ROLE OF POLYTECHNICS IN ENVIRONMENTAL PROTECTION AND SUSTAINABLE DEVELOPMENT

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SYNOPSIS

This article is an extract of a paper on the same topic presented at the NATIONAL SEMINAR ON ENVIRONMENTAL ENGINEERING held at T. T. T. I., Madras on 4th March 1994. The article reviews how in the guise of development and progress, environmental degradation and pollution have already reached alarming proportions in most developing countries especially in urban conglomerations, compounded by problems of population explosion and migration. The task of crying a halt to this process and limiting pollution levels to acceptable standards has become a stupendous task impossible to tackle by designated government agencies and departments alone. Educational institutions at all levels need to get involved and introduce in their courses relevant components of environmental awareness, basic knowledge, skills and attitudes in order to produce a future generation of citizens who can help fight this degradation and pollution.

Polytechnics in particular, could do a lot more in this area. They could produce environmentally conscious technicians to avoid repetition of the infamous Bhopal and Chernobyl type of disasters. They could also take up environment - friendly activities by acquiring a GREEN lable and produce local pressure groups to resist and fight all types of damaging activities within their own communities, besides teaching courses related to environmental engineering. This article elaborates the above concepts with practicable and implementable strategies.

1.0 INTRODUCTION :

As the world inches forward to the threshold of the twentyfirst century, both developing and countries alike are struggling to grapple with environmental problems albeit of different kinds. In the developing countries, until the 1970s (and to some extent even today) plans for growth and development " stressed the need to boost industrial potential in order to make goods competitive in the world market, but, little if any consideration was given to the effect of these policies on the environment ". The results of such policies stare at one's face every day both in cities and even in rural areas. Fortunately, in India (as in other parts of the world) there is increas ing awareness for environmental protection. In the early 1970's the first enviro-mental movement in Kerala to protect

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the Silent Valley from the ravages of development, has hit the head lines and later the Chipco Movement in U. P. has drawn worldwide attention to the wanton destruction of forests. The latest in this series of snow balling opposition calling for development that is sustainable is the Narmada Bachao Andolan led by the indomitable Ms. Medha Patkar. The urgent need to protect the ecological balance and mitigate pollution through a properly designed strategy towards sustainable development is the unquestioned need of the hour.

2. 0 REPORTS OF UNESCO/ UNEP & INTERNATIONAL AGENCIES :

During the last two decades, several international organizations and intergovernmental meetings have been held to focus attention on these issues :

* The United Nations Conference on Human Environment held at Stockholm in 1972 first proclaimed its resolve " to defnd and improve the environment for present and future generations ". (Ref. 1)

* Recognising education as a powerful tool for social change in this vital area, the first Inter-governmental Conference on Environmental Education at Tbilisi (USSR) in 1977 appealed to the member states " to include in their educational policies, measures designed to introduce environmental systems". As a result of these decisions, environmental components have already been introduced into the Secondary School Curricula in India through the efforts of NCERT. (Ref. 2)

* To facilitate the introduction of environmental education components into the higher education system (particularly Technical and Vocational Education), UNESCO/ UNEP organized a Consultation Meeting at the Colombo Plan Staff College for Technician Education, Singapore in March 1986. The Report of this conference and subsequent working documents have provided the guideline for extending this activity to ITIs and Polytechnics in India. (Ref. 3,4)

* Responding to these concerns, the World Bank too has made it mandatory to address environmental concerns in all projects funded by it and thus in the World Bank Assisted Project for strengthening Technician Education in India, the incorporation of Environmental Education components in all technician curricula and Teacher Training Programmes has been made compulsory. All the 19 states in the project covering about 550 Polytechnics and four T. T. T. I.'s are now working towards this goal. (Ref. 5)

3.0 GUIDELINES PROVIDED BY UNESCO / UNEP FOR INCORPORATION OF ENVIRONMENTAL EDUCATION (E. E.) COMPONENTS INTO TECHNICIAN CURRICURA

The Technician Education Sector in India was one of the first to recognize its responsibility and accountability to society in the area of environment by not only preventing mishaps of the type that occured in Bhopal and Chernobyl but also by producing a future generation of technicians who are both aware and sensitive to the damaging effects of technology and development on the environment. It has responded positively to the call of UNESCO/ UNEP and the imperatives of the World Bank and is now seriously engaged, to begin with, in the task of incorporating E. E. components into technician curricula.

This is, however, a daunting job since these pressures on technician curricula are diverse and heavy. Some of the factors which complicate the curriculum revision process are :

a) The need to incorporate new and emerging technologies.
b) The need to cater to technology upgradation particularly due to the impact of electronics and computers.
c) The need to diversify into related areas.
d) The need to introduce more of science and humanities and management concepts etc.

In this process, clear cut guidelines have been provided by UNESCO/ UNEP in the Final Report of the Consultation Meeting held at CPSC, Singapore in 1986 relevant extracts of which are reproduced in the following pages :

3.1 STEPS & COMPONENTS FOR E. E. IN TECHNICAL EDUCATION :

The first and foremost requirement is for the national government in every country to have a clear cut policy on Environment which is reflected in the functioning of each and every ministry (including HRD) from which the aims and objectives of E. E., the corresponding Competencies and Curricula, the instructional methods and evaluation techniques to be followed are evolved. Some of these basic steps are indicated in Fig. 1 which is self explanatory.

3.2 A CONCEPTUAL FRAME WORK FOR E. E.

In the Education system in every country, there are certain heirarchical structures of courses aimed at different levels of jobs and the needs of E. E. at each level need to be identified. This exercise was attempted briefly as seen in the conceptual frame work enclosed (Fig. 2). for Technical Education at different levels.

3.3 E.E.COMPONENTS IN THE CURRICULA IN TECHNICIAN COURSES :

As regards Technician courses in particular, there are already certain subjects covered such as Sources and Properties of Materials, Design of Systems and Components, Principles of working of devices and machinery, Manufacture/ Fabrication/ Construction, Testing to standard specifications etc. In each of these areas/ subjects, new components relating to E. E. will need to be added and a representative sample is shown in Fig. 3.

3.4 MODELS FOR CURRICULUM DEVELOPMENT :

There could be many models adopted for incorporating E. E. components into the curricula, but two specific models have been indicated in the document and these are useful for application in Technician Education.

3.4. 1. THE DEFICIENCY MODEL :

In the deficiency model shown in Fig. 4 : the total components required for the curriculum with emphasis on the environment are worked out and from this the existing components are subtracted leaving the additional components now needed to be incorporated.

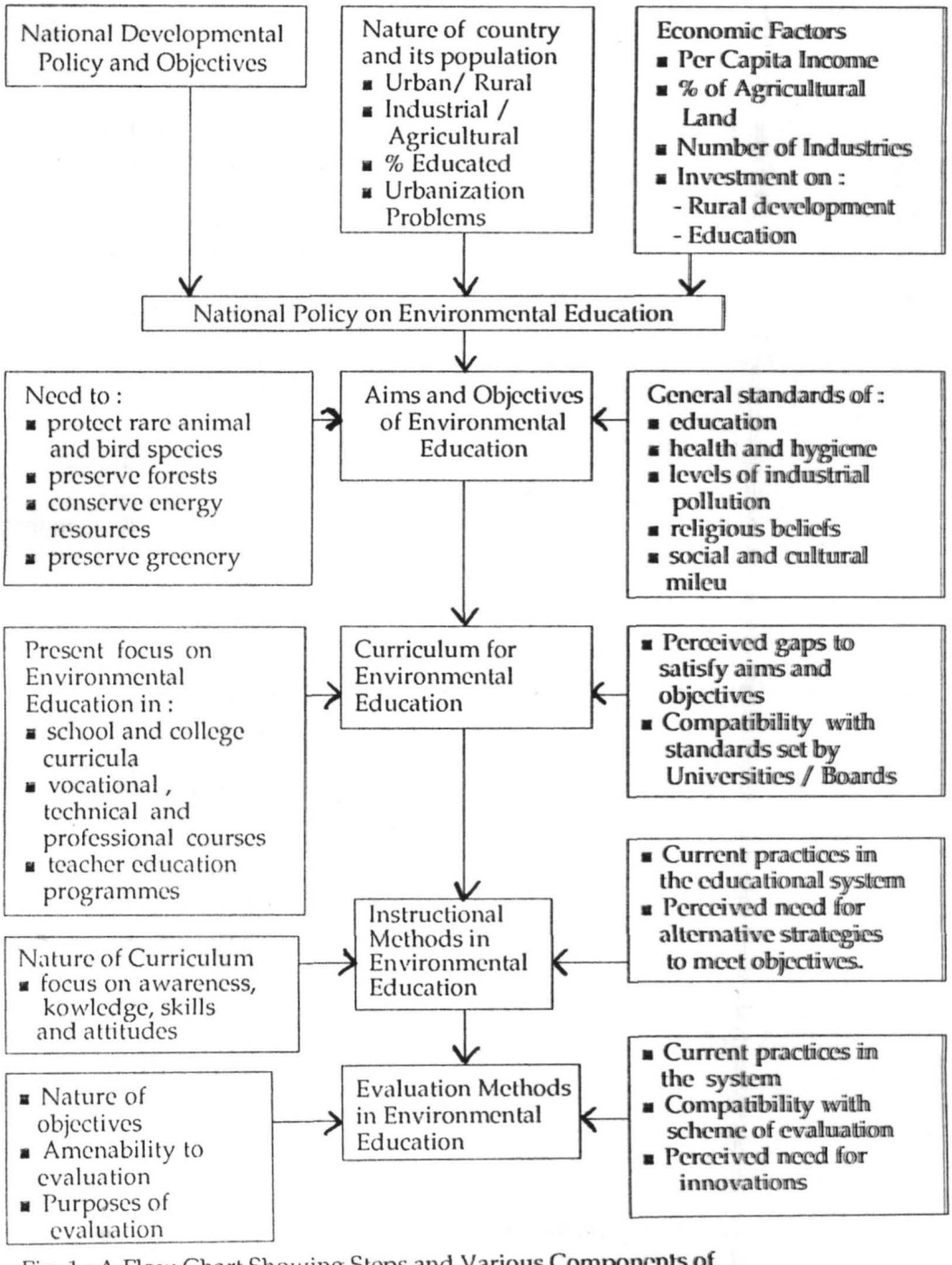
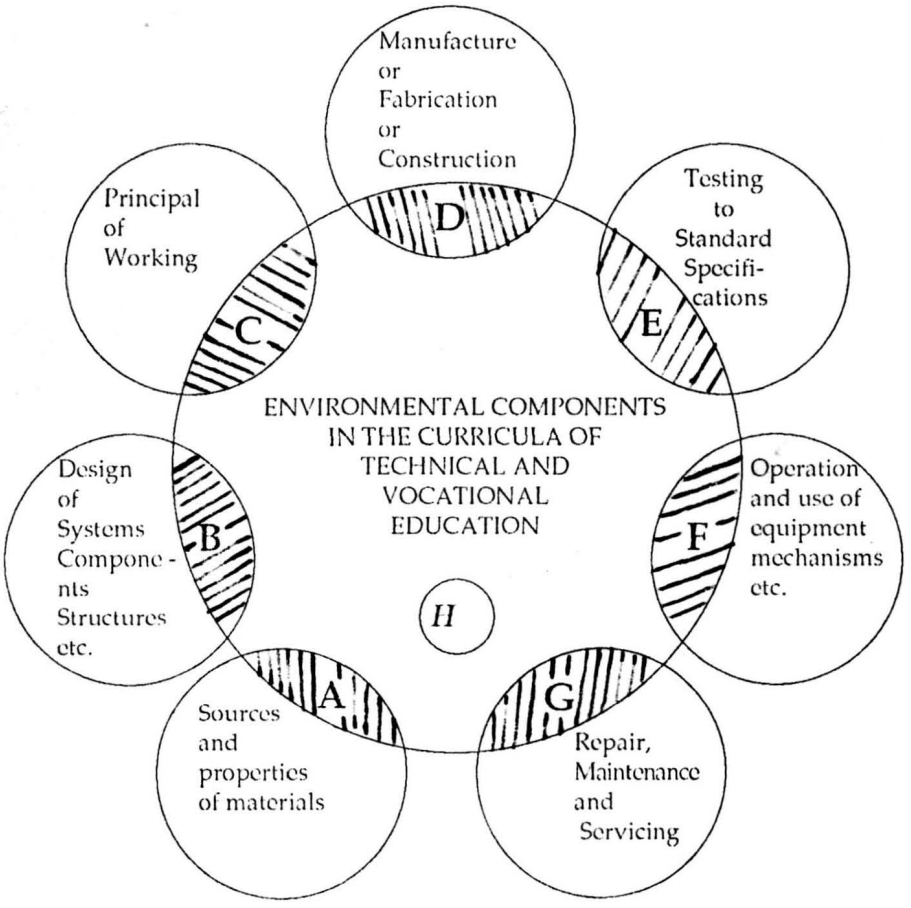


Fig. 1 : A Flow Chart Showing Steps and Various Components of Environmental Education in Technical and Vocational Educattion.

EDUCATIONAL LEVEL			JOB LEVL	NEEDS OF E.E.
CONTINUING EDUCATION FOR PROFESSIONALS Degree Courses (at Univrsity) (4 years)			→ PROFESSIONAL	■ Updating of environmental knowledge ■ New technology ■ Innovative approaches to solution of environmental problems ■ Research and Development
	Technician Courses (2 years)	→	TECHNICAL JOB (Skilled)	■ Application of technology to solve environmental problems ■ Skills in problem identification, analysis and solution
Higher Secondary School	Pre Technical Courses (2 years)	Vocational Courses (2 years) →	SPECIALISED JOBS (Semi-skilled)	■ Understanding of technological aspects of environment ■ Skills in routine, problem solving techniques
SECONDARY SCHOOL →			ENTRY LEVEL JOBS (Unskilled)	■ Understanding of : - Ecology and Ecological balance - Environmental problems and their sources - Need to protect environment
(About 4 years)				
PRIMARY SCHOOL (About 6 years)				Awareness of : ■ Environment ■ Human needs ■ Plant and animal needs

Fig. 2 : A Conceptual Framework for E E in the Educational System*

* Adapted from Teravuti Boonyasopon " Vocational and Technical Education in Thailand" 1984 (Mimcographed)



A - Sources of Energy (Non- renewable)
Properties of materials, land, air, water etc.
Properties of chemicals and materials which cause pollution

B - Design aspects pertaining to ventilation, safety , waste and refuse disposal, exhaust gases etc.

C - Use of non- renewable energy sources
Nature of exhaust gases;
Efficiency

D - Processes focusing on lessning waste and minimizing pollution, treatment of waste and effluents etc.

E - National and International standards and techniques for testing air, water, food, noise, etc.

F- Operational procedures and their relationship with ecological factors

G- Repair, maintenance and servicing of equipment used for monitoring and controlling pollution

H- Research and development to produce new processes and techniques with an accent on environment
Problems and projects from Industry.

Fig. 3 : Environmental Areas in the Curricula of Technical and Vocational Education

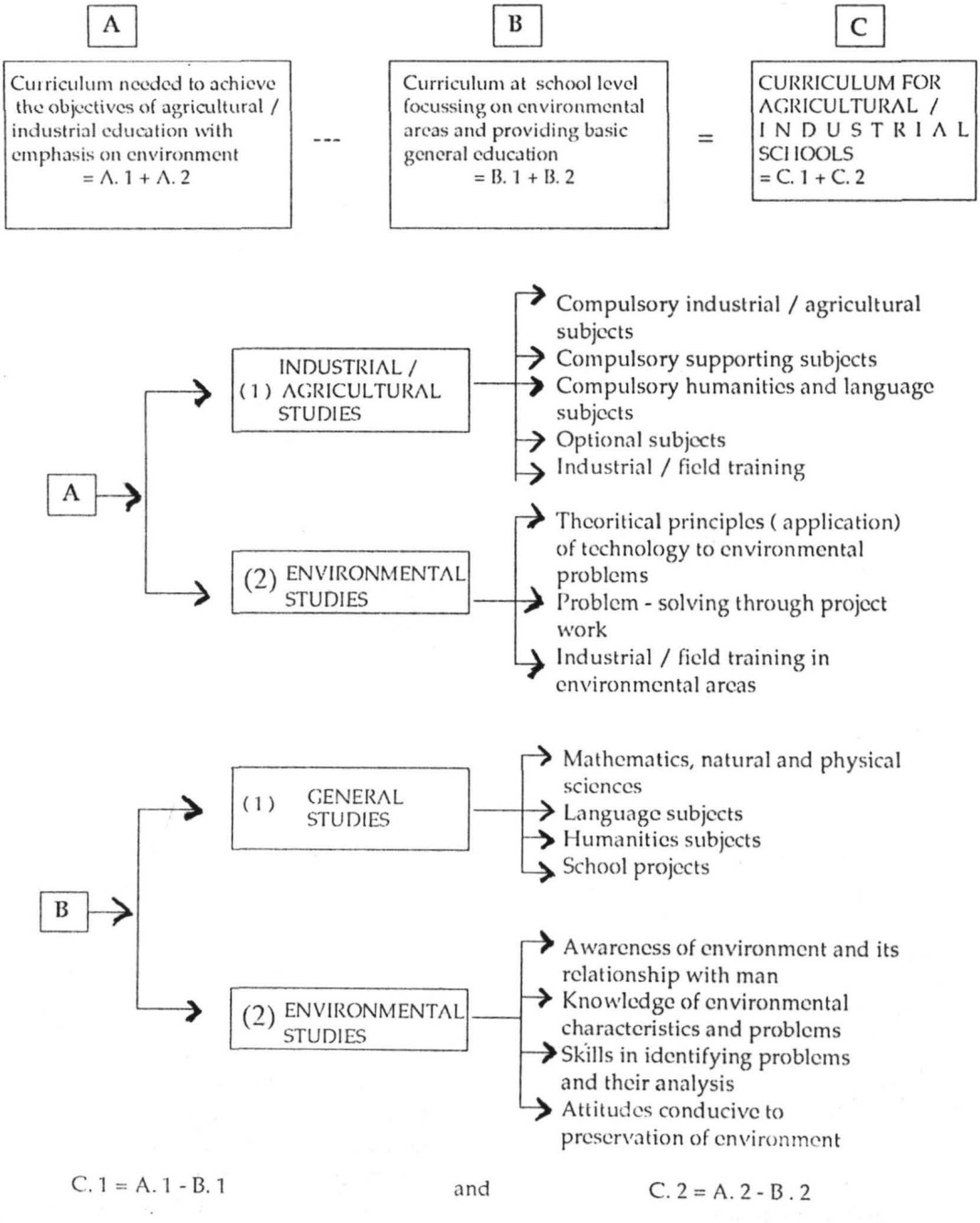
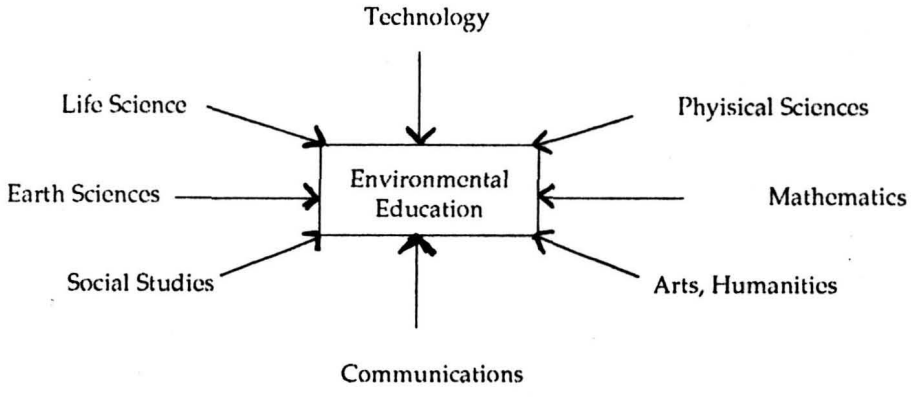


Fig. 4 : A Framework for Deciding on Curricula in Industrial / Agricultural Schools

A. **Inter- disciplinary Model**



B. **Multi- disciplinary (Infusion) Model**

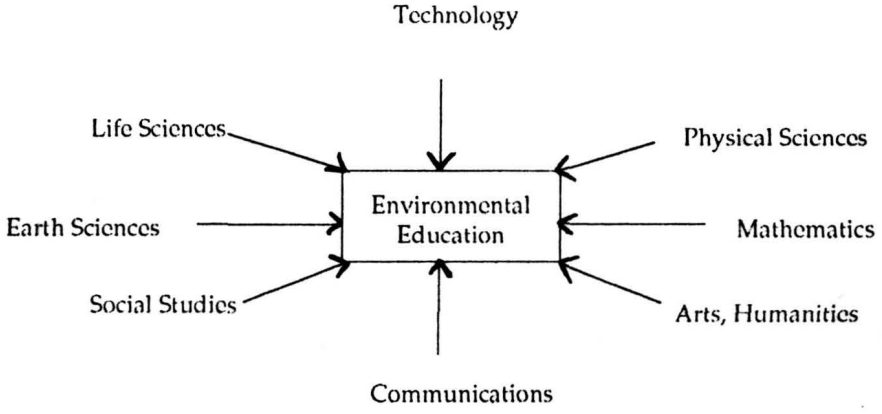


Fig. 5 : Two Conceptual Models of Environmental Education Curriculum

In (A) relevant components of many disciplines are drawn upon to create a distinct EE unit, course, or module. (B) Illustrates the *infusion* of EE components into other established disciplines where appropriate.*

* Adapted from Harold R. Hungerford and others. Strategies for Developing an Environmental Curriculum, (UNESCO, 1980) p. 11.

3. 4. 2 : THE HUNGERFORD MODEL :

In this model shown in Fig. 5. two alternate approaches are presented :

a) In the Interdisciplinary or Diffusion model, a new interdisciplinary subject is created and into this subject, all the relevant components under different areas such as Sciences, Mathematics, Arts etc. are all incorporated.

b) In the Infusion (Multidisciplinary) model, the respective components relating to E. E. are integrated into the respective subjects without creating a new subject and over burdening the course structure.

The relative merits and demerits of these two Hungerford models are indicated in the table below :

MODEL	MERITS	DEMERITS
DIFUSION MODEL	* A new subject or course can be introduced without disturbing the existing pattern of curricula in other subjects.	* Work load in other subjects has to be adjusted to accommodate the new subject. * Separate teachers have to be appointed to teach this subject posing administrative problems. * Students may not well appreciate the relationship between this and other traditional subjects.
INFUSION MODEL	* Infusion of E. E. components into existing subjects brings a better understanding of the role of technicians in environmental protection. * Total structure of the 3 years Diploma Course need not be disturbed. * No additional staff need to be appointed.	* Engineering and Science subject teachers need to be trained in environment related areas.

TABLE 1 : MERITS AND DEMERITS OF THE TWO HUNGERFORD MODELS (Ref.6)

4.0 THE COMMUNITY POLYTECHNICS SCHEME :

Fortunately for the Technician Education System in India, Polytechnics have already discarded their ivory tower existential model and have come forward to show their concern for social problems such as Rural Development. In 1979, the Government of India, Ministry of HRD identified initially 35 Polytechnics in the country and established "Community Development Cells" (with Corresponding Centres at the four T.T.T.I.s) which are directly working for Rural Development in SIX designated areas. The scheme has gathered considerable momentum and now covers nearly 190 Polytechnics, 61 of which are in the Southern Region. Now that the focus on Rural Development is shifting towards sustainability and Environmental protection, it is not a dificult task for them to take into consideration these additional constraints and reorient their work towards greater effectiveness. In this context, a conceptual model for incorporating sustaintability in to the existing activities was evolved (Fig.6) and was accepted recently at a conference held in GOA. Fig.7 presents an analysis of the current activities in these Polytechnics and the shift that will take place when environmental concerns are incorporated into their activities. The additional activities that need to be performed in each of the SIX existing areas as a consequence of this decision are indicated in Fig.8. It is thus evident that these Polytechnics are now moving towards an area where sustainability will become the main focus of their activities in Rural Development through transfer of technology.

5.0 PRO-ACTIVE INVOLVEMENT AND THE CONCEPT OF THE "GREEN" POLYTECHNIC :

Although some Polytechnics as above, designated as Community Polytechnics are working for sustain able Rural Development, the remaining Polytechnics are also teaching courses leading to a Diploma in Environmental Engineerng or have E.E. components incorporated in all their technician curricula.

However, it is not possible to expect all institutions to take up activities related to environment with the same level of rigour, commitment and intensity. In some cases the System Managers, Principals and Staff may be proactive and get more involved than the others. Fig.9 represents a typical structure showing the difference between proactive involvement and normal (reactive) involvement in this area.

5.1 THE GREEN POLYTECHNIC :

Proactive institutions of the type mentioned above qualify for the award of a GREEN label and get designated as "GREEN POLYTECHNICS". Such institutions consider Environment not as a mere subject of study in the institution, but as a "Way of Life". They not only teach the subject, but practice in daily life demonstrating to others in the community how its students and staff are committed fully to environmental protection.

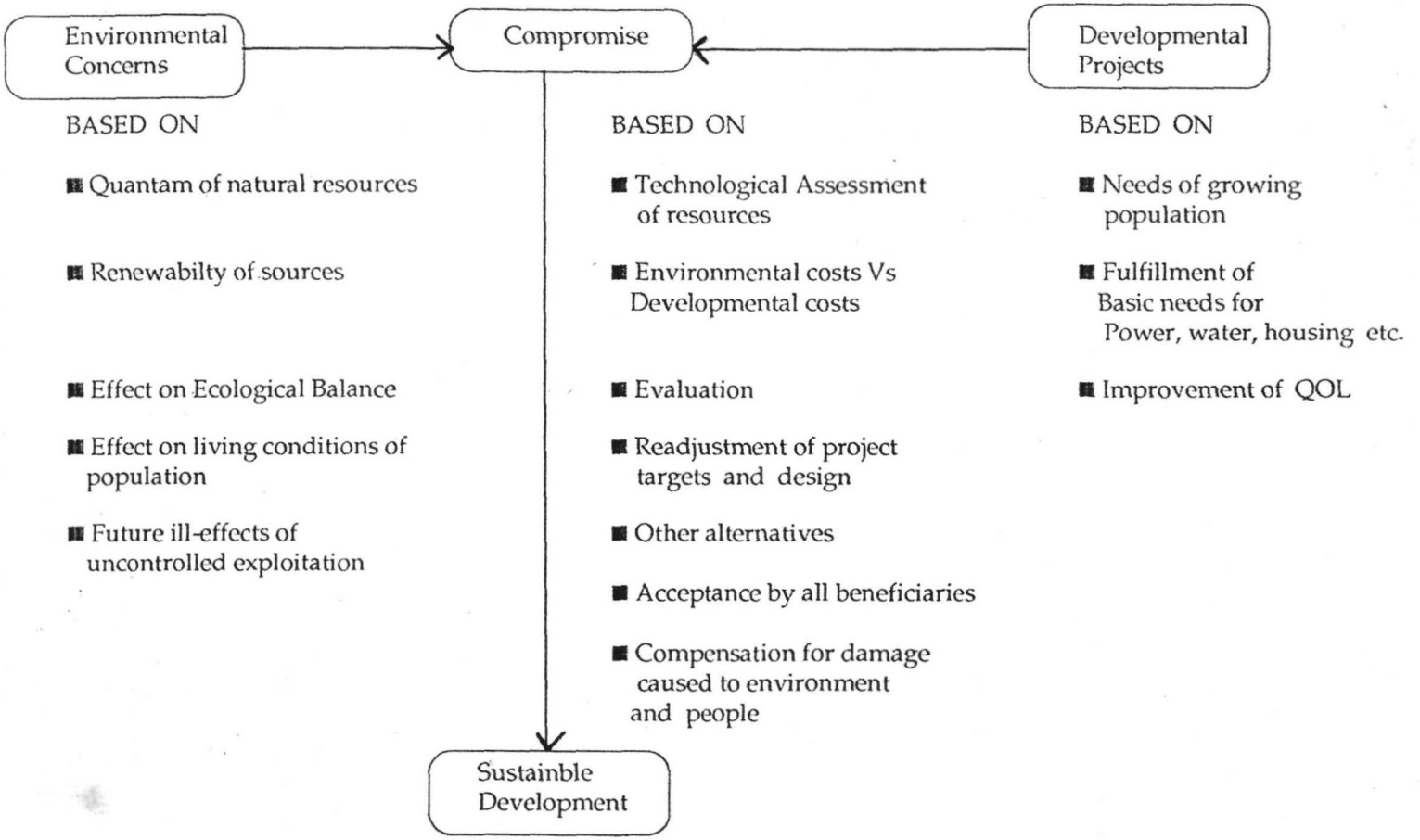


Fig..6 : THE CONCEPT OF SUSTAINABLE DEVELOPMENT

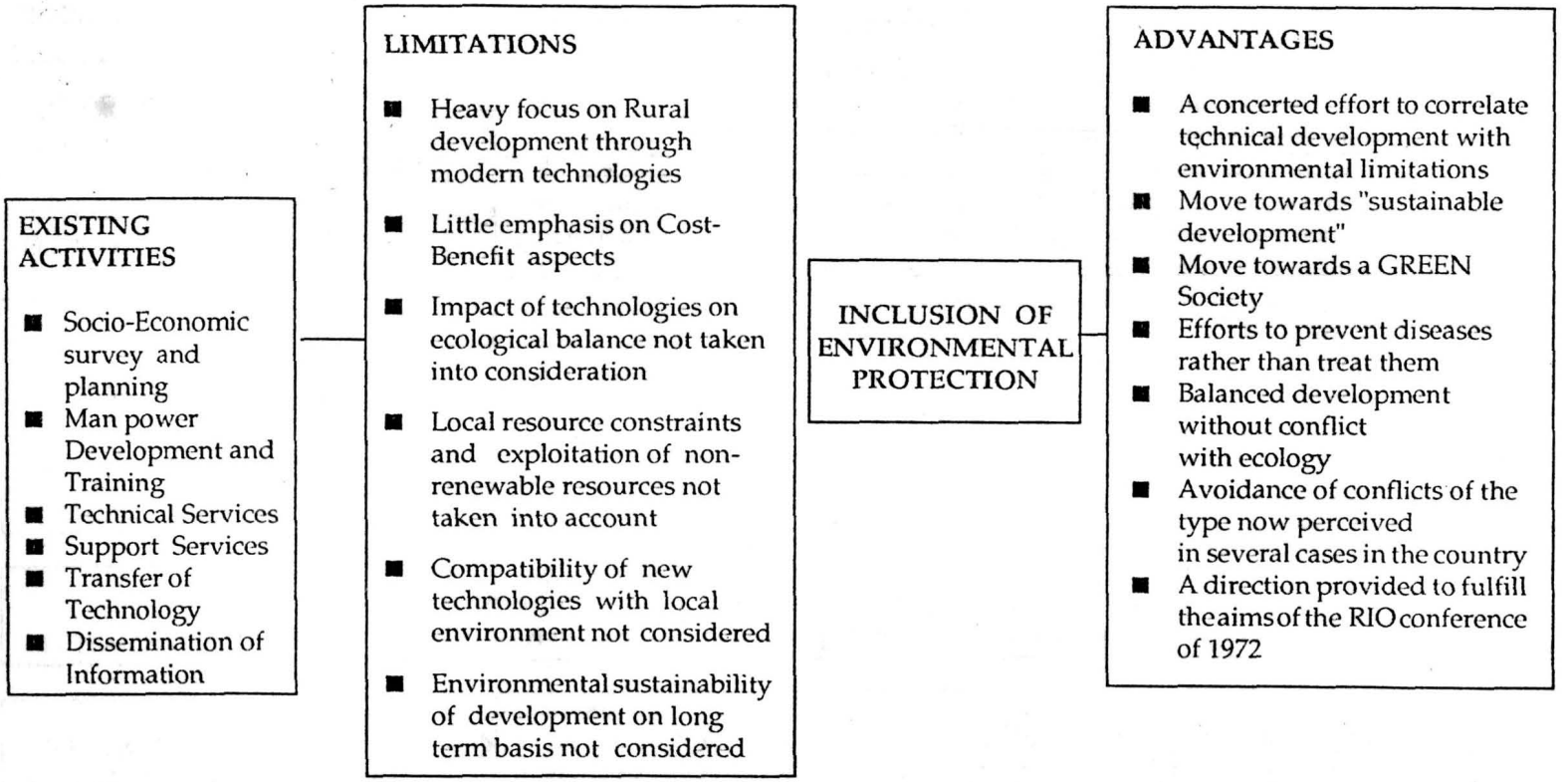


Fig. 7 : ANALYSIS OF CURRENT ACTIVITIES OF COMMUNITY POLYTECHNICS

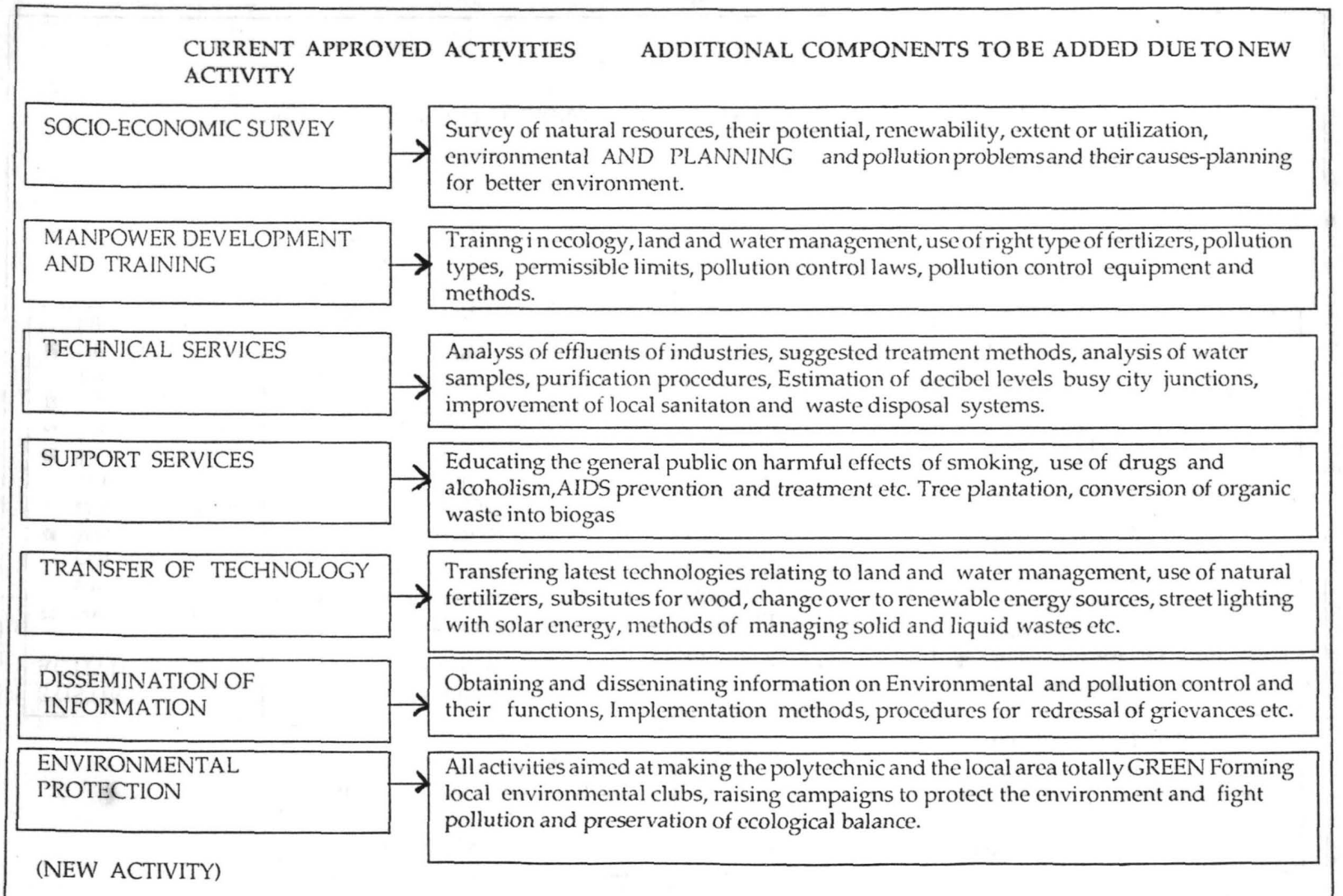


Fig. 8 : CHANGING CONNOTATION OF COMMUNITY POLYTECHNIC ACTIVITIES

Level	Pro-active Role	Reactive Role
A. National Level	Technical and Vocational system foresses environmental problems and : (1) Makes recommendations to the government for a warranted change in policy to protect the environment. (2) Evaluates consequences of new developmental plans and projects as they effect the environment and recommends alternatives to government. (3) Exhibits strong positive desire to participate in national policy making for environmental protection.	Technical and Vocational Education System : (1) Follows the policy outlined by the government and adjusts its programmes and courses to suit such directives. (2) May not wish to involve itself in activities outside the purview of educational programmes.
B. System Level	The system assumes a significant role in the implemen--tation of Environmental Education components and : about environmental change. (1) Recommends new sets of objectives, targets and action plans for implementation. (2) Surveys the needs of society and the community and the community pinpoints critical areas and programmes to befocussed upon. (3) Evolves new programmes and courses	The Technical and Vocational Education system assumes a limited role n bringing (1) It rests contended with conduct of instruction in a few Environmental Education related areas as identified by authorities. (2) Its interest in reacting to society and community needs beyond educational activities is solely inresponse to external pressures.
C. Institutional Level	(1) Institutions are involved wholeheartedly in community activities and in grappling with environmental problems. (2) Institutions develope good rapport with Environmental Education related industries and organizations. (3) Institutions conduct studies and research into environmental problems faced by the community. (4) Insitutions evaluate their own programmes and make innovations wherever necessary. (5) Institutions might conduct contests and competitions in essay writing, short stories, slogans, drama etc. in environment related areas to create local awareness.	(1) Institutions adhere to set patterns of courses and programmes in Environmental Education areas. (2) Institutional activities are limited to teaching, related practical and project work. (3) Environmental Education areas are seen as additional to normal requirements. (4) Institutions do not perceive the need to educate anyone outside the institutional community. (5) The institution limits itself to institutional boundries.

Fig. 9 : Pro-active and Reactive Roles of Technical and Vocational Education in Environmental Education

Some of the activities which are performed by a GREEN Polytechnic could be as follows :

* The polytechnic maintains a green campus with shady trees and well laid out lawns. Wherever possible, efforts are made to plant special varieties of trees which are likely to become extinct. Flower beds and Vegetable gardens to meet the needs of the students hostels are grown with care.
* The campus is made totally free from smoking, spitting, tobacco-chewing and use of drugs both by students and staff.
* The campus is always kept clean and tidy wth proper waste-disposal systems such as incinerators or Biogas plants which convert all degradable campus wastes into gas used n the hostels for cooking and in the laboratories for experimentation.
* Staff and Students are familiar with local environmental problems and take up issues with the concerned authorities whenever environmental laws are found to have been violated.
* The Polytechnic conducts periodic meetings, seminars, campaigns, exhibitions etc. to educate the general public about environmental issues.
* Staff and students take up local projects to analyze water sample, measure air and noise pollution and bring these to the notice of the authorities and the public.
* During Industrial Training of students and staff special attention is paid to a study of the impact of the industry on the local environment.

6.0 CONCLUSION :

The overall scenario makes it abundantly clear that the problems of the environment have already assumed such gigantic proportions that Herculean efforts are needed to stop further damage and preserve ecological balance on this Planet Earth. This is certainly a job that cannot be left to the government agencies alone. Voluntary organizations and educational institutions have a vast potential to contribute their might and spread this philosophy. The award of a GREEN label to Polytechnics totally committed to environmental protection is one possible and practicable approach in this direction.

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