

11 April 2007

## **Khmer Rouge Irrigation Development in Cambodia**

By Jeffrey Himel

“If we have water, we can have rice. If we have rice, we can have everything.”

There has never been a modern regime that placed more emphasis and resources towards developing irrigation than Democratic Kampuchea from 1975-1979. The Khmer Rouge emptied all cities and towns, and put practically the entire population to work planting rice and digging irrigation dikes and canals. Yet, over 20% of the population died of exhaustion, starvation, disease and execution, and the overall rice production likely never attained that of the peak output of the 1960s. This paper describes what the Khmer Rouge did to develop irrigation on such a massive scale and the reasons behind their policy and its failure.

The Khmer Rouge leadership believed that they were implementing the purest socialist revolution the world had ever seen based on their having distilled a unique “correct line” of socialist thought. Society was completely restructured along military lines for agriculture to cut people’s ties to the land and each other. Rice production targets were set for the first year at more than triple the pre-war average for the entire country. This huge increase in yield was to be attained without chemical fertilizers, expertise or mechanization – the Khmer Rouge intended to prove that technology was not needed; the sole requirement for success was the collective will of the revolutionary people. Thus, this case study provides an antithesis to modern irrigation understanding that confirms current practice, particularly the importance of appropriate technology and its proper application and farmer-led agriculture and irrigation management.

### **Introduction**

“In order to adhere closely to plan and to resolve problems in a timely fashion, in the direction decided upon of three tons per hectare...Choose as models, districts which have increased production to three tons per hectare so that they can fly the flag of the “Great Leap Forward.”... The real key is three tons [per hectare]”

The speaker of these words, believed to have been Pol Pot, was explaining to the Khmer Rouge cadres of the West Zone that they should more than triple their rice production from peak pre-war levels in the coming season. Although this region was one of the poorest in Cambodia and one year removed from five years of civil warfare, the speaker foresaw the task ahead to be a relatively simple and easily attainable one. After all, according to the Party Center of the Communist Party of Democratic Kampuchea (CPK):

“We have leaped over the neo-colonial, semi-feudalist society of the American imperialists, the feudalists and capitalists of every nation, and have achieved a socialist society straight away. The situation is completely different from other countries... As for us, we have a different character than them. We are faster than they are... Our time is correct, both in terms of strategy and tactics... Our characteristics are different. Our line is different... Our revolutionary movement is a new experience, and an important one in the whole world, because we don't perform like others.”

These speeches and the policy documents that were produced by the leadership of the Khmer Rouge articulate a confident, clear and consistent policy for the rapid economic and political development of a pure socialist state, in their phase of “a Super Great Leap Forward.” The leap was to be powered by a massive increase in agricultural production countrywide. This agricultural surplus then would provide the capital for moving into light, then heavy industry. The most important factor in the success of this revolution was harnessing the force of the people and applying it collectively to the obstacle of the land,

“because technology is not the decisive factor; the determining factors of a revolution are politics, revolutionary people, and revolutionary methods.”

Only two and a half years later, the Khmer Rouge regime collapsed, leaving a desperate population wandering shocked across the countryside in search of other family members. It is estimated that approximately 1.7 million people died from exhaustion, disease, starvation, privation and execution under their leadership. Most of the deaths occurred within these three and a half years, as the harsh living conditions took their toll on the people and a series of widening purges implemented by the Party Center spiraled out of control.

**How was this “Super Great Leap Forward” to occur?**

A new social order. First, and foremost, was the complete restructuring of society. This was vital in order to transform the people into revolutionaries and to best harness their labor along with the other “means of production” to apply to the land. The cities were emptied immediately upon the Khmer Rouge victory in April 1975, with people moved out to the rural areas to become farm labor. The population was reorganized along military lines into “production groups,” consisting of “cooperatives” and “mobile brigades.” The people were assigned groups according to their age, physical condition, gender and civil status, with some constantly on the move within regions and others attached to a commune. The production groups were then exhorted to produce more rice using “storming offensives” to attack the land.

All land, tools and livestock were collectivized, and people were assigned various agricultural work including children and the elderly. Practically all people were mobilized for the digging of dikes and canals throughout the country. A subversive motive behind this restructuring was to break up family units – children were generally allowed to visit their parents only once every two or three months and were brainwashed into trusting only the “Angkar,” i.e., the Khmer Rouge. In order to replenish the population, marriages were arranged by local cadres without any consultation or consideration of the people involved.

An additional and primary consideration of the Khmer Rouge was maintaining constant “class struggle” so as to eliminate what they perceived as internal and external enemies who were opposed to the revolution. This would also serve to purify the Party gradually and consolidate control with the Party Center. Anyone who was a poor farmer from an area that had supported the Khmer Rouge during the war was by definition of the proper class, while anyone who was a better-off peasant, bourgeois, non-Khmer Rouge soldier, educated or from an area opposed to the Khmer Rouge during the war was a class enemy. The population was thus segregated into the “base” or “old” people who could be trusted and the “new” people who could not. The violence of the revolution ensured that local orders and national policy were followed without question, even where it was clear that mistakes were being made.

A new agriculture fueled by irrigation. The key strategy for the increase in rice production was to double- and triple-crop as many areas as possible through irrigation. Cambodia’s pre-war rice cropping area had been approximately 2.5 million hectares, of which only 74,000 hectares was irrigated. In December 1975, Pol Pot noted in an interview that the plan was to irrigate 1.5 million hectares of land. The strategy was described by Pijpers:

“To reach these [national increases in production] objectives a national ‘land reclamation plan’ was launched, based on a very simple technical approach:

1. a nationwide chessboard of leveled 1 ha plots in productive areas and in the reclaimed forest;
2. water management (irrigation and drainage) needed for high yielding varieties through a rectangular pattern of ditches and canals:
  - a. canals in a 1x1 km grid following the coordinate lines shown on the 1:50,000 topographical maps [or aligned with the national roads] and with a base width larger than 3-5 m;
  - b. within each 1x1 km grid, ditches each 200 m surrounding a unit of 4 has;

In Takeo province the satellite picture shows also a 10x10 km grid of larger canals

3. the creation of reservoirs by constructing long dykes along depressions or by damming natural depressions and alleys; dykes were often projected along a canal at the coordinate lines of the 1x1 km grid;
4. the construction of river closures with control structures to divert water into reservoirs or the canal/ditch system;
5. the building of water control structures using given general guidelines;
6. the construction of pump stations to supply additional water for the canal/ditch system.

This approach reduced the plan to setting out alignments, using even given standards for cross sections of canals, ditches and dykes, providing materials and organising labour. Each village chief had to fulfill a certain programme of works in his area... First priority at village level was continued rice growing but earthworks for the ‘reclamation activities’ were almost as important... Everything was done by hand with only a few hand tools. Materials were in short supply and houses were demolished to provide rebar and bricks. There was no technical or quality control of the works.

A result of all this work during the Pol Pot era is an inheritance of an enormous amount of canals, dykes and structures all over Kampuchea. Only mountainous terrain preventing canal construction...”

In places where traditional irrigation structures or French-constructed structures existed, the Khmer Rouge enlarged the dykes to expand the reservoir areas and built new canals. The reparcelization into the grid network described above proceeded in new areas and in the lower-lying and most productive soils. This breaking down of the traditional paddy field arrangement served also to separate the people from the lands that they had owned before, another strategy to promote collectivization.

The extent of the construction of the works was so astonishing that W.J. van Liere, a noted expert on Cambodian agriculture and irrigation working at the Mekong Secretariat, was able to track the development using low resolution satellite imagery. In an inventory of Cambodian irrigation systems conducted in 1993-1994, fully 79% of the schemes had been constructed in the brief period of Democratic Kampuchea – and practically all schemes existing prior to this era had been altered by the Khmer Rouge.

In terms of agricultural practices, almost everything was changed. The traditional rice seeds were gradually replaced by higher yielding varieties imported from China by 1977-1978. Even small details such as the distance between transplanted seedlings and the number of seedlings per bunch was changed as a general policy across the country. With the lack of imported materials such as fertilizers and insecticides, a tremendous effort was made to maximize the use of available materials for green manuring, compost and production of natural insecticides. Human fertilizer was used extensively despite the cultural abhorrence of this method. Some insecticides were imported from China in exchange for rice, but these limited amounts were used only on land that had been designated as having the highest production potential.

### **The Results of the New System – Irrigation Work**

Examination of the irrigation works in the post-Khmer Rouge period has allowed clear definition of the many problems caused by the new system. The hydrology of the overall system was deeply flawed. Canals of tens of kilometers in length were dug connecting adjacent watersheds together. But this complex interweaving of canals and catchments was controlled by local cadre according to their immediate needs. Thus, there was no way to predict or adjust the effect of one canal or weir closing on the rest of the system nor any communication between those operating different parts of the system. The natural drainage patterns were badly disrupted and the new routes caused unexpected flows to occur that could not be predicted by the local people who had lived there for their entire lives.

The irrigation works were built anywhere it was possible without consideration of the overall water requirements or stream capacity. As a result, there was more infrastructure than could be served by the catchments and no control or rational sharing of the resources according to where the highest or most equitable benefits could be gained. Most of the large canals above the floodplain block overland runoff and were built with minimal cross-drainage. Therefore they caused flooding when runoff pooled and could not be drained and were eventually breached by overflows, causing major repairs and constant maintenance.

The dikes were built in flat areas, so often flooded as much area as they were meant to irrigate. Manual labor was exclusively used for dike construction, even on very large dikes, so compaction was poor and the dikes prone to piping and settling. This problem was exacerbated by the exclusive use of local soils for dike construction regardless of their suitability and the extremely high daily volume of soil that was required to be dug by each worker.

Lack of technological expertise for design and materials for structures meant that spilling structures were inevitably under-sized and usually built too high. It was only a matter of time before they were over-topped or undercut and formed a large hole in the dike. Then the dikes served to channel flows from the periphery of the shallow valleys to the center, whereupon they quickly drained through the natural channels and grid of ditches into the Mekong River system. This is the opposite effect of the traditional smaller dikes built by the Khmer farmers that served to spread flows out from the center of the watershed to the periphery where they were captured in the paddy and in small tanks.

The Khmer Rouge systems always used the spilling structure for irrigation as well as drainage, so the main drain functioned as a primary canal when spilling wasn't required. Thus the primary canals were too wide and deep, didn't command many of the fields they were meant to serve, and inevitably were eroded by the annual flood flows.

As the local leaders lacked the expertise or technicians to design canals and canal structures properly, all reservoirs had a "sub-dyke" below the main dyke that served to pool water below the main structure and enable flows to enter the canals. This increased the water lost to infiltration and evaporation, and took the pooled area out of production; it was thus very inefficient. When flood flows had to be spilled, they had to be spilled through the sub-dikes as well, resulting in damage to both and heavy maintenance requirements.

The reparcelization of small paddy fields into larger uniform 1 hectare plots destroyed the intricate system of paddy cells that had been constructed carefully over centuries to capture and distribute rainfall and runoff, and take advantage of the specific conditions of soil and traditional seed varieties.

The canals/ditches surrounding them were dug as shallow, wide, flat channels with low bunds and so were ill-suited for both irrigation and drainage. The lack of topographic survey and poor standards to which canals had been constructed meant that the grid of canals essentially served to drain higher paddy lands, leaving them prone to drought. In lower-lying areas, the drained flows concentrated and were blocked by dikes and the larger canals, and so caused flooding. Often canals ran uphill or were simply dug lower into the ground next to the fields so they could not carry water to the paddy they were meant to serve. The checkerboard grid constructed over much of the productive paddy area contained thousands of junctions – yet there were no construction materials or expertise to build permanent regulation and distribution structures. Therefore the ability to distribute and control flows within the network was severely compromised and the canal network required constant attention for operation and maintenance.

### **The Result of the New System – Agriculture and the Social Order**

Cambodia had over the centuries of rice cultivation developed thousands of indigenous varieties of rice, each suited to the particular soil, water and other conditions of the area where they grew. Certain varieties were simply not planted, such as deepwater, or “floating” rice, as the Khmer Rouge judged them to be valueless. As floating rice was the only variety that could be planted in the deepwater areas, this otherwise useful land was left fallow. The optimal conditions for the higher yielding varieties preferred by the Khmer Rouge were attainable in some places but unsuitable in most. Thus, the potential benefits for the substitution of the new varieties were lost by rigidly uniform and overly accelerated implementation.

The reparcelization into larger 1 hectare fields made working the field more efficient; however, the fields were very uneven in their levels. As a result, parts of the field were exposed and prone to water stress and provided haven for pests while other areas were in deep water. The same rice varieties were planted throughout the field so conditions varied within the same field and reduced yields accordingly.

Many of the other efforts to maximize production through the use of locally available materials were also wasted through poor implementation as detailed by Martin:

“The leaders of the new regime had other ideas: produce more, indeed, but also apply the same methods everywhere... The agronomists who worked in the rice growing said that the human fertilizer, in some places, was badly utilized: it was spread prior to the ploughing during the dry season, allowing evaporation, the wind and the sun’s rays and the rain to eliminate the fertilizing elements, most notably the nitrogen. Often the same was true with the compost which had been dried out by the sun before being spread on the fields... [for the new transplanting arrangement] The Khmer Rouge adopted a method which, according to them, existed prior to 1970, perhaps in a uniquely experimental state as it is unknown to the peasants and agronomy staff interviewed... All peasants, technicians, engineers, and agronomists who participated in the transplanting emphasized the major inconvenience of this modification: the rice bunches were less fat with less developed plants, the grains were shorter, the maturation of the grains was poor and in extreme cases, the husks were empty... It is probably the combination of these different factors which explains the average results, even mediocre in terms of yield, at least in the beginning.

Other schemes contained within CPK documents demonstrate the lack of understanding of the leadership in agricultural and industrial development. The plans were hastily thrown together and inconsistent, and contained tables filled with numbers for production that appear to have been plucked from the sky. Numerous instances demonstrate how the leaders were naive and plans were far-fetched:

“[on improvement of rice varieties] we must set up a meteorological station... [on coal] we start thinking about our own coal from now on...if there’s any we’ll find it. We must set up factories to refine them...[on the problem of fertilizers] The possibility of using human urine hasn’t been exhausted either. Urine has yet to be collected. We collect thirty percent. That leaves a surplus of seventy percent. There’s also the urine of cows and buffaloes. We could make enclosures for them and at night they could urinate into troughs and we could gather the urine. In this way we could fulfill the 1977 plan.”

The plans outline the big picture, including shopping lists all of the different items that were to be produced for the population and the quantities in tons of each item to be made for each year. Yet it also defines in detail the lives of each person, including the actual meals and numbers and types of desserts that are to be eaten on a weekly basis.

With the rapid and sweeping changes and limited number of trusted people available to the Khmer Rouge, it was necessary that there was a high degree of decentralization with wide variance in terms of local application of policy. It is equally clear that there were attempts to



control every aspect of agriculture and irrigation from above. As noted by Twining based on his interviews with refugees from Democratic Kampuchea:

“According to numerous refugees, for example, rice was planted on soil whether it was good or not; each administrative entity had to undertake a specified amount of irrigation work, whatever the need... The word of when to plant, when to weed, when to harvest, was often transmitted from on high. An entire region might begin planting all on the same day, although the water conditions over such a large expanse and could hardly be expected to be uniform.”

A consequence of the segregation of the people into “new” and “old” people and the constant maintaining of “class hatred” was that in many places the educated technical people (including engineers and agriculturalists), as well as better and more innovative farmers, were eliminated or turned into silent laborers under severe hardship while the poorest people became their overseers and leaders. The poorest people were often the least equipped to manage the agricultural production and irrigation works and their lack of capacity caused many of the failures observed.

Finally, the overly ambitious targets for rice production resulted in local cadre collecting the rice produced and shipping it back to the central authority without keeping sufficient food for the people. The meager rations, harsh working conditions, heavy work load, lack of medicine, and often unsympathetic cadres led to many deaths from exhaustion, disease, starvation and execution. The workforce was progressively weakened and reduced as their workload increased. Internal purges of the local and regional leadership resulted in changes in leaders and large movements of people, thereby further destabilizing agricultural production.

### **The Root Source of the Problems**

The Khmer Rouge were fanatically self-reliant and determined to prove that their revolution could succeed with a bare minimum of technical knowledge and assistance. While there were instances where technically-trained people were used, including Chinese and North Korean technicians brought in to assist in the development of irrigation and industrial plants, it is clear that technical assistance was anathema to the leadership. Most of the irrigation works were deliberately built by a trial and error methodology as shown in Vickery:

“Clearly more important than development of industry was the mania for self-reliance and building on a poor-peasant base without using technological expertise from the old society. Early in 1977 Khieu Samphan said, “whether the dams and reservoirs that we have built last only 5 or 10 years does not matter,” for the people would learn by doing (implicitly without the help of irrigation engineers like Pin Yathay)...”

But the lack of engineering technical know-how resulted in useless or grossly inefficient irrigation works causing a huge waste of effort and loss of life in building and repeatedly repairing the works. The lack of agricultural extension and research caused a failure to achieve benefits from the heavy labors. This was ignored though because technology was a threat – people who possessed it had a power that did not stem from revolutionary consciousness and obtained their knowledge from the corrupt society the Khmer Rouge sought to replace.

“Compared to other countries, in industrial terms, we are extremely weak. Moreover, we don’t use old workers, because if we used old workers without carefully selecting and purifying them first, there would be many complications, politically, which would lead to more difficulties for us.”

Thus, Khmer students who were abroad when the revolution began were exhorted to return to help rebuild the country. But when they returned, they were either killed or imprisoned for the remainder of the regime. Even an early Khmer Rouge defector who had been working with the Mekong Secretariat on pioneer projects to develop irrigated agriculture was not used in this capacity – instead he was also held at the Boeung Trabek prison.

The speed of implementation and scale of the irrigation works and changes in agriculture were far too ambitious and not based on a complete or competent understanding of the issues. There was no local development process and no trials to develop successful approaches or local adaptations. As a result, the ambitious Khmer Rouge irrigation development failed catastrophically, leaving the wreckage strewn across the landscape. Dealing with this failed infrastructure and the lack of human resources remains one of the most pressing and difficult challenges faced by Cambodia today.

## **The Responsibility for the Problems**

The responsibility for the catastrophe of Democratic Kampuchea ultimately lies within the Party Center, the small core group within the Communist Party of Kampuchea (CPK) who led the revolution. This group was responsible for developing the “correct line” of policies that have been described. Their words in speeches and surviving documents demonstrate astonishing hubris in the certainty that their policies were infallible and a viewpoint that everything was essentially political in nature.

“We do not blame the objective conditions.”

Achieving success in the revolution was entirely a result of maintaining proper class consciousness and following the correct line; it had nothing to do with whether rainfall was timely or other “objective conditions.” Consequently, those who didn’t reach the targets set by the leadership were impure, unpurged of their base elements rooted in the unjust society. This explains why the poorest peasants were to be trusted while the “new” people could not. One’s class consciousness was demonstrated irrefutably by one’s material conditions.

The failure to achieve production targets threatened the entire foundation of the revolution as the surplus rice being produced was not providing near enough to rapidly industrialize and arm the military for a war with the “hereditary enemy” of Vietnam. Thus, not achieving production targets became incontrovertible evidence that there were traitors within the CPK in these areas who were sabotaging the revolution – it was only a matter of time before the Party Center would purge them to find out who was responsible. The cadres identified were then taken to Tuol Sleng prison and brutally tortured until they confessed to being counter-revolutionary. This provided evidence to support the original charge; and the victims would name their friends and associates who would then be brought in to be tortured to death in an increasing deluge of blood and misery.

As for the results of the agrarian revolution, it is well summarized by Martin:

“One can always ask oneself if it was necessary to overthrow the politics of the country, to demolish the family structure, to abolish at a single stroke centuries of culture and civilization, to mobilize the majority of the population for rice-growing, to work at a brutal pace in order to produce pretty much the same, as it seems, as that produced in the 1960s and to establish a general famine in a country where food shortages were not existing before, at least in quantity. Those who were carried away by disease, starvation or violent death during this work, “hardly more than a million” say the officials of Democratic Kampuchea, can no longer pass in silence.

They explain by themselves the unpopularity of a regime whose priority was the success of agriculture and that the population, including peasants, vow today to forget.”

### **The Lessons Learned from the Khmer Rouge Experience**

The main lessons that can be summarized from the sad experience of Democratic Kampuchea serve as a confirmation of much that has evolved as modern irrigation practice, including:

1. The importance of proper technical design and implementation.
2. The need to identify innovative, competent and popular local leadership free of outside politics.
3. The necessity for local adaptation, bottom-up planning and flexible approaches to irrigation and agriculture.
4. Maintaining a step-by-step and learning approach appropriate to the capacity of the people and agricultural system.

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