ibid., p. 231), Antioch 500,000 (ibid., p. 479; Kahrstedt, 1924, p. 663; Rostovtzeff, 1941, I, 498), Seleuceia 600,000 (Beloch, 1886, p. 479; Rostovtzeff, 1941, I, 498; II, 1140), and Alexandria at the end of the Hellenistic period the same number (Rostovtzeff, 1941, II, 1139 ff.). The recently published "gerusia acts" lead Rostovtzeff (ibid., p. 1139; cf. Premerstein, 1936, p. 56) to conclude that for A.D. 37 the total population of the Egyptian capital "must be estimated at one million at least."

It is also illuminating to compare these figures with estimates for metropolitan populations in pre-Spanish America and feudal Europe. Prevailing expert opinion credits Cuzco with

200,000 and Mexico City with 300,000 inhabitants (Rosenblat, 1945, pp. 205, 191). Some cities of Moorish Spain may have housed several hundred thousand persons, and the capital, Cordova, at its peak, a million (Wittfogel, 1956, chap. vi; cf. also al-Makkari, 1840, pp. 214 ff.). In contrast, in the fourteenth century the most populous city north of the Alps seems to have had 35,000 inhabitants (London), while other major English cities comprised 11,000 (York), 9,500 (Bristol), or between 7,000 and 5,000 persons (Rogers, 1884, p. 117). At the beginning of the fifteenth century the foremost city of the Hanseatic League, Lübeck, had 22,300 inhabitants and Frankfurt 10,000. Other big German towns of this century sheltered between 20,000 and 10,000 persons, Leipzig 4,000 and Dresden 3,200 (Büchner, 1922, p. 382.).

Chinese census data have been discussed at length. What should be remembered is that these data were compiled primarily for fiscal reasons. Since tax payments had to agree with the announced population, the census records tended to represent not the actual but the admitted population, that is, the lowest figures the regional officials dared to submit (Wittfogel and Feng, 1949, p. 53). Weak regimes got understatements, and tougher and more effective governments more realistic accounts. Two decades ago Buck, on the basis of a comprehensive rural survey, obtained population figures about 23 per cent higher than the official data. He hesitated to press his findings, but he stated that, if his higher figures were used, "the total would be over 600 million" (1937, p. 363). The first census taken by the new Communist government claims a total mainland population of almost 600 million persons.

Much more could be said on this subject. But the just-cited data fit with our other information on Oriental demography. Obviously, the hydraulic way of life permitted an

accumulation of rural and urban populations which, though paralleled in a few non-hydraulic territories of small-scale irrigation, such as Japan, has not been matched by the higher agrarian civilizations based on rainfall farming.

DIMENSION OF HYDRAULIC CIVILIZATION IN TIME, SPACE, AND MANPOWER

According to conservative estimates, hydraulic civilizations took shape in the ancient Near East not later than the fourth millennium B.C., and they persisted until very recent times. It may therefore be said safely that in this area hydraulic civilization endured for about five millenniums.

The great hydraulic civilizations of India and China maintained themselves for some three or four millenniums. And recent archeological finds suggest that in certain areas of the Western Hemisphere, such as Peru, hydraulic civilizations may have existed at least since the first millennium B.C., that is, for more than two millenniums prior to the arrival of the Spaniards.

Neither ancient Greece nor feudal Europe nor Japan can equal these figures. Greek agrarian civilization seems to have lasted for a millennium until Hellenistic despotism put an end to its non-Oriental pattern. The societies of feudal Europe and Japan had an even shorter duration.

The core areas and the margins of the hydraulic civilizations covered the greater part of western, southern, and eastersn Asia. The Hellenistic regimes, the Orientalized Roman Empire, the Arab conquests of Spain and Sicily , and Byzantine, Turkish, and Russian expansions imposed Orientally despotic regimes on large areas of Europe.

In Africa north of the Sahara, a hydraulic way of life prevailed for millenniums. A thousand years ago it seems to

have spread temporarily from Lake Tanganyika and Kenya to Rhodesia (Huntingford, 1933, pp. 153, 159 ff.; Wilson, 1932, pp. 252 ff.; Hall and Neal, 1904, pp. 356 ff; Randall-MacIver, 1906, pp. 12 ff.). In recent times it was observed among the Chagga and a few other tribes of central East Africa.

Hydraulic agriculture and goverment persisted in some major Pacific islands, such as Hawaii. In pre-Columbian America hydraulic developments spread beyond the Rio Grande in the north. In the Meso-American highlands and in the lowlands of Yucatán, clusters of lcose and marginal hydraulic civilization emerged. And in the south hydraulic expansion reached its maximum on the eve of the Spanish conquest. Early in the sixteenth century the Inca Empire stretched from Peru to Ecuador in the north and to Bolivia and Chile in the west and south. It co-ordinated practically all important centers of higher agrarian development in South America. Clearly, hydraulic civilizations covered a vastly larger proportion of the surface of the globe than all other significant agrarian civilizations taken together.

The demographic dimension of the hydraulic world has already been indicated. According to our present information, it would seem that, prior to the commercial and industrial revolution, the majority of all human beings lived within the orbit of hydraulic civilization.

COSTS AND PERSPECTIVE OF HYDRAULIC CIVILIZATION

Manifestly, then, this civilization was an eminently successful "going concern." It stimulated organization in depth. It gave birth to certain sciences. And it refined farming and handicraft. Yet, in terms of human affairs, it was as costly as it was tenacious. While such scientific aids to counting and measuring as astronomy and mathematics emerged, these developments eventually stalled, and the experimental sciences never gained significance. Masses of men were co-ordinated for public works and warfare,

but the patterns of integration were crude, and they improved little throughout the centuries. Farming techniques were subtle, but from the standpoint of the main protagonist, the peasant, their one-sidedly labor-intensive development was frustrating. Hydraulic agriculture made the cultivator till his fields with a minimum of labor-saving tools and animals and with a maximum of human labor. Being politically without influence, the hydraulic farmer maintained a man-nature relation that involved unending drudgery on a socially and culturally depressing level.

Aristotle's vision of a society of free men based on the advance of the mechanical arts is increasingly being realized in the multicentered industrial societies of the West. It never materialized in hydraulic society. For reasons inherent in this institutional conformation succeeded in perpetuating the economic and technological order which was the raison d'être for their existence.

The stationary character of the great Oriental civilizations was noted incisively in the eighteenth and nineteenth centuries, when the expanding commercial and industrial societies of the West began to loosen up what had previously seemed to be an indestructible societal edifice. The Western impact on man-nature relations in the countries of Oriental despotism was as varied as the forms in which it occurred. No fair-minded observer will deny its destructive aspects. But he will also point to the positive and non-totalitarian innovations that not infrequently accompanied it. And he will submit that, even in its most predatory and aggressive manifestations, Western colonialism, which today is subsiding, is more superficial than the new totalitarian colonislism, which is spreading so rapidly.

Hydraulic ("Oriental") civilization has been in transition for generations. It continues to change in a global situation dominated, on the one hand, by the forces of the totalitarian

revolution and, on the other hand, by the forces of the multi-centered Western world, in which the growth of an increasingly open society is enhanced by the democratic version of a second industrial revolution. The future of hydraulic civilization and of man's relation to nature and man everywhere ultimately depends on the relative strength of these two competing revolutions.

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