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POVERTY ERADICATION THROUGH TECHNOLOGY INTEGRATION APPROACH, A CASE STUDY OF SRI LANKA

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A B S T R A C T

The contributions of this paper are manifold: First, it presents the Technology and Poverty Reduction Framework that integrate all the key stakeholders involved in the process of Research & Development (R&D) and technological innovation in Sri Lanka by linking farmers, fishermen and small and medium scale enterprises. Second, it presents a new framework for Technology Development Directions and shows the Sri Lanka's low equilibrium trap position. Third, this paper analyzes the history of technology development in Sri Lanka. Many technological innovations have been made or transferred during the last few decades in Sri Lanka in many fields. However, the majority of the population has not had adequate access to these new technologies, especially communities involved in small/medium, micro and cottage industries, agriculture and fisheries are out of the reach of these new technologies. Therefore, this paper proposes an agenda for the development of new technological advances and seeks to identify ways in which technology could be made to be accessible to all segments of the population. It also has the distinction of being one of the first papers that explored the history of technology development as well as the link between technology and poverty eradication in the context of Sri Lanka. Finally, it emphasizes that massive investment on S&T, R&D, innovation, technology transfer and acquisition itself will not be the solution to eradicate poverty without proper integration approach to disseminate these new technologies to poor.

Keywords: Technology, Poverty, Research & Development; R& D, Innovation, Sri Lanka.

INTRODUCTION

Technology, innovation and Research and Development (R&D) are widely recognized as the most important factors in eradication of poverty which is the prime objective of economic growth and development in any developing country. It has been documented that long-term poverty eradication programs and strategies should be designed by incorporating the technology, innovation and R&D aspects. Many developed countries had achieved their economic growth, development and industry competitiveness by paying due attention to technology, innovation and R&D aspects while formulating development strategies. Therefore, this paper discusses various aspects of technology development and its interaction with poverty from a Sri Lankan perspective by giving more emphasis to the dissemination of new technologies to poor. First part of this paper gives a brief historical note on Sri Lankan technological development and second part presents technology development direction framework and thirdly an integration approach and finally concluding remarks will be followed.

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BRIEF HISTORY OF SCIENCE AND TECHNOLOGY DEVELOPMENT AND ITS INTERACTION WITH POVERTY IN SRI LANKA

Sri Lankan technological history can be divided into a number of periods. Technologies in different sectors were developed and applied in these periods and evidence was not available about its exact contribution of technology to reduce poverty. However technology contributed in many ways to improve economic growth and development which ultimately reduces poverty. Therefore, in reaching the present status of technology and eradication of poverty, we can find two major periods: pre-independence period (before colonial and after colonial) and post-independence period (before and after 1977 policy reforms).

Pre-Independence Period: The Sri Lankan technology level before the 16th Century was comparable to most developed societies of the time around the world. It is believed that in an ancient times high knowledge of trigonometry, some practical geometry and astronomy were well known to Sri Lanka. Spinning jenny was used in traditional weaving industry even in the 16th Century and a Portuguese writer reported that Sri Lankan guns were the best in the world at that time. In the health sector, a number of hospitals were built by many Kings (Parakramabahu and Dutugemunu) and therefore, most writers reported that Sri Lanka was very advanced with respect to contemporary Ayurveda medicine technology. On top of that, Sri Lankans were excellent in irrigation technology including many trans-basin diversions, multi-purpose irrigation, drainage, flood control and conservation. Some writers reported that Sri Lankan 12th Century ancient irrigation technology was unique and such technology could not be seen in the rest of the world till the 17th Century (Goonathilake.S, 1976; Needham.J, 1956; Mendis. D, 1974). During this period, technology was developed locally through inputs by the indigenous people themselves. There is evidence to prove that the use of technology during these periods helped to improve the living standards of people throughout the country.

With the Colonial incursion from the 16th Century, Sri Lanka was increasingly exposed to Western technology. This western technology was introduced as a package without any interaction with the existing indigenous technology. Western technology was introduced to the country without a careful analysis of the specific needs of the people unlike in the period prior to the 16th century. This technology introduced by the British was appropriate for certain sectors of the economy such as plantations and not so for others such as paddy which relied on indigenous technologies. Portuguese did not introduce that much technology into Sri Lanka but the Dutch introduced some technology with respect to construction of water canals, buildings, roads and harbors. But the modern technology era began in Sri Lanka in the 19th Century with the British colonization of the country. This was the starting point for the emergence of techno-dualism, where urban dwellers were exposed to western technology and reaped the benefits of it while, rural people were isolated from technological developments and could not achieve economies of scale and scope in their economic activities. The British idea was to develop Sri Lanka as an agricultural base for them and market for their industrial products. Therefore, they identified tea, rubber and coconut as main produces from Sri Lanka to the world market. In order to facilitate these, they developed major rail and road networks and the Colombo seaport as well as associated engineering departments such as Ceylon Government Railways (CGR), and Public Works Department (PWD), Government Factory, Colombo Port Workshop and private sector owned Walker Sons & Co. Ltd, Walker & Greig, Brown and Co. Ltd and Colombo Commercial Company. At the beginning, all the key positions of these organizations were manned by the British and later to train technical people for these organizations, the Ceylon Technical College was founded in 1893, but in 1950 this was elevated to the status of Faculty of Engineering under the University of Ceylon. In order to eradicate tropical diseases and to improve the health of the settlers, the British established a Bacteriological Institute which is now known as Sri Lanka Medical Research Institute, Ceylon Medical College in 1870 and Nurses Training School in 1939. In addition to this, a number of hospitals, clinics, and dispensaries were established and due to all these measures substantial advances were made in health sector. This had created various implications for demography in Sri Lanka. In the field of agriculture, the Department of Agriculture, Tea Research Institute, Rubber Research Institute, and Coconut Research Institutes was set up in the 1930s, but little attention was paid to the Research & Development of rice, subsidiary crops and spices. The British later attempted the restoration of major ancient irrigation works mainly due to pressure from Sri Lankan representation in legislature. The Galoya multi-purpose project, the first modern irrigation work started with the assistance of USA Consultants. Irrigation Department developed and repaired most of the irrigation works by using Indian and other war displaced nationality engineers. Irrigation Department works mainly used local technology talent with labor intensive methods. In the industrial sector the British pioneered the establishment of several factories such as coir (1937), steel-rolling (1937), plywood (1941), leather (1941), acetic acid (1942), paper (1942), glass (1944) and ceramics (1944) due to war situation. During this period, the Industrial Research Laboratory was established in the Department of Commerce and Industries to serve the

industry. Some technology achievements were made in hydropower electricity generation, transport and telecommunication & broadcasting fields during the British occupation of Sri Lanka. During the British period though large scale industries were created, small and cottage industries, agriculture and fisheries have been neglected and this has had a crucial impact on the rural population as they rely to a significant extent on SMEs for their livelihood.

Post-Independence Period: After political independence in 1948, a number of R&D institutions were established in order to develop Science & Technology in Sri Lanka. Ceylon Institute of Scientific and Industrial Research (CISIR) was the first of such kind. But this institution failed to deliver its objectives as reported by many publications (Wijesekera, 1976; APCTT, 1986) due to inadequate staff, lack of research groups and expertise in different fields, too wide area coverage and lack of linkages with industry. In 1966, the Industrial Development Board (IDB) was set up to provide various technical services to Small and Medium scale Industries (SMEs). Its principal functions were preparation of the feasibility reports, technical services, surveys on industries, documentation and publications, loan arrangements, management information and advice to SMEs. It is expected that IDB will inform other R&D organizations about the technology needs and capabilities of other industries. But this does not happen and a significant contribution did not happen in indigenous technology development of the country. In 1956, a Ten year Plan was developed by the Planning Secretariat with the help of famous Economists by ignoring the R&D community to develop S&T in Sri Lanka (APCTT, 1986). In 1965, the National Science Council was set up after intense lobbying by the S&T community in Sri Lanka. At the beginning, National Science Council (NSC) was trying to formulate a national science policy for Sri Lanka which still could not be completed. In 1974, the National Engineering Research and Development Centre (NERDC) was set up to carry out and promote research, innovation and commercialization. Research and development was carried out successfully, but commercialization was not very successful. In 1976, an UNCTAD mission came to Sri Lanka and they reported that Sri Lanka has the mechanism for screening imported technology but it is incomplete and considerable R&D sector development is required. This mission recommended that a Centre for Transfer and Development of Technology be established as a focal point to link R&D institutions with national economic planning apparatus. But so far no action has been taken on this front. R&D efforts in the private sector are confined to local subsidiaries of multi-nationals and their joint ventures and some Sri Lankan Blue chip companies. Some specialized R&D works are carried out by some state corporations such as ceramics, tyres, mineral and sands. During 1960 – 1977 periods, much R&D work did not take place in the private sector due to heavy state involvements in the economy. During this period, most of the technology transfers occurred as donations from the Soviet block in setting up mega factories. Most of these industries are import substitutions and they showed inefficiencies at the outset and later political involvements almost wiped out the competitiveness of these industries and became a burden for the public.

After 1977 economic policy reforms, foreign and local private sectors was given a leading role in the economy. Thereafter private R&D activities showed positive growth in some industry and firm levels. Technology transfer and R&D occurred in sectors such as infrastructure, construction (housing and dams, etc), garments, communication, ceramics, rubber products and information technology through sub-contracting, out sourcing or developing their own R&D units. From 1983 onwards the escalation of the ethnic conflict meant that government expenditure was mainly diverted to war rather than to industrial development. Furthermore, foreign or local private sector did not invest as expected. Therefore it is obvious that much development in R&D and S&T did not happen after 1983. After the peace process gathered momentum in 2001, a positive trend towards R&D and S&T culture can be seen in Sri Lanka. But again on 2005 on virtual collapse of peace process and continued political uncertainties of the country cause less attention on S&T, R&D and innovation. Especially during early stage of 1977 policy reforms some western companies showed some trend in transferring their R&D divisions to Sri Lanka but later this trend reversed. Investments in Research & Development [R&D] are vital for technological development. Sri Lanka is a developing country (GDP per capita US $ 1197 in 2005) and the severe uncertainties exist in country precludes local or foreign private sector participation in R&D and innovation. In this context, the active participation of the government in R&D is vital for

the development of new technological innovations. Government recognition of the importance of technology and commitment to technology development are very important factors in technology development of any country. Present government has taken initiatives to develop SMEs through various policy measures and incentives. A number of foreign funded programmes are ongoing with respect to this SMEs technology capacity building (see Dasanayaka, 2006, 2011).

FRAMEWORK FOR TECHNOLOGY DEVELOPMENT DIRECTIONS

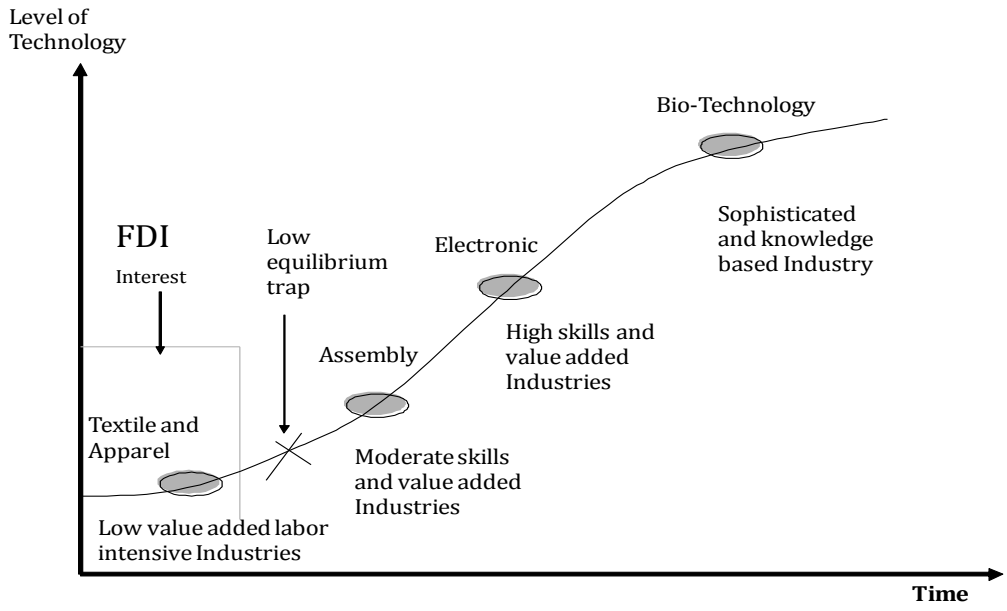


Figure 1. Technology Development Directions.

An analysis of the direction of technology development in industries reveals that the development of new innovations has been limited to apparel and textile industry in Sri Lanka. Even these industries are labour intensive and have little value addition through technology as most raw material imported. Research in areas such as electronics, automobile assembly and biotechnology has not been very successful in Sri Lanka. This could be due to several factors. Bio technology requires sophisticated knowledge and infrastructure. As a developing country we cannot afford to spend large amounts on a single research area. The lack of suitable researchers trained in bio technology is also a critical aspect. Research related to electronics is ongoing at several universities in Sri Lanka. However, the existence of large scale industries related to electronics is minimal. Research & Development (R&D) activities generally take place in large scale industries. This is so because large scale industries can achieve greater economies of scale and scope and therefore have the funds to invest in R&D activities. The lack of interaction between the university system/research institutes and the industry could affect the development of useful technologies and their implementation. In comparison to both these industries, textile and apparel industry is more labour intensive. However, they are the primary source of gross foreign exchange earners in the country. Thus they have the funds to invest in the latest technologies. This is limited to large and established factories. An analysis revealed that even in the apparel industry low value is added to the end product. This could be because garments are produced for mass markets and not for elite customers in the fashion capitals of the world. Thus, the development of technology has been limited to a low equilibrium trap position. In order to move beyond this point, greater investments in infrastructure related to R&D as well as training key personnel are needed. This requires the participation of not just the government but other organisations, donor agencies, and key resource persons from other countries to liaise with both the local R&D community and the industry.

Future Directions of R & D: The majority of the R&D

activities related to traditional industries are limited to improving the existing technologies to improve the productivity and diversification or improvement of the quality of existing products. There are limited R&D for developing innovative value added products. For example, R&D related to tea industry mainly concentrates on new machinery and new flavors even though there are possibilities for cosmetic applications such as perfumes and facials (See Dasanayaka, 2006b). Utilization of local raw materials is essential for industrial development of a country. Sri Lanka is rich with natural resources (e.g. industrial minerals, plants, animal products, seawater). All these natural resources can be exploited to obtain valuable commercial products (e.g. silica and quartz mineral for electronic grade silicon, seawater for chemicals). Most of the natural resources are non-renewable. Thus, the present practice of exporting these resources without value addition should be prohibited and the maximum benefit has to be obtained from these resources. Product and process technologies should be developed to give maximum value addition to local raw materials. Harvests are wasted because produce cannot be stored or processed. Under this situation, R&D for high yield is useless. Parallel development of technologies for high yield and post-harvest food processing, packaging and transport should be carried out. This situation is not very different even in the other sectors. Therefore the coordination between technology development activities is essential. Thus, the implementation of technology is not enough to increase the incomes of the poor and the marginalized. The context within which they live in should also be analyzed and a solution that includes a suitable answer to all of these concerns should be adopted. People need not only jobs (working poor), but high quality industrial jobs that enable people to learn new, adaptable technological skills. However, presently the majority of the industries in Sri Lanka do not use highly advanced technologies while adding low value to the product. Most foreign direct investments target these industries and provide jobs without much enhancement of the quality of life. Non availability of adequate technological capabilities is one of the major reasons for the Sri Lankan industries being in this low equilibrium trap. Thus future technology development activities should be targeted to attract the industries like automobile assembly, chemical, electronics and biotechnology. Inter-firm relationship in technology development activities is at a very low level in Sri Lanka. Cooperation in R&D activities will help to reduce the high level of risk and R&D expenditure. Technology Management literature shows three levels of cooperation as follows:

i- Research and development cooperation: Cooperative activities can be carried out in the pre-competitive stage in different forms: University based cooperation research financed by associated firm, Government-industry co-operative R&D projects with universities and public research institute, R&D cooperation on a private joint-venture basis.

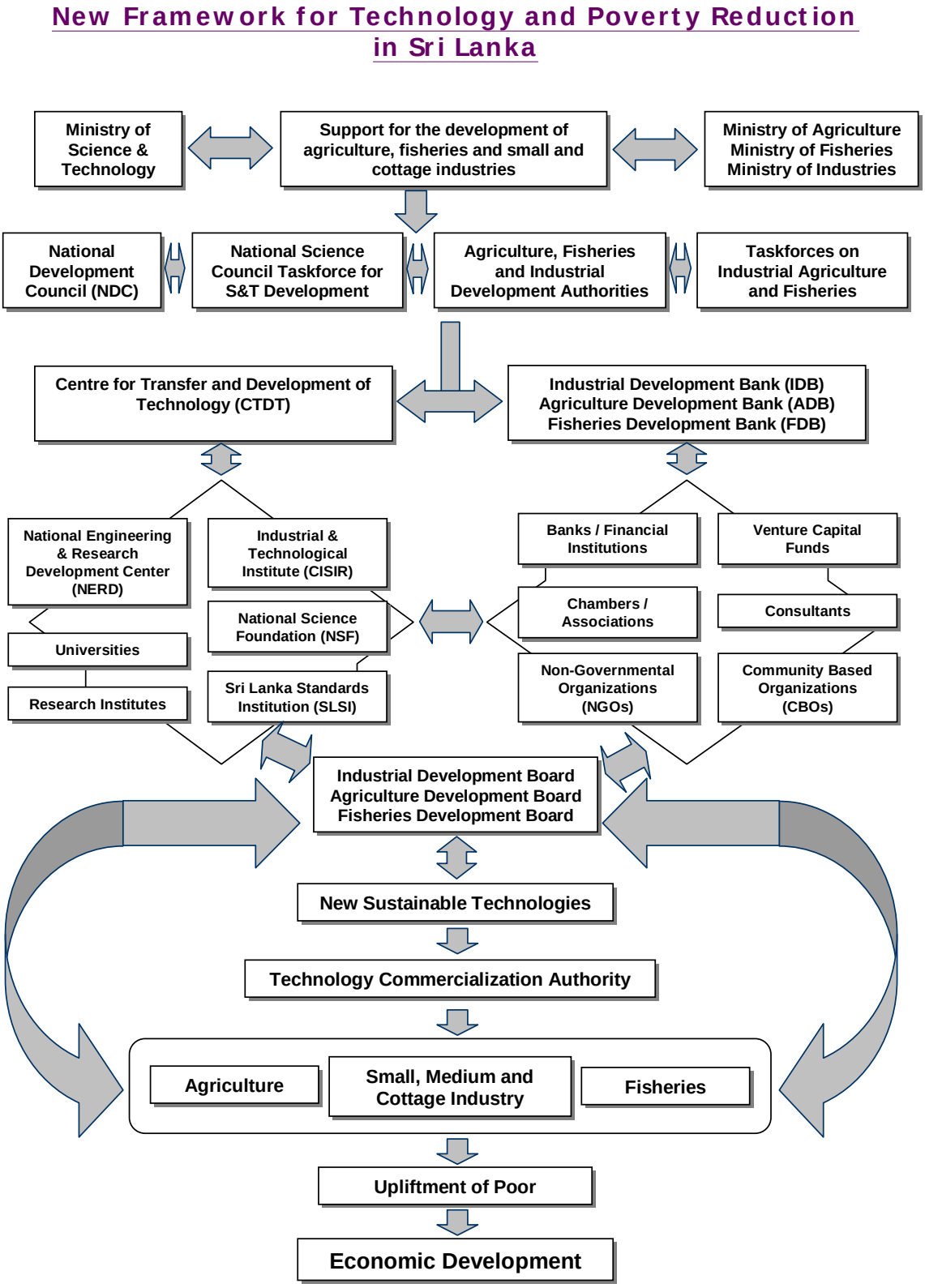
ii- Technological cooperation: Corporate agreements can be formed to transfer and share the technology between firms in the competitive stage. Corporate venture capital in small high tech. firms is another form of cooperation.

iii- Manufacturing cooperation: Firms can build partnerships to manufacture the end product.

Availability of S&T indicators is important to measure the S&T capability of the country. National Science Foundation (NSF) does a fairly good job of tabulating such data. NSF work should be extended to provide a comprehensive analysis and to set a benchmark by looking at the performance of organizations of other countries. This will help R&D organizations to set targets and measure performance.

Several factors have contributed towards the decline in useful technological innovations that directly eliminate poverty. These include the lack of interaction between universities and the industries concerned, the out migration of talented S&T personnel, lack of co-ordination between various R&D institutions, lack of financial resources and the lack of a marketing strategy for the technologies that are thus developed. This framework is introduced in the context of increased investments in R&D by the government. It identifies the key stakeholders involved in R&D and technological innovations such as research institutes, universities as well as others who facilitate such research through financial inputs, government policies or through extensive involvement with the community. R&D institutions in Sri Lanka such as ITI, NERDC, universities and research institutes are crucial for the development and implementation of new technological developments and innovations. The interaction between universities, R&D institutes and the industry has been minimal. This is a critical aspect in the development of technologies that meet the needs of the people. In the proposed

PROPOSED FRAMEWORK FOR TECHNOLOGY STAKEHOLDER INTEGRATION AND POVERTY REDUCTION IN SRI LANKA.



framework the necessity for such links between the industries, R&D institutions and universities has been emphasized. This is significant in several ways. It will ensure that research is targeted towards the needs of the industry and that researchers understand the particular industrial environment. It will also help universities to develop the curriculum so that it is relevant to the present requirements of the industry. This will ensure that talented S&T graduates do not venture into other disciplines such as management to a certain degree. R&D requires a great deal of expenditure and the government alone cannot fund all activities related to R&D. universities and other R&D institutions such as ITI and NERDC lack financial resources. Though the government has increased the amount spent on R&D, more than 69% is spent on recurrent expenditure. Therefore additional financial in vestments are needed to enable the development of new technologies. Thus, the assistance provided by banks and other financial institutes, venture capital funds and other associations are important. The framework also proposes the establishment of three separate financial institutions to assist the following sectors, agriculture, fisheries and industries to enable those engaged in these sectors to obtain credit to reap the benefits of technological innovations. The advantage of creating the following, Industrial Development Bank, Agriculture Development Bank and Industries Development Bank are that it's possible to design credit schemes that suit the respective sectors, and it will be easier for these communities to obtain loans from such banks rather than through conventional banks. At present, the R&D activities of each institution are conducted in isolation with one another. The framework outlines the establishment of a National Science Council Taskforce for S&T Development. It proposes that the R&D activities of each and every R&D institution should come under the purview of the National Science Council Taskforce for S&T Development and other bodies such as the National Development Council. This will ensure that recent research and knowledge is shared between the institutions. This is very important if the country is to develop new technologies, given the constraints on resources. The framework further proposes the establishment of Agriculture, Fisheries and Industrial Development Authorities. These institutions will outline long-term and short-term development plans in concurrence with the National Development Council and National science Council Taskforce for S&T Development. The proposed taskforce on Agriculture, Fisheries and Industrial Development will be responsible for the execution of these proposals. The implementation of projects in Sri Lanka has not been viewed favorably by foreign and local experts, and the establishment of such a taskforce will expedite the process. R&D institutions in Sri Lanka lack knowledge regarding the latest innovations in the technological field. The framework proposes the establishment of a Center for Transfer and Development of Technology (CTDT) to overcome this drawback. In fact the UNCTAD mission in 1976 recommended the setting up of such an institution. It will liaise with R&D institutions, universities, National Science Foundation and the Sri Lanka Standards Institution to improve the technological capabilities of these organisations. The framework also identifies the role played by the government through the involvement of key ministries related to R&D, the Ministry of Science and Technology and the Ministry of Industrial Development. This approach will lead to the development of new technologies through continuous research programs. The out migration of key resource persons due to factors such as lack of opportunities for publications, brain drain, bureaucratic hurdles and lack of research funding has the need to in corporate those professional who have opted to enter the private sector quite appropriate. In the quest for economic growth through the utilization of new technologies; advances the input of all key resource persons in the country is important and thus relevant resource persons in the private sector should also be incorporated into the development of new technology. The lack of commercialization of technologies has also been a crucial barrier to the effective deployment of technological innovations. Effective marketing strategies will ensure that R&D institutions are able to recover the monies spent on R&D. The framework proposes the establishment of a Technology Commercialization Authority for the purpose. Technological advances will increase the progress made in eradicating poverty through enhancing economic growth. The framework has specifically focused on technological innovations in the field of agriculture, fisheries and small and cottage industries. This is because the great majority of poor people earn a living while engaged in one of these sectors. Though economic growth prompts gradual elimination of poverty, other factors if not addressed at the outset will halt the progress made to eradicate

poverty. These factors include the context within which the poor are based, their specific needs, government policies such as macroeconomic management and the proper management of the technology that is introduced as a measure of poverty reduction. The needs of the poor and the contexts within which they live are different across countries and even within the same country. The factors that propel them towards poverty are also significantly different. Thus, the necessity to consider these factors in the adoption of technology is crucial. Maintenance and training the poor to make vital decisions about the use of technology are important to ensure that technology is used effectively. This will mean that technology is adapted to the specific contexts of the poor and will give greater benefits to them in the long-run.

CONCLUDING REMARKS

- The Sri Lankan history in Technology Development was not so successful. Prior to independence it is obvious that the state deliberately ignored technology issues which are not the domain in plantation agriculture. But after independence, the most significant reason for the failure was a lack of high level political commitment and support for R&D activities.
- After the 1977 economic reforms the government has taken considerable efforts to develop the country as a newly industrialized country based on S&T. Due to matters such as lack of improvement of conditions for the S&T community, non development of proper S&T policy framework, lack of a S&T culture and uncertainties brought about by the ethnic conflict, the efforts for S&T development were not very successful.
- Sri Lanka R&D expenditure is well below the recommended value for developing countries; R&D is much labour intensive in comparison to other countries.
- Interaction between academics and industrialists is not geared to developing new technologies. It's limited to providing solutions for some problems and providing continuous education. This is a major drawback if the promotion of new technologies is to be the focus of economic growth.
- Due to the poor living conditions of the S&T community, many graduates from S&T disciplines seek employment in other fields and qualified S&T professionals leave the country. This affects the quality and volume of research outputs.
- In terms of Technology indicators some R&D institutions are dominating others. Lack of commercialization of R&D is a major problem in all the institutions.
- The majority of technological developments are in the field of agriculture. Recent research has revealed significant levels of success in productivity as a result of technological improvements in the field of agriculture.
- Despite the fact that technology can be used to eliminate poverty, other means should also be analyzed before technology is adapted to any context.
- The disadvantages of using the technology should be taken into consideration before it is implemented. The implications of factors such as costs should be closely analyzed as the target groups are living in poverty and the consequences of ignoring crucial factors such as these could be severe.
- The particular needs of the people, what knowledge is needed to use it, as well as how to maintain technical systems should be addressed before implementation.
- Technology should be implemented in such a way that it will not serve to be a barrier to the day to day lives of people living in rural communities.
- The appropriateness, affordability and accessibility of the technology are vital if people are to make effective use of it. All these three components need to be met if technology is to succeed in reducing poverty.
- Sri Lanka should develop the acquisition, adaptive, operative and innovative capabilities in line with the country's factor and resource endowments. While acquiring the technology all the components of technology such as technoware (machine embodied form of technology), humanware (human embodied form), inforware (information embodied form) and orgaware (organization embodied form) should be obtained to gain maximum benefits and to create national technology capabilities.
- Unless technology reaches the farmers, fishermen and small and cottage industries mass poverty reduction cannot be expected. In order to make technology suitable for these groups, particular

attention should be paid to the social, economic and technical appropriateness of the technologies.

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