RECOMMENDATIONS

OF THE

WORKSHOP

ON

PRIORITY AREAS FOR RESEARCH

IN

DIFFERENT DISCIPLINES

IN

PHYSICAL AND ENGINEERING SCIENCES

HELD ON

20TH JUNE 1987

AT THE

AUDITORIUM OF NARESA

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SPONSORED BY THE WORKING COMMITTEE ON PHYSICAL AND ENGINEERING SCIENCES OF NATURAL RESOURCES, ENERGY AND SCIENCE AUTHORITY OF SRI LANKA

C O N T E N T S

1. INTRODUCTION

NARESA has been awarding research grants in all scientific disciplines since 1970. While the response to NARESA's annual call for applications for research grants is good in some natural sciences, notably biology and chemistry, it has been singularly poor in the physical sciences. To make a start in overcoming this problem, the Working Committee on Physical and Engineering Sciences felt that it would be useful to hold a workshop to enable the scientists in these disciplines to come together and discuss current research work, the constraints to research, the ways in which research and development could be stimulated, and the priority areas for research and development.

The workshop was held on 20 June 1987. The participants were selected from among experts in the different disciplines in the physical and engineering sciences. The broad objective of the workshop was to bring together the scientists working in each discipline so that they could discuss the state of R & D and the national priorities in relation to their areas of work. The expected out come of the workshop was a statement of priority areas in research and development. It was also expected that the discussions at the workshop would stimulate more physical scientists and engineers to apply for grants.

The workshop report listing priority areas was expected to assist the Working Committee in evaluating applications for research grants and also in promoting research and development in areas which, though important, are at present receiving inadequate attention.

The workshop commenced at 9.00 a.m. at the NARESA auditorium. The Director General, NARESA, opened the workshop with a brief address. He then invited Prof. Sam Karunaratne, Chairman, NARESA's Working Committee on Physical and Engineering Sciences, to chair the workshop. The Chairman addressed the participants on the objective and the expected outcome of the workshop. The workshop then broke-up into six groups representing the different disciplines to discuss matters

pertaining to research and development in their areas of work.

In the final session, during the afternoon, the workshop reconvened in plenary and a spokesman from each group reported the findings and recommendations in relation to the priority areas for research and development.

2. REPORTS OF THE WORKING GROUPS

2.1 Working Group on Earth Sciences

Priority Areas for Research:

(a) The study of the mass movements in drainage basins - soil erosion, transport of debris from landslides, silting of reservoirs.
(Possible joint study with engineers)

Justification:

This study on mass movements is of vital importance for the smooth and efficient working of the major hydro and irrigation projects by slowing or preventing the silting of the major reservoirs. eg. Norton Bridge, Castlereagh, Polgolla, Kotmale, Victoria and Randenigala.

(b) The detailed geological mapping on scales of 1:50,000 and 1:10,000 of selected areas for a better understading of the geology of Sri lanka.

Justification:

Understanding of the geology of Sri Lanka is based on very limited published basic data i.e. geological maps and petrological, structual, geochemical and geophysical studies. There is a great need for more basic large scale geological mapping and regional studies.

(c) The study using geophysical methods of weathered overburden for gem gravel potential, for landslide hazards and for foundation conditions.

Justification:

The study of the overburden is a prerequisite for all engineering works and also vital in evaluating unconsolidated resources (i.e. clays, gravel, sand etc.) This study could

be conducted using simple geophysical instruments.

(d) The geological/geophysical study of nearshore areas of the continental shelf for marine mineral resources potential (i.e. heavy minerals, construction material, phosphates)

Justification:

As a result of the Law of the Sea deliberations Sri Lanka has gained control over a large ocean area and therefore the geological/geophysical study of the nearshore areas of the continental shelf is now considered an integral part of the country's development plan. The marine mineral potential of the continental shelf is considered high and as such priority should be given to such studies.

(e) Geotraverse across the island using ground and remote sensing equipment to determine the deep structure of the island with regard to subsurface mineral potential (if possible with foreign collaboration).

Justification:

A study of the geological, geochemical and geophysical characteristics of a stripacross the island will throw light on the structure of the crust in Sri Lanka and the relationships of the various crystalline rock units.

(f) The study of the geothermal energy potential of the island as an alternative source of energy.

Justification:

Sri Lanka has many hot water springs located in areas where deep seabed fracture zones have identified. A study of the geothermal potential of these areas of the island is therefore a necessity.

Members of the Working Group:

Prof. W. Vithanage

Prof. P.G. Cooray

Dr. S. Wickremeratne

2.2 Working Group on Mechanical Engineering

Priority Areas for Research:

(a) Necessity to encourage research activity in commercial (industrial) establishments.

NARESA to extend recognition to such efforts, and partly (or fully) fund the research.

Justification:

Valuable applied research in industry is going on without the recognition or notice of NARESA. It is felt that recognition of meritorious research and in possible cases funding as well would encourage applied research.

(b) Problems of manufacture of quality spare parts for textile and other industries:

(Principally metallurgical problems)

Justification:

Problems of metallurgical nature needs solving to improve quality of the components to turn out these simple components indigenously and to eventually promote local manufacture of basic plant and equipment.

(c) Problems on the use of hitherto unused soft timbers - seasoning and preservation

Justification:

Timber resources are fast dwindling and therefore we have to turn to, 'lesser' timbers to get the same function as 'higher' class timber. Therefore study of seasoning, preserving and other modifications necessary is deemed essential.

(d) Mechanization of farming implements and development of agricultural produce processing machinery.

Justification

A fair amount of work is already done but more applied research is welcome which is expected to yield tangible benefits to the farming community and agricultural processing sector.

(e) Loss to the national economy due to corrosion.

Justification;

To create an awareness amongst people of the enormity of the problem. eg. Corrosion repair to a vehicle which may average from Rs.5000-10000 which will illustrate the total cost for the vehicle population, similarly the losses due to corrosion of plant, machinery, equipment and other structures.

(f) Problems of conversion of sucessful pilot products/plants to marketable counterparts.

Justification;

It is felt that good products of research are in want of commercial exploitation. A study into this deficient area would be very rewarding.

eg. 1) Dimmer switch produced by NERD.

2) Fuel - efficient domestic hearth developed by CEB etc.

(g) Information to be made available on research facilities available in all institutions in Sri lanka.

-A directory to be prepared

-A video production showing some key facilities would be useful to put across the message to public in general and to the industrialist in particular.

Justification:

Information to be made available on research facilities available to all institutions in Sri Lanka.

It is proposed that

(i) NARESA compiles a directory (and updates periodically)

(ii) Public awareness is aroused by means of a video production to be telecast over National TV Network.

(iii) This could also be made available to interested parties.

Members of the Working Group:

Dr. M.P.U. Bandara

Dr. C. Patuwathavithana

Dr. W.D. Maliyasena

Mr. H.H.P.S. Wijayapala

2.3 Working Group on Physics

Priority Areas for Research:

The following fields have been identified as priority areas.

(a) Condensed matter and materials

Justification:

Frontier research area with resource personnel available.

(b) Geophysics (Solid Earth, Atmospheric)

Justification:

Frontier research area with resource personnel available. There are several people working in above areas at present.

(c) Computational Physics

Justification:

Although facilities are available, research in this area is completely neglected.

(d) Astrophysics, Solar Physics, Membrane Bio-physics.

Justification:

These are completely neglected areas of research in this country. At least for cultural reasons people should be encouraged to pursue research in these fields.

(e) Electronics and Optics relevant to Bio-medical problems.

Justification:

Potential practical applications.

Members of the Working Group:

Prof. K. Tennakone

Dr(Mrs) Dayawansa

Dr. J. Ratnasiri

Dr. W. Siripala

Dr. D.A. Tantrigoda

2.4 Working Group on Electronics and Telecommunication

Areas Recommended for Development:

The group has identified two major areas for development.

1) The need to provide telecommunication facilities to the rural communities. The proposal is to develop a low cost telecommunication switching system for community usage. These community pockets are characterised by

    1. Low traffic density
    2. Low revenue generation

Justification:

Since the telecommunication facilities development is undertaken on a national basis, after taking into consideration the traffic density and the revenue generating capacity, these projects are confined only to the established commercial urban areas.

This does not allow the telecommunication facilities to be extended for communities where heavy communication traffic is not experienced at present.

Therefore there is a need to develop a low cost telecommunication switching system to provide intercommunication facilities within small countries.

The device is expected to be something in between a central exchange and a PABX.

This is expected to generate demand so that at a later stage central exchange facilities will become economically viable.

Out of the telecommunication facilities, only telephone is to be provided initially. Other services to be implemented in stages.

In order to provide information specific to a particular community, this may be extended in the future to provide

access to information retrieval from a central database.

(2) The need to promote the application of microprocessor based devices and systems in

(a) Instrumentation

(b) Industrial control

Justification:

The manufacturing industries which have been set up about 25-30 years ago, need rehabilitation and modernisation.

The use of devices and systems based on microprocessors will improve the productivity and efficiency in addition to improving the quality of product.

The application areas are numerous, but mainly fall into the mechanical engineering discipline.

The main obstacles experienced by developers in this connection are

(a) The non availability of latest technical literature, eg. Data sheets.

(b) The limited availability of electronic components in the open market.

It may be worthwhile if a non-profit making organisation can maintain a component bank from which researchers can draw components when the need arises.

Members of the Working Group:

Dr. A.S. Induruwa

Mr. L. Pinto

Mr. S.S. Ediriweera

2.5 Working Group on Electrical Engineering

Identified Areas of Possible Research:

(a) Lightning protection of tall structures, equipment (including electrical and communication equipment) by the use of lignthning conductors both conventional and radio-active.

Justification:

Pure protection for the building or the equipment.

Damage that can be caused to expensive terminal equipment such as computers, or switching equipment due to lightning can be minimised or eliminated by proper safe conduct of the lightning discharges to earth.

(b) Development of power system (including distribution system) software for planning, design, operation and optimisation (including optimisation of reservoir operation for multipurpose activity).

Justification:

Software may not be available for the specific application. If available the developed software will be of excessive cost. Power systems being basically nonlinear will need computer based solution and this has already been realized both by the CEB and Lanka Electricity Co. who have pruchased software for some aspects of their activity.

Members of the Working Group:

Prof. W.P. Jayasekara
Prof. S. Karunaratne
Mr. Rohan Wirasinha
Mr. Vidura Wickramaratne

WORKING GROUP ON CIVIL ENGINEERING

Priority Areas for Research

The project areas identified are covered under six main groups. They are given below.

1. Water Resources Engineering
2. Geo-technical Engineering
3. Highway/Railway and Transportation Engineering
4. Building and Structural Engineering
5. Public Health and Enviornmental Engineering
6. Coastal Engineering

The subheads are given below under each group.

1. Water Resources Engineering

(i) Feasibility and potential of mini/micro hydropower.

Justification:

While the full potential of major hydropower in Sri Lanka is estimated at about 1100-1200 MW, there is one school of thought whose estimate of mini/micro hydropower potential is in the same region as that of major hydro. At the present time in history when a decision has to be made on the choice among nuclear coal etc. it would be essential to undertake research on this topic.

(ii) Feasibility of exploitation of ground water as against surface water for irrigation

Justification:

There are about 750,000 Ac. of irrigated agriculture in the country whose source is surface water. These cultivations have been failing to different degrees in the recent past due to unavailability of sufficient surface water and there is sufficient evidence to believe the existance of large

quantities of ground water whose potential could be exploited for irrigation. Hence the feasibility studies.

(iii) Effects of irrigated agriculture on pollution of ground and surface water

Justification:

In the recent past, the Sri Lankan farmers have been some how or other, using increasingly large quantities of chemical fertilizer, weedicides and pesticides, etc. The secondary effects of all these have been to pollute both surface and ground water the end product being the possible dangers to both plant and animal life. Hence the need to research.

2. Geo-technical Engineering

(i) Stability of slopes

Justification:

Even though there is very little work done in this field in this country, there is a great deal of economic activities on lands described as slopes in consturction of dams, roads housing and plantations, etc. And the possible contribution from such projects depend on the stability of slopes. Hence the need for research.

(ii) Settlement of different soils including filled up lands

Justification:

Sri Lankan residual soils and peat do not follow the normal behaviour with regard to settlement. Also lands are being reclaimed in low lying areas where soil strata are highly heterogeneous and hence the need for studies in this area.

(iii) Guide lines for inspection of structures

Justification:

There are a large number of major engineering structures both ancient and modern and they play considerable roles in the economy of the country. They could either fail totally or get damaged due to various structural and other reasons. In an attempt to guard them against such a situation, it is necessary to inspect and examine them regularly on a very scientific basis. Hence the justification for these studies.

(iv) Seepage studies

Justification:

Regarding seepage losses through canals, dams and evan reservoir beds, it is essential to carry out seepage studies. to help in planning water management, lining of canals and evaluation of design criteria. Hence the need for these studies.

(v) Effects of new construction in the vicinity of already existing buildings

Justification:

Migration of more and more people to cities has made it necessary to construct new buildings adjacent to existing buildings particularly in Colombo. Under such circumstances there had been many cases where damages have been caused to the existing buildings. Hence it is essential to study the effects of new construction on existing buildings.

(vi) Geological studies in existing tunnels and their stability

Justification:

There are a several recently constructed tunnels in the various hydropower projects in Sri Lanka. The performance and behaviour of these tunnels will have to be closely

monitored in the light of the accelerated programme of construction of these projects. Hence the justification for these studies.

3. Highways, Railways & Transportation Engineering

(i) Road network analysis for Colombo and other cities

Justification:

Roads have been constructed and tens of thousands of vehicles have been introduced to these roads without any planning and hence a very unsatisfactory state of affairs on the roads. It is believed that this situation could be improved with the available roads, provided all traffic is appropriately routed. Hence, the necessity for road net work analysis.

(ii) Effects of electrification of railways on highways

Justification:

As a result of railway electrification there is very likely to be changes in the travel patterns one way or the other. Further, with electrification, the higher frequency of trains will interrupt highway traffic probably to its detriment unless properly planned. Hence the justification for research.

(iii) Safety aspects on fast riding surfaces

Justification:

With the rehabilitation of road surfaces that is being carried out now with new types of surfaces, it is essential to study the skidding properties and long term maintenance problems which may contribute.

(iv) Road safety measures and its impact on traffic flow

Justification:

The details like sign posting, street lighting and speed breaking have an impact on traffic flow. But as quick

traffic flow (with safety) is the ultimate aim, it is necessary to study the subject in depth for traffic planning.

(v) Canal transportation

Justification:

Canal transportation has once been one mode of goods transport in this country and it is so in many parts of the world today. With the deterioration of both Rail and Road transport systems and adverse fuel prices, it is worthwhile looking at canal transport again.

4. Building & Structural Enginering

(i) Economic use of building materials

Justification:

Studies in this area will literally help the low income groups to build houses and promote appropriate use of building material.

(ii) Guide lines for small building constructions

Justification:

As there is very little or no publications on such guide lines and there are a large number of potential small house builders, work in such areas would go a longway in construction of small buildings.

(iii) Design of software for design and project management

Justification:

With the ever increasing application of Engineering and Technology to economic development it is essential to develop software for engineering designs and project management.

(iv) Low cost housing

Justification:

It is that of the middle or the lower middle class whose income levels are so low as to make it almost impossible for them to think of their own housing. And a large majority of working Sri Lankans fall into this class. Hence, it is the advances made in low cost housing through research that can be expected to make any impact on housing for this majority.

(v) Standardisation of brick size

Justification:

Both engineers and building contractors have been discussing the size of bricks for decades now without ever taking much constructive effort to solve the problem. This has created few other problems for house builders. Hence it is necessary to get some studies in this area to determine what corrective measures could be taken.

(vi) Formulation of standards for variation of strength of concrete

Justification:

The strength of concrete also depends on the fine and coarse aggregates and cement used for making concrete. The different properties of these materials will give rise to a variation of concrete strength. So attempts should be made to formulate standards for the variation of strength.

5. Public Health and Enviornmental Engineering

(i) Pollution of canals in urban areas

Justification:

Even though all the necessary technology is locally

available to handle pollution of canals in urban areas, very little or no work has been done in this area. Yet the men who live and/or work in cities are fully aware of the problems they encounter as a result. Hence, the need for studies in this area.

(ii) Studies in water quality

Justification:

Urbanisation and concentration of industries (though small) is adding to the deterioration of water quality. Therefore it is essential to carry out studies to monitor water quality.

(iii) Noise and air pollution

Justification:

Most of the "so-called" developed countries are already suffering from both noise and air pollution and are investing large sums of money in researching to find solutions to these problems. Sri Lanka should undertake studies to cover these areas before severe problems are encountered.

(iv) Solid waste disposal studies

Justification:

This subject is connected with pollution and water quality etc., and with some increase in industrialisation, there is justification for research in this area.

6. Coastal Engineering

(i) Stabilisation of beach materials by use of appropriate vegetation

Justification:

Work should be carried out to study the possibilities of beach erosion prevention by using local vegetation.

Members of the Working Group:

1. Prof. D.S. Wijesekara
2. Prof. N.P. Ranaweera
3. Dr. C. Kariyawasam
4. Mr. M. Chandrasena
5. Mr. G.G. Jayawardene
6. Mr. A.D.S. Gunawardene