THE DEVELOPMENT OF TECHNOLOGY IN SRI LANKA

D.L.O. Mendis

Early Development : The Ancient Irrigation Works

In pre-historic times early man wandered through the primeval forests and jungles, and grasslands, hunting and gathering his food.

After a rather long period of such survival, Neolithic Man achieved the first revolution in human history when he discovered how to grow his own source of food. Next came settled agriculture and 'primitive' man now passed an important benchmark in his 'development' process. He was now 'civilized'.

In Sri Lanka, there is every reason to believe that 'civilized' man had occupies this tropical island for a very long time in th the period that is now veiled in the myth and tradition of pre-history and proto-history. This myth and tradition has it that the island was occupied only by Yakkas and Nagas until the advent of the first invaders from India in the historically sacrosanct years 543 B.C.The subsequent development of a marvellous hydraulic civilization is credited entirely to those newcomers, from about the 4th Century B.C.

The historical chronicles, as well as rock-incriptions have given us some evidence as to the authors of many of the magnificient features of this civilization, such as some of the major resevoirs and canals. However, there is also some evidence that chronicles had been inclined from time to time to give credit to the reigning monarch for consturction of a new irrigation structure, when in fact he had only caused an existing structure to be improved, or restored (if it had fallen into discse), This adds to the difficulties faced by a researcher trying to identify the references to various major works, in the chronicles.

There is evidence that the Wet Zone in Sri Lanka that gets the benefit of both the North East and the South West Monsoons, had been inhabited before the 1st Century, A.D. In the intervening 10 Centuries it would appear that the Wet Zone had been only sparsely occupied, while a flourishing civilization existed in the rest of the Country, the Dry Zone of Sri Lanka.

The hydraulic civilization held sway for at least 17 centuries of the so called historic period. During this period the country was sometime under a single ruler, but often it was divided into a number of Kingdoms or principalities. The island flourished under a single ruler as an unitary kingdom for the last time in the 12th Century, before the coming of the colonial conquerors, some centuries later. In the interim period an irreversible decline appears to have set in, in the once flourishing Rajarata, and the cemtres of population had shifted to the south and south-west.

The Pre-Colonial Period

During this long period of about 17 centuries which may be called the Pre-colonial period, a stable economic system had undoubtedly evolved, supported by science and technology. The basic needs of food, shelter and clothing had been well provided through the development of indigenous technology for production and manufacture in Agriculture and Industry. Indigenous technologies for provision of services including Health and Education, Transport and Communications were also well developed.

The extensive infrastructure of the ancient irrigation system evident to this day, as well as the vast and many splendoured religious edifices build in those times are ample evidence that available resources had been carefully husbanded and a considerable surplus had been generated. The sophistication of construction techniques as seen in the quality of the bricks used in the Dagodas, or the fine gradients used in very large trans-basin canals for conveyance of water (to give only two examples that may be appreciated by any layman) are an indication of the high level of technological development in that period.

There has been some discussion about the social formation that gave rise to the ancient hydraulic civilization. Wittfogel (1957) after a study of the other civilizations dependant on irrigated agriculture, but without refering specifically to this country, came to the conclusion that such a system could only have existed under what he described as 'oriental Despotism'. Leach (1959) who had first had acquaintance with the Dry Zone of Sri Lanka, refuted this theory in so far as it applied, by implication to this country, in his notable paper "The Hydraulic Civilization of Ceylon." Marx and Lenin have referred to an Asiatic mode of Production which presumably could include the hydraulic civilization.

For the purpose of this presentation on the development of technology in Sri Lanka, the technology associated with this entire pre-colonial historical period will be described as "Traditional Technology." It should be appreciated that there is such a traditional technology in all the sectors and sub-sectors of the modern economy even today. (Typical sectors are Agriculture, Industry and Services. Typical sub-sectors are Food and non-food in Agriculture and Transport, Health Education etc. in Services.)

This traditional technology is associated with "traditional systems" which exist in virtually all the Sectors and sub-sectors of the economy even today. viz. Agriculture, small Industry, Health, Education, Transport etc.

In fact, it would not be wrong to conclude that traditional technology in traditional systems in all these afore-mentioned sectors and sub-sectors, sustain a numerical majority of the population even today.

The Colonial Period

The advent of the Colonial Powers was ostensibly for trade, but the historical record reveals that such unequal trade amounted to no more than an extractive process sustained with much vigour over a period of nearly 4½ centuries in this country.

The Portugues who came in 1505 and the Dutch who took over the so-called maritime provinces from the Portuguese in 1658 indulged in this extractive process for 3 centuries in all. They were mostly content to 'trade' in spices and gems and ivory that were made available by their native counterparts of the ruling class, although the Dutch did introduce some system for cultivation of cinnamon. The British however, soon subjugated the hitherto unconquered hinterland by capturing the King of Kandy through the use of guile rather than by force of arms; and in a comparatively short time thereafter, they set about establishing plantations. The Wet Zone of the fertile tropical colony indeed had the ideal agro-climatic environment for such an industry. Although coffee which was the first crop to be planted extensively by the British was devestated by a blight that destroyed several hundred thousand acres of planted land, the intrepid British pioneers around 1870 introduced tea, which soon flourished. Thereafter rubber was introduced as a plantation crop, from the jungles of Brazil (where it grew in its wild state) via the famous botanical gardens at Kew (where it had been grown under hot-house conditions). Finally, coconut which had long existed in the wet zone (from at least as far back as the 12th century), and had been known to have been grown in the dry zone at the of the hydraulic civilization, (in the 6th century), was also established as the third plantation crop. These plantation crops were all cultivated scientifically with back-up research provided by new research Institutions, set up expressly for this purpose, namely the Tea, Rubber, and Coconut Research Institutions.

The colonial period can therefore be divided into two subperiods which may be called the EArly Colonial Period and the Late Colonial Period respectively. The former may be said to date from about 1505 to about 1870, and the latter from about 1870 to 1948. which of course is the year when the country achieved its political independence.

Early Colonial Period

In the arely colonial period there were sovereign Kingdoms based in Jaffna, Kotte, and Kandy that had trade relations with the colonial powers. These kings were often at war with each other, as well as from time to time with the foreign invaders. Both the Portuguese and the Dutch also found it useful to promote local conflicts by supporting one king against another.

There is a story that when the Portuguese first landed near Colombo, some spies of the king of Kotte had reported back to the king that they had seen foreign devils who ate stones (bread) and drank blood (wine), and whose cannon sounded louder than thunder.

This story illustrates rather vivifly the superficial impact of technology transfer, also described sometimes as an example of 'technology shock'. In this case, as in many others since, the result in a relatively short time was the adaptation of the new technologies by the local people. Although this is an example of a 'transferred technology' being adapted, it is also the beginning of what can be called Empirical Local Technology, which is the description given to the dominant technology of the early colonial period. This technology came into being on the local scene in many sectors and sub-sectors through contact with the colonials, basically through a process of adaptation and development by trial and error, essentially an empirical process.

Late Colonial Period

In the late colonial period however, the British developed their plantation industry through the use of Research based Local Technology, as has been shown. Thus we may identify this as the dominant technology of the late colonial period, since the plantation industry was the major economic occupation of the period.

Howerver, the plantation industry was not the sole activity of the British in Sri Lanka. Many

Colonial administrators were men who appreciated the glorious history of the colony, and made real contributions to the study of this history. Mainly through the impetus of such research, the colonial government did take steps to restore some of the ancient irrigation works that lay abandoned in the jungles of the dry zone.

The technologies used in the course of such restoration work would be described as both traditional and empritical local technologies, at the beginning. However, after the Irrigation Department was set up in 1900 by hiving off a branch of the PWD and giving it the status of a new full-fledged department, the stage was set for the introduction of research-based local technology in this area of increasing importance to the economy. Although much real research work was done by men like Kennedy, the Irrigation Director who served under D.S. Senanayake as Minister of Agriculture, the actual institutionalisation of this research took place only in the mid-forties, when a Designs and Research Branch was established in the Irrigation Department.

In the Industrial sector however, there was little attempt to bring in research-based local technologies into what was merely extraction of minerals like plumbago (graphite) for export in the raw form for processing and adding value abroad. Thus empirical local technologies and traditional technologies were used extensively in this sector in the colonial period.

A few remarks may also be made about some Services. In Health, western allopathic medicine was introduced and made available in western-style hospitals and dispensaries manned by local people trained and educated in the use of the appropriate technologies transferred from the west. Here we see the first extensive use of a Transferred Technology, the last technology type identified in this presentation. However, it should be noted, that the local systems of Ayruveda, Unani etc. continued to be the only medical technology available to a majority of the people, and this 'traditional technology' was the dominant mode even during the colonial period for most of the people. Similar remarks apply to Education, where the majority of the people were educated in the 'traditional' centres of teaching and learning, but the minority who benefitted from 'transferred technology' were to have untold benefits and advantages not available to the majority educated through the 'traditional' system. In colonial times this would have been taken as the natural orders of things. In very recent times, in other countries, there has been serious questioning of this process by men like Ivan Illich and Paulo Feeire, for example.

The transport sector provides some interesting case studies. The railways were introduced primarily to service the newly created plantation industry. This represented a transfer of technology from the west of course, but in the construction of the railways, traditional and empirical local technology was extensively used. This applied also to the building of roads. However, some forms of traditional technology tthat had been in use in precolonial times suffered neglect. For example, water transport that had been used extensively in the channel systems of the vast irrigation networks in the dry zone, fell into disuse even after the channels were restored. A classic example of this is the Elahera canal. In other areas of the Services sector, new technologies were transferred where there were no equivalent local or traditional technologies available, as for instance in the case of telecommunications.

Post Colonial Period

In the Agriculture sector, the same colonisation policies that had been introduced by D.S. Senanayaka as Minister of Agriculture, were continuted after Independance, when he was the first Prime Minister. On many of these projects like Kalaweva, Elahera, Nachchaduwa etc. work continued from British times through independance, interrupted to some extent only by the war. On these settlement projects, traditional and local technologies were used (both empirical and research based), but there was also an element of transferred to technologies that had crept in which was an indication of the astuteness of the colonial entrepreneurs. Every new colonist was given a brand new axe and mammoty that had been imported from Brittain. To the local administrators there may not have been anything unusual about this, because they would have been in all probability creatures of the 'transferred technology based' educational system which would have taught them that good tools came only from the 'mother country'. Such men would have been amazed indeed if they had been told that a British writer J.W. Bennet published a book "Ceylon and its Capabilities" way back in 1843, in which he said: ....." they (local carpenters) complain greatly of the English tools as being very badly adapted to the hardness of ebony and satinwood timber. I would therefore suggest to the British manufacturers to study the shape and temper of the native tools which are of the most simple construction, and thereby emsure certain and profitable returns from their export to the Ceylon market."

It was only in very recent times, under the D.D.C. projects of the previous government that offical recognition was given by government to the locally available traditional technology of the village blacksmith, which should have been barnessed in the cause of the development effort long, long ago, instead of merely supporting transfer of technology that benefits foreign manufacturers as so vividly described in the above quotation from 141 years ago.

In the late forties, the Gal Oya project was launched based on the Tenessee Valley Authority project from USA, rather than on our ancient Kalaweva, Jayaganga etc. A cost plus contract was given to an American contractor and foreign consultants were also employed. No doubt local personnel gained much valuable experience from the work, but so too did the foreigners.

After Galaoya, the Walawe project should have been taken up for implementation with the same equipment, but this did not happen). It would be worthwile to investigate why this did not happen). Finally, Walawe headworks were built in the late sixties with some of the old Galoya heavy construction equipment, and some of the old Galoya men, Engineers, Technicans, and above all, Machine Operators, and Mechanics. This was an unique effort of co-operation and collaboration between Sri Lanka public and private sector organisations and a foreign agency, Skodeazport of Czechoslavaki. The total cost of the Uda Walawe headworks in the late sixties was less than Rs.50 million. (In comparison today, the Kotmale coffer dam alone was estimated as Rs.200 million: some changes in the design were effected, and the cost reduced to Rs. 100 million; a much publicised saving of Rs.100 million!) This example of Kotmale is typical of the Agricultural Sector today,where in the Accelerated Mahaweli Project, there is virtually one active or dominant technology type, transferred technology.

In the Industrial sector in the post colonial period there was a deliberate policy to set up heavy industries in the public sector and then hand them over to the private sector, in the pre-1956 period. HOwever the policy did not see any significant application before the 1956 electoral change similar radical change in policy with respect to industrialisation also which henceforth would be the prenegative of the public sector for the next 21 years. Now after the electoral changes of 1977, the pre-1956 conditions have returned, and the emphasis is on transferred technology.

Similar remarks would apply to the Services sectors. Today Agency Post Offices are in use in the Communications sub-sector for the first time in this country. It is to be expected that they would use transferred technology rather than any other form of technology even if this was available.

In the Transport sector again with the new emphasis on the private sector there is a dominance of transferred technology which is inevitable. The denationalisation of the Railways is a possibility that can follow from this change in emphasis from REsearch-based and Empirical local technology that was in use in the Railways previously, to a very noticeable dependance on transferred technology: Indian 'experts' are at present administering these RAilway workshops for example.

In the Health sector, although Sri Lanka has achieved a remarkably low death rate, undoubtedly due to medical technology in the field of preventive medicine which has been transferred from the developed world, there appears to be a certain over-dependance on transferred technology in certain areas, where local research-based technologies can be used to much better effect. The best example of this is in orthopaedics. Many years, a local Orthopaedic Surgeon, Mr. Muller F.R.C.S, had started development of a rubber footpiece for artificial limbs in this country. This work had been published in the British Medical Journal and it had been seen by a Medical doctor in Jaipur Hospital in India who had himself been trying to develop a locally available technology for artificial limbs. Dr. Sushi F.R.C.S. eventually developed his Jaipur foot, a truly impressive example of a local Research-based technology developed in India. Here in Sri Lanka, medical practitioners are not all interested in the transfer of Jaipur technology. They are more keen to have a technology transfer from Finland, even though amnutes who know something about the subject are very keen to have the Jaipur technology transferred to Sri Lanka. This is a good example of the 'dependancy syndrome' that afflicts those who are exposed too much of the transferred type of technology, especially in education.

Technology and Social Formations

An attempt will now be made to examine the social formations corresponding to the four techno=logy types that have been indentified, namely Traditional technology, Empirical local technology, Research-based local technology, and transferred technology.

Kumari Jayawardena in a study of emerging class formations in Sri Lanka in the late 19th century has identified the following social classes:

Bourgeoisie consisting of Plantation Owners and Merchants; Petite Bourgeoisie consisting of Clerks and Minor Bureaucrats Small Landowners, Traders and Petite Producers; and Working people consisting of Plantation workers, Peasants, and Agricultural workers.

This emerging class fromation is shown in the figure 1. From this model, a second model has been derived which is shown in figure 2. In this model, three emerging economic sectors are shown, described as the Rural sector, the emerging Urban sector, and the Plantation sector.

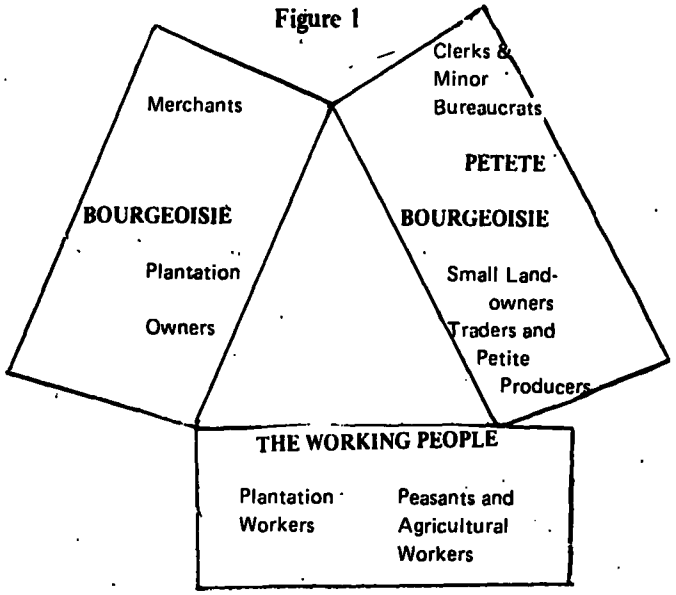
The dominant technology types corresponding to these three economic sectors are the previously identified Traditional technology, Empirical local technology, and REsearch-based local technology, respectively, which we had earlier seen to belong to the historical periods described as pre-Colonial, Early colonial, and Late colonial respectively.

	(a)	(b)	(c)	
Historical Period	Pre colonial	Early-colonial	Late colonial	Post Independence
Dominant Technology type	Traditional	Local empirical	Local Research-based	Transferred
Technology sub-type		(a)	(a), (b)	(a), (b), (c)
Mode of Production	Pre-capitalist	Early capitalist	Plantation capitalist	Neo-colonial
Economic Sector	Rural	Emerging Urban	Plantation	All sector

In terms of Kumari Jayawardena's emerging class formations, the dominant modes of production corresponding to these three economic sectors are the pre-capitalist, early capitalist, and plantation capitalist modes of production, respectively.

With the addition of Technology sub-types that support the dominant technology types corresponding to each period, we can therefore interrelate the Historical period, the Dominant technology type, Technology sub.types, Mode of Production, and the Economic sector, as shown in the table

Figure 1



EMERGING CLASS FORMATION IN SRI LANKA IN THE LATE 19TH CENTURY
(after Kumari Jayawardena)

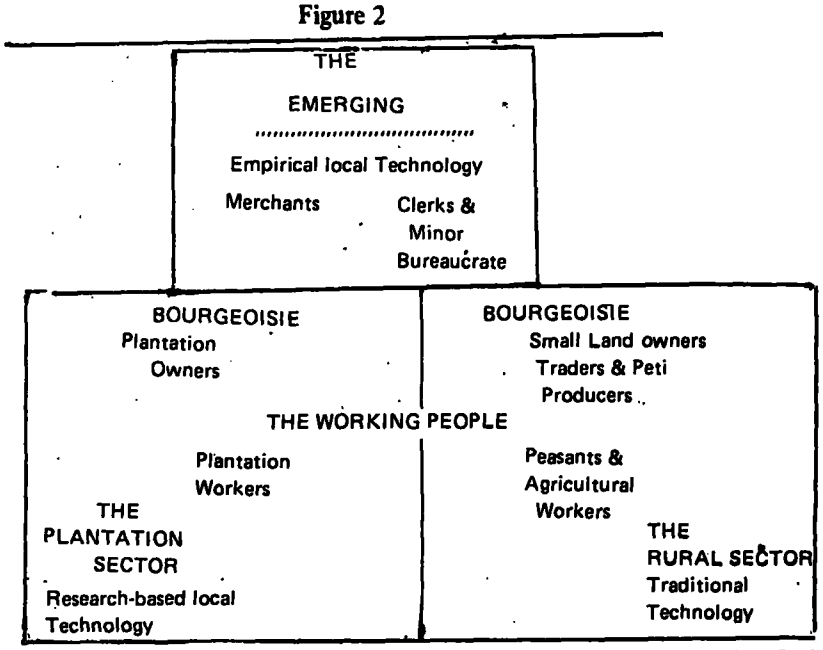
Conclusion

I consider it an honour to have been invited again this year to present a Foundation Lecture on TEchnology at the International Srudies Course of the Bandaranaike Centre for International Studies.

Last year I said that some of the material I presented was in something of a'fluid state because I was then studying Technology, Mode of production and Class formation in Sri Lanka, in a some what tentative fashion.

What I have presented here in this year's Lecture takes that preliminary presentation a step further. If this effort stimulates further research by any members of this years BCIS class, my own work in the past year would not have been in vain.

Figure 2



EMERGING ECONOMIC SECTORS & DOMINANT TECHNOLOGY TYPES