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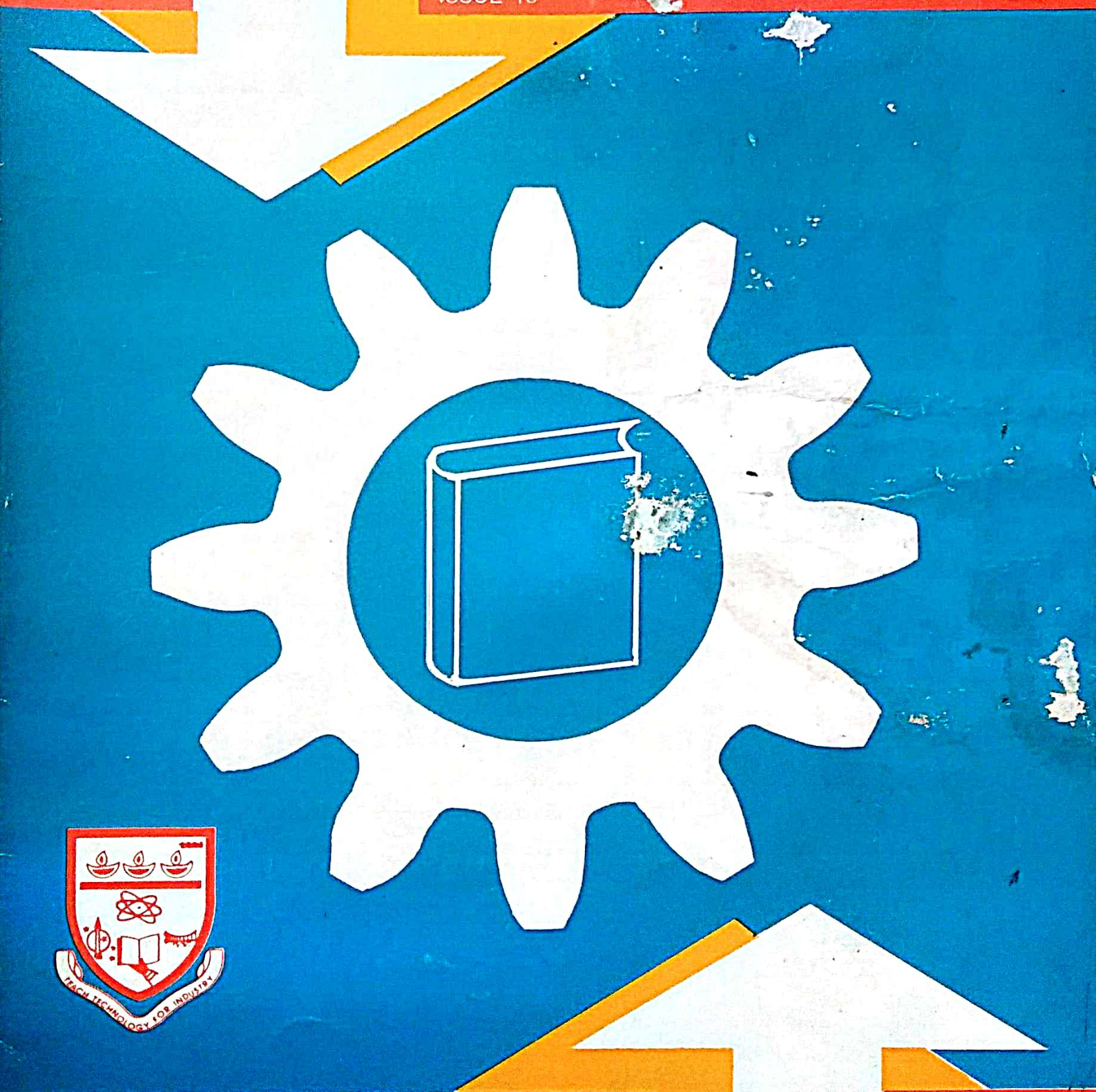

TECHNICAL TEACHERS' TRAINING INSTITUTE

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EDITORIAL

We are happy to bring out the 18th issue of Journal of Technical and Vocational Education in time. We got tremendous responses from our contributors and a good number of research paper abstracts and Ph.D abstracts, are appearing in this volume along with other articles and papers. We register our sincere thanks to our contributors as they sent their articles/research papers much earlier than the last date of submission of papers. Almost all the articles and research papers in this issue were all thought out and well written.

The first article of the present issue is on quality technical education which JTVE has been propagating for the last two decades. Professor Rathore and his colleagues have given their valuable ideas on emerging challenges, research and development, partnership, intellectual property rights, strategic issues related to quality technical education. They are of the opinion that continuous efforts are required to improve the quality of technical education and technical institutions for the country to produce world class technical manpower for the society. Related to quality technical education Dr. Srinivasan and Ms. Renukadevi in their article have dealt with women's education vis a vis development and they have come up with the suggestion that UGC should promote a career bureau in all universities exclusively, for women. Further, towards achieving the quality technical education, Professor Samaga in his article advocated flexibility in technical education.

Professor Ezugwu has presented a research paper on survey of the organization and administration of private business schools. He has given certain suggestion like adequate instructional material, adequate library and workshop facilities and experts in business education need to be involved in curriculum development process for private business schools. From the same country of Nigeria, Professor Ikeagu has contributed one research paper on Mastering Learning Technique (MLT). The author has come up with the conclusion that MLT will be of tremendous advantage in the field of science and technology and the author has advocated the utilization of MLT in teaching - learning process.

Sri Kulanthaivel and Professor Ekambaram have presented an unique article on use of information technology by disabled people. They are of the opinion that there must be concious efforts to increase accessibility to systems and to improve relevant technical aids. They feel that information technology will substantially increase the employment prospects of the disabled.

Professor Ramachandran and his colleagues in their approach paper have highlighted the importance of including environmental management in higher educational curriculum. We are looking forward to publish their views in detail in the next issue. Professor Sharma and his associates have contributed a valuable research paper on influence of environmental uncertainty and cognitive style. The authors have discussed on five hypotheses and their study brings out the fact that persons of appropriate "type" must be at the helm of affairs in specific type of environment to ensure that a suitable SMP is chosen. Professor Jaiprakash Narain, in the present volume has come up suggesting environmental education for sustainable development. He has concluded that the spectrum of environmental education falls in four major but integrated components i.e. awareness, real life situation, conservation and sustainable development. This has to be matched with different levels of education system.

We acknowledge the contribution of authors from India and abroad for the present volume. We welcome papers and research abstracts for future issue.

We thank Dr. R. Srinivasan for going through the proof and discharging other responsibilities for the journal which made it possible to publish the journal in time.

– Editor

CONTENTS

Quality Technical Education - Challenges and Strategic Issues

B.S. RATHORE, J.S. SAINI and S. KRISHNAMURTHY

1.0 INTRODUCTION

Technology is perhaps the most important resource for any nation. Inventions, innovations, adoption of new technologies, new products and their commercialisation are the major processes in wealth creation and making the country technologically superior, which in turn leads to economic supremacy.

Technical education must play its crucial role in development of technologies in key areas like advance materials, electronics and information technology, bio-technology, advanced manufacturing techniques, aerospace, pharmaceutical and agro-food sectors. This is possible by providing quality technical education and training and undertaking targeted, collaborative R & D projects with industry and research organisations. The vast technical manpower available in the country if updated through continuing education programmes and utilized in a right way, may help the country to become a major exporter of technologies, products and services.

In the post-GATT environment and with the adoption of liberalised policies, unless our industries are able to successfully compete against the multinational corporations, we will not be able to achieve economic security. The twentieth century technologies while giving lot of power to industrialised economies, are heading for the junk heap. However, at the dawn of 21st century numerous innovations are finding their place into real life application. For example, recycling has become the need of the day. Strategic industries for tomorrow will be based on growth of recycling technologies. Nanotechnology, Programmable Assembler and Smart materials will have application in whole range of new products. We are slowly heading towards an era of intelligent products, which will have ability to restructure the faults or defects.

It is estimated that India in 2020 will be nation of 1.5 billion people with half of the population either migrated to cities or industrialisation transformed rural areas into townships and industrial belts. To provide this enormous mass of humanity,

a minimum quality of life (food, shelter, education, employment, and health care), the Gross Domestic Product (GDP) of the country will have to be around Rs.350 trillion with at least 10% growth rate. Choice of technology, taking into account economic, social and cultural factors along with technical considerations, indigenous development and support to technology, and utilization of such technology; acquisition of technology through import and its subsequent absorption, adaptation and upgradation; ensuring competitiveness at international levels in all necessary areas; and establishing links between and various elements concerned with generation of technology, its transformation into economically utilizable form, the sector responsible for production (which is the user of such technology), financial institutions concerned with the resources needed for these activities, and the promotional and regulating arms of the government are the prerequisites for achieving the projected GDP.

Technology Information, Forecasting and Assessment Council in Ministry of Science and Technology, Govt. of India, is of the opinion that critical technology areas for development of strategic industries in the country, will include : aviation, electronics, sensors, space, communication and remote sensing, critical materials and processing robotics and artificial intelligence, and a few break through technologies.

2.0 EMERGING CHALLENGES : AN OVERVIEW

The ongoing efforts by India to integrate with the rest of the world, together with the whole host of changes that punctuate global economics will make responsiveness a business imperative. Business will function in a market-led rather than a product-led context. We thus face a vibrant, externally oriented opportunity of rapid growth. This opportunity addresses our ability to respond to demanding international markets. It comprehensively challenges our methods of production, delivery, servicing, quality, management and pricing. It raises demands on us to create a highly productive work-place, to innovate, to leverage technology, to network with a variety of institutions, organisations and people, and to compete successfully on time. The adeptness with which we respond - therefore plan and execute change - will alone ensure survival and growth. It will entail looking for better ways to bring products and services of international quality, at the right time and prices to the market. It will call for a strong people orientation towards business partners be they employees, distributors or customers. It will demand effective use of information technology within and across continents and businesses. It will involve re-engineering processes and reshaping employee behaviour. In short, change will keep survivors in a constant quest for

innovation, improvement and continuous learning.

3.0 RESEARCH AND DEVELOPMENT

Our industries by and large have so far depended on foreign collaboration without making meaningful investment in R&D, which has resulted in our industries becoming obsolescent, inefficient and outdated. This trend needs to be discouraged. It is because the oversold concept of pure import substitution has only resulted in producing goods and products, which are a poor imitation of improved systems instead of encouraging innovation, originality and true self-reliance. Motivated by quick profits, our industries have generally followed the imported black box approach, instead of building a healthy organic linkage with our R&D establishments and educational institutions. While import of technology in the initial stages may be desirable or even necessary in high technology areas, no industry can prosper in the long run unless it builds up a self-reliant base by forming a "partnership triad" with educational institutions and R&D establishments. Like other developed countries of the world Indian industries need to enhance their stake in Research and Development activities. For instance, in Japan over half of the total R&D expenditure in the country is met by their industries, which has resulted in a dramatic impact in improving the quality of their products and services. It is essential to encourage Indian industries to invest at least 5% of their total sales in R&D with a stipulation that 50% of this amount must necessarily be invested in academic or national institutions for carrying out research in areas relevant to the particular industry.

4.0 PARTNERSHIP THAT WORK

Prior to liberalization, globalization and privatisation of Indian economy vast majority of Indian corporate citizens did not bother much to invest in R&D. Ever since the opening up of Indian economy, competition in market place has increased, multinational corporations are increasingly becoming active in India and Indian industry is feeling the heat of these developments. Inefficient and complacent corporate houses are getting eliminated. Survival in industry today calls for continuous improvement, cost reduction, innovation and research, networking, keeping pace with changing time and professionalising management practices. All these areas cannot be handled by industry in isolation. Particularly in the area of research and development and professionalisation of management practices, our industries can have benefits of synergy by joining hands with good technical institutions and universities. Ministry of Human Resource Development (MHRD), Govt. of India, has already recognised the importance of strengthening such ties. With a view to provide needed R&D support and world class manpower to our industries, the World Bank assisted project for

improvement in technical education was taken up in early 1990. First and second phase of this project, which largely aimed at improving diploma level of technical education, are over. The third phase of this project is now in progress and during this phase MHRD; Govt. of India is aiming at development of 50-60 world-class institutions and centre of excellence. Intake in IITs, IIMs, IIITs and other institutions of higher learning is being increased. Some already existing good institutions are being given the status of IITs.

On the other hand, Department of Scientific and Industrial Research (DSIR) has been instrumental in getting coined a new category of companies called 'R&D Companies'. Unfortunately, most Indian universities, technical institutions and government laboratories do not seem to know much about this important scheme. Such companies are not manufacturing companies. To promote the formation and growth of such companies DSIR has been able to get the finance ministry to agree to all imports of capital goods, components, raw materials, software etc. by such R&D companies to be tax exempted for 5 years from the date the R&D companies commence their commercial operations. The generous incentives inbuilt in the scheme should motivate enterprising and research oriented faculty to form their own R&D companies. Small Industries Development Bank of India (SIDBI) has also been requested to evolve suitable financial packages for such companies. Our scientists and engineers in academic institutions, government laboratories and industrial and consultancy companies should make full use of these incentives and promote R&D companies.

Forward looking progressive companies and R&D companies can join hands together to promote R&D related activities so as to enhance competitiveness of Indian business houses. It is necessary to have such linkages in present context. Because of India's large size and late entry into the international market, the option of development through quantitative increase based on existing technology is mostly closed. Progress can be relied only upon qualitative superiority over what other competing nations offer. That is going to require R&D led technology innovation.

According to Ashok Parthasarthi (1999), 3,00,000 S&T personnel working in our laboratories, universities, IITs and industry can contribute enormously to R&D in the country. However there are only 3500 industrial companies today employing some 75,000 S & T personnel in R&D division or centre or department. There are thousands of other companies who are also doing R&D but where the R&D is mixed up with manufacturing. There is vast scope to interact with the 3500 companies and many more which will soon just this select list of companies.

5.0 INTELLECTUAL PROPERTY RIGHTS - SCENARIO IN INDIA

Technology has become a significant competitive edge in international business and indeed a tradable asset of value. But every technology is based on some one's intellectual property, and the sellers of the technology want to ensure that their Intellectual Property Rights (IPR) can and will be effectively protected. Thus the role of IPR becomes paramount in technology transfer in present context.

The nationals of developing countries held no more than one percent (35000 in all) of the 3.5 million patents in the world. They are on the periphery of world patent system. In comparison they represent 75% of world population, 40% of enrolment in higher education, 20-25% of world GDP, 15-20% of world industrial output and 1% of world's patent stock.

We have to gear up R&D activities to develop cutting edge technologies and products. We have to increase our stock of patents. Council of Scientific Industrial Reseach (CSIR) has a network of around 40 laboratories and due to this changed orientation there is a dramatic increase in the international patents which they have filed from 18 in 1993-94, the number of international patents filed have gone upto 110 in 1998-99. In a vision paper CSIR has projected a target of 500 international patents by 2001. By March 2000 the cumulative figure had already reached 350. What this suggests is that the problem is not with Indian scientists but the system in which they were asked to function.

Industries, technical institutions and universities should also be intensively involved in R&D projects that should lead to more patents and commercialisation of these projects to bring Indian industries in real global competition.

6.0 STRATEGIC ISSUES IN R&D AND INDUSTRY INSTITUTE INTERACTION (III) ORIENTED TECHNICAL EDUCATION

1. Current trends in industrialization suggest shorter product life cycle for most of the products in future. Market forces compel the industrialists to develop new and newer models in less and lesser time. This needs application of intelligence and research and not just industrial manufacturing. According to Munjal (1999), Indian Industry till recently used to make the product and sell them in the market without much problem, but the situation has drastically changed now. Every product has to be need based and superspecial. The industrialists have to look for the spiral only then they will grow. The products should also meet global standard and stand against competition not only in Indian market, but certainly in the market, which is accepted as a global market. In such scenario industry

alone may not be in a position to quickly capitalise on application of intelligence and research. Munjal feels that unless our interaction with universities and technical institutions increase it will not be possible for the industry on its own to continue to bring out new products which are innovative in design, in technology and in meeting the needs.

2. Good amount of action research takes place in our industries. Industrial executives and professionals undertake such research to improve upon their productivity. Industrial executives, busy as they are, may not devote much time in documenting and disseminating the results of their action research. There is wisdom in collaboration with technical institutions and universities to properly document and refine such research findings for their wider dissemination and application. Application of such action research would help in enhancing productivity in variety of work situations.

3. It has been observed that R&D is a very costly affair for most of the industries. It is also evident that research in Indian technical institutions and universities is very much cost effective. Collaborative R&D projects are therefor feasible both for industry and academic institutions. Involvement of academicians in real life problem solving and R&D activities would go a long way in improving quality of teaching in classroom situation.

4. Patent Regime and Intellectual Property Right

   Some of the developed countries owe much of their economic development and prosperity to technology and knowledge explosion patents and IPRs are becoming increasingly relevant. Technical institutions and universities can help industry a great deal in patenting their products. Leading companies like Ranbaxy Laboratories, Dr. Reddy's Laboratory, Shantha Biotech Ltd., CIPLA Limited etc. are among those who benefit from R&D and Industry academia interaction in a big way. Many Indian industries develop world class products but they lack in getting them patented. It is hoped that joint efforts of technical institutions/universities and industry will help in protecting the interest of Indian Industry. Such an arrangement would also help in getting recognition to faculty and improving quality of technical education in the country.

5. Curriculum Design and Review:

   Frequency of curriculum design and review is slowly increasing. With a view to making our curriculum

specific to the needs of industry and to produce world class manpower, we need to work in close collaboration with industry. Any collaboration with industry would help in bridging the gap between what industry needs and what we teach in our technical institutions and universities.

6. Training of Students and Teachers

In present system of technical and higher education industrial training of students is not compulsory. However, vast majority of technical students (degree and diploma level) undergoes one or two months' industrial training during their studies. Industrial training is usually organised during summer vacation for students. Since teachers do not have any teaching load during summer vacation, they also prefer undergoing industrial training during this very spell. This all results in creating a mismatch between number of training seats available in industry/other organisations and number of training seats needed to accommodate entire population of students and teachers intending to undergo industrial training. Industry may not be fully aware of the constraints of the educational system. Once industry and academic institutions start undertaking collaborative R&D projects and problem solving through project based exercises, they will have better understanding of each others constraints. They will be in a better position to interact with each other and solve some of their problems pertaining to training of students and teachers by way of brainstorming and other convenient modes. They may evolve some mechanism of staggering of training without disturbing the academic session and production schedule of the industrial unit. Any improvement in training of students and teachers would ultimately result in quality improvement in technical and higher education.

Technical education should be made competency based, modular and flexible so as to meet the changing needs. Industrial experts to be involved in evaluation of competencies. Total Quality Management technique may be used in technical education system to improve programme design, instructional processes, laboratory and workshop practices, project work and student evaluation. Emphasis should be on student centred learning, industrial problem solving and teacher should act as a catalyst and facilitator in the entire process.

In order to provide effective interface between technical institutes and industry, production-cum development centres be established under industrial leadership to

provide effective industrial training to pass out students. These centres will train the students for specific needs of the industry and will network with business and industry.

7. Investment in Education

India hardly invests 3.2% of its GDP in education. In a poverty stricken nation where vast population is still illiterates we need to enhance investment in education. In some of the developed countries investment in education is well above 6 per cent of GDP. The kind of budget, which is provided to vast majority of technical institutions and universities, hardly meets cost of salaries and essential overheads. There is hardly any money left for modernisation of laboratories and infrastructure. As a result our laboratories and workshops become obsolete and they do not attract industry and other users. Deteriorating - laboratories and workshop facilities affect development of teachers and students and finally result in poor quality of passouts from technical institutions and universities. It is therefore in our national interest to enhance budgetary allocation in favour of education. Without enhancing investment in technical and higher education the desired goal of collaborative R&D, training of world class manpower and effective linkages between academia and world of work may not take place.

8. Integration of IT application and Small Business education with discipline specific education will greatly enhance the value addition in technical education. Technical institutions may promote business incubators in partnership with industry to develop the technical students for entrepreneurial career.

7.0 CONCLUSION

Continuous efforts are required to improve the quality of technical education in the country. Induction training of teachers and their regular updating by involving them in R&D projects and professional development programmes is essential. Curricula have to be customized and industry and other field organisations are to be effectively involved in design, implementation and evaluation of technical education programmes. Like IITs and IIMs other technical institutions in the country should also start producing world class technical manpower for the society.

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Women's Education and Role in Indian Economy

R. SRINIVASAN and S. RENUKADEVI

The census figures from 1951 to 2001 reported the maximum increase of 51.34% in Women's literacy for persons aged 7+ is shown below.

Table 1: Indian Women's Literacy Rate

Year	%
1951	2.82
1961	16.32
1971	23.0
1981	29.75
1991	39.42
2001	54.16

The latest census indicates that gender inequality is declining. Women have started entering defence services too. Now even separate engineering colleges for women have come up. In the wake of the National Policy on Education (1986), residential women's polytechnics have been established in a number of states. Further to facilitate women empowerment among rural girls who dropped out from schools, a number of women's polytechnics are implementing the community polytechnic scheme under which they are enabled to develop their skills in identified trades/courses to make them earn their livelihood.

On the other hand women's participation in organised activities is very low as indicated below.

Table 2: Women's Participation in Organised Activities

Year	1961	1975	1985	1992	1995
%	10.9	11.3	12.9	14.38	15.36

Though in rural areas substantial number of women are actively engaged in different activities in the unorganised sector their extent of participation in organised sector having a secured employment is low and was only 15.36% in 1995.

Enrolment of women in collegiate education was highest in Kerala (53.8%) and lowest in Bihar (19%) in 1998-99. This highlights the literacy levels which are low. As the base of the educational pyramid has not been broadbased, so the top is also not developing.

If one looks at their enrolment in collegiate education it has moved from 10% in 1950-51 to 34.7 in 1998-99 out of a total 74.17 lakhs. The longevity for women in 1995-96 was 64.2 years (62.8 years for men). This shows that their welfare is also improving. The census of 2001 indicates a sex ratio of 933/1000 which is higher than 927/1000 reported in 1991. This positive sign will also help in narrowing inequality.

The year 2001 has been declared as **"Women Empowerment year"**. This perhaps has enabled the Government of India to allot Rs.160 crores for free education of girls upto college level in the last budget of 1999-2000. Now in primary schools only women are preferred for appointment as teachers. In some states there are women development corporations to facilitate their development. To woo women towards entrepreneurship as a career now even separate entrepreneurship development programmes are organised.

All higher educational institutes for women should organize coaching classes to enable their learners to prepare for competitive examinations too. The University Grants Commission insists setting Women's cell in universities to look into their grievances. The Government is also working on the formulation of a National policy on Women, which will continuosly guide and inform action at every level and at every sector.

This paper suggests the following

- Increasing the literacy of Women
- Helping the women in unorganised sector by encouraging Self Help Groups
- New approaches in the proposed National Policy on Women
- One Women's University should be setup in all states; now there are only 5 universities for women out of 256 university level institutions in India.
- Women development corporations too should become operational in all states

These could jointly promote women's development in the states concerned based on the socio-economic conditions and needs. On the pattern of the women's cell the University Grants Commission should promote a career bureau in all universities exclusively for women in the tertiary educational institutions to concentrate on women development.

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A Survey of the Organization and Administration of Private Business Schools in Makurdi Urban

S.O. EZUGWU

1.0 INTRODUCTION

The history of education in Nigeria has no doubt, been that of missionary and government efforts. The educational system bequeathed to us by the colonial masters was fashioned along the British charity grammar schools which de-emphasized business knowledge. Even after independence, successive governments in Nigeria had, until recently, maintained the status quo in our educational curriculum design. Demands brought about by the changes in socio-economic activities in our developing economy exposed the short-comings in the curriculum contents of our public grammar schools. According to Aina (1986) the increase in commercial activities and the inability of the public schools to provide training for office workers called for the establishment of private business schools by individuals.

Private business school as the name implies is a school owned and managed by an individual or group of individuals. Osuala (1996) defined private business school as a type of school established, owned, funded and managed by a private proprietor or group of individuals. It is on record that Nigerian proprietors were pioneers in the establishment of private business schools and had in no small measure helped to extend the scope of secondary education in Nigeria. The management of the schools depends on the human and material resources made available by the proprietors.

The attainment of set goals or objectives of any educational programme, depends to a large extent, on the organization and administration of the human and material resources at the disposal of the proprietor. As according to Edem (1990), administration involves planning activities which aim at the fulfillment of the goals of a particular organization and these activities include describing the tasks to be performed to accomplish certain objectives and assigning these tasks to carefully selected

and trained personnel; and finally making the personnel perform efficiently by using the tools provided for them. Therefore, business education being unique, requires also unique organization and administration of the individuals and group resources as well as the facilities so as to achieve the desired goals. This is especially important as business education is concerned with training programmes for skills and knowledge for improvement on individuals abilities to utilize goods and services available to them.

2.0 PURPOSE OF THE STUDY

The purpose of the study was to examine the organization and administration of private business schools in Makurdi Urban.

3.0 METHODOLOGY

Population and Sample of the Study

This was made up of private business school students and teachers. Three out of six private business schools in Makurdi Urban of Benue State were randomly selected for the study. One hundred final year students and 50 teachers were purposively selected for the study.

4.0 INSTRUMENT

Questionnaire were used for data collection. The questionnaire were divided into four sections.

Section I was designed to ascertain the organizational structure in the schools under study. Section II sought information about the curriculum preparation objectives while section III was meant to find out about the recruitment of teachers. Finally, section IV intended to know about the instructional materials/facilities provided in the schools. Questions were validated by experts.

5.0 TECHNIQUES OF DATA ANALYSIS

In analysing the data collected, the researcher made use of the mean. Based on the 4-point Likert scale of the instrument, a mean of 2.0 was adopted as the minimum score an item can obtain before it can be accepted. Findings are summarized in Table 1.

Table 1: Responses on the Organization and Administration of Private Business Schools in Makurdi Urban

S.No.	Descriptions	Mean (x)	Remark
1.	**Organization Structure**	2.18	A
	There is hierarchy in the private business schools.		
	The proprietor is the principal and allocates subjects to teachers.	2.46	A
	The proprietor owns the school and takes all the decisions.	2.55	A
2.	**Curriculum Preparation and Objectives**	2.92	A
	The proprietor prepares the school curriculum without consulting the teachers.		
	The school curriculum meets the needs of the students.	2.28	A
3.	**Recruitment of Staff**	3.26	A
	The proprietor solely recruits the teaching Staff.		
	Appointments of teachers are based on educational qualification.	2.66	A
4.	**Instructional Materials/Facilities**	1.42	R
	Adequate library, laboratory and teaching aids are provided.		

A - Acceptance R - Rejection

6.0 DISCUSSION

The table shows that there is hierarchy in the private business schools as shown by 2.18 mean score of acceptance, while the proprietor is the principal and allocates subjects to teachers with a mean score of 2.46. The proposal that the proprietor owns the school and takes all the decisions was accepted and had a mean score of 2.55.

As shown in the table, the curriculum preparation and objectives being prepared by the proprietor without consulting the teachers was rated with a mean score of 2.92 as being accepted, whereas the curriculum meets the needs of the students had a mean rating of 2.28 as accepted.

Recruitment of teaching staff solely by the proprietor was accepted with a mean score of 3.26 while appointment of teachers being based on educational qualifications was also accepted with a mean score of 2.66.

Lastly, the provision of adequate library, laboratory and teaching aids was rejected with a mean score of 1.42.

The findings of this study negate the views contained in previous studies. Aina (1986) stated that the private business schools were poorly organized inadequate in terms of curriculum, equipment, and instruction. In corroboration of the above assertion, Osuala (1996) opined that the quality of instruction, staff and equipment in business schools are usually considered substandard, inadequate equipment and lack of staff contribute to the unpopularity of courses offered in business schools. Similarly, Mbamalu cited in Osuala observed that poor funding, staffing, lack

of equipment, workshops and prejudice against private business schools are the major causes of its unpopularity among students.

7.0 CONCLUSION

Based on the findings of this study, the following conclusions are therefore made:

1. Private business schools in Makurdi Urban are hierarchically structured.
2. The proprietors are the principals and they allocate subjects to teachers.
3. The proprietors own the schools and they take all the decisions.
4. The curriculum of the schools are solely prepared by the proprietors.
5. The students needs are meant by the curricula of the private business schools.
6. The proprietors solely recruit the teaching staff based on their educational qualifications.
7. Instructional materials/facilities such as library materials, laboratory and teaching aids are provided by inadequate in number.

8.0 RECOMMENDATIONS

(a) Adequate facilities such as library, laboratories and workshops should be provided by the proprietors of private business schools. This is in view of the practical nature of the programme.

(b) To ensure effective day-to-day management of the schools, the proprietors should not function as principals.

(c) Experts in business education should be involved in curriculum preparation for private business schools.

(d) National diploma in Secretarial Administration or NCE in Business Education should be made the minimum qualification for recruitment as a teacher into private business schools.

(e) To ensure effective teaching and learning, adequate instructional materials should be provided by the proprietors of private business schools.

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The Effect of Mastery Learning Technique in Enhancing Cognitive Achievement of Science and Technology Students in Nigerian Polytechnics

C.N. IKEAGU

1.0 INTRODUCTION

Most teachers expect that at the end of the course, the performance of the students will approximate the normal curve. However, it is only about a third of the students learn adequately what the teachers have to teach because the individual differences in relation to prior learning, learning rate and learning styles of the students are not considered by most teachers while teaching. Consequent upon this, the normal curve is most often derailed.

The researcher is of the opinion that this type of expectation is the most wasteful and destructive aspect of the Nigerian educational system which basically emphasizes functional and utilitarian education for national development. Hence, it reduces the aspirations of both the learners and teachers and as a sequel, it systematically destroys the ego and the self concept of most students both of which psychologists strongly believe are the motivating driven for learning.

It is to be pointed out here that MLT has been used widely as a means of adapting instruction to the needs of the diverse students. MLT as a system of instruction emphasizes the achievement of instructional objectives by all or almost all the students by allowing learning time to vary (Ebenebe and Unachukwu 1995). They noted that the basic idea in MLT is to ensure that students have learned a particular skill to a pre-established level of mastery before they move onto the next skill.

MLT was first proposed as a means of solving the problem of individual differences (Bloom 1976). Bloom (1976) suggested that students who do not master their lessons in the time usually allowed should be able to reach achievement levels typically attained by only the most able students if they are given additional instructional time. Where the additional instruction is given (corrective instruction)

Bloom proposed that 80% of all students should be able to achieve at a level usually attained by only 20% of students and that under such circumstances, aptitude or ability should be unrelated to achievement. Bloom (1976) also intimated that when teachers present a series of learning tasks using the traditional instruction (LM), they may find that students who do not learn the first task will also fail at the second task and that those students plus some others will fail at the third task. However, on the contrary, Bloom (1976) noted that when teachers make sure that most students thoroughly learn one task before tackling similar but more advanced tasks, they may find that the number of high achievers in their class will increase. This increment is sequel to the fact that MLT entails breaking up subject matter into small meaningful units and employees a variety of learning resources, formative evaluations and a variety of corrective instruction to make the quality of instruction optimal for all the students even under group-based instructional situation. the sole function of corrective instruction as hinted by Ebenebe and Unachukwu (1995) is to provide each student with the opportunity to correct specific learning difficulties. This techniques aims also to reduce the wastage inherent in the present education system by developing talents rather than selecting them for the emacipation of science and technology in the present millennium. True as this may be, most Nigerian teachers across all educational levels are either ignorant or reluctant to using mastery learning technique hence, the proposed functional and utilitarian education is still a mirage since a technologist or scientist cannot be trained and produced without them, mastering the basic skills involved in the business of science and technology. So, the Nigerian polytechnics should take this challenge seriously since they are the pivot on which the development of science and technology revolves.

2.0 PURPOSE OF THE STUDY

The study sought to find out:

1. the effect of mastery learning technique in enhancing students cognitive achievement.

2. whether or not there will be significant different in the performance of the treatment and control groups taught using mastery learning technique and lecture method respectively.

3.0 HYPOTHESIS

There will be no significant difference in the performance of the treatment and control groups.

4.0 PROCEDURE

An experimental research design was used which involved two departments (Library Science and Marketing) of (ND I) year one, National Diploma Programme

Students located at the Federal Polytechnic, Oko in Anambra State of Nigeria. The two departments were selected out of the five departments in the school of Arts. Again, the National Board for Technical Education (NBTE) made General Biology compulsory for the two departments. Thus, the pair could have no significant difference in their mean performance on biology pretest. to establish the superiority of MLT, the treatment group was taught by the researcher (writer) using MLT while the control group was taught by the researcher too using the lecture method so as to remove the influence of teacher variable. A post-test was administered at the end of the research period.

5.0 METHOD

The study involved 140 ND I students (mixed sex), seventy (70) were included in the treatment, group (Library Science Department) while the other seventy (Marketing Department) formed the control group. There was no attrition of subjects while the research lasted. To avoid contamination of the groups the researcher enjoined the students to receive lectures only in their designated department as the study lasted and not to compare notes even outside lecture hall. Since the researcher is a biology lecturer in the Federal Polytechnic, Oko, she had no problem as per what the NBTE syllabus stipulates to be taught on Biology per semester. The contents among others included, introduction to living things, cell structure, nutrition, interaction between organisms and their environment, activities of man and their consequences and how offspring resemble. These contents were broken into meaningful units with specified objectives for the treatment group. The MLT used formative tests during the study period so as to find out the learning difficulties of the students in order to give corrective instruction to enhance mastery of the content. In addition, it used a variety of learning resources such as team assisted individualization (TAI) involving a four member mixed ability learning teams during which they reviewed their formative test results and co-operatively overcome the difficulties the tests exposed. Moreover, alternative or supplementary reading materials were sought by exchanging textbooks since many biology texts were in use in the school as s result, the student is free to read any textbook of choice to understand the content. Audio visual materials in the form of film strips, drawings and specimens were extensively used too. The control group was taught the same materials for the same period of time (a semester) using the lecture method. The two groups used the last two weeks of the semester for revision and examination.

6.0 INSTRUMENT

An achievement test of the subjective type was constructed. The unit content areas were itemized and the educational objectives for formative evaluation were

specified at various levels such as knowledge of terms, facts, rules and principles, ability to make translation and application.

Each behavioural objective was sampled adequately and the items were a good representative of the topics. The test items were subjected to expert opinion of three lecturers of biology in the Polytechnic before they were administered. Their comments ensured the modification of the test items and finally 20 items out of the 30 were eventually retained and used for the study.

Twenty ND I students were used to ensure the concurrent validity of the test items and they were not used for the study due to halo effect. Their scores on the test were correlated with the marks they obtained in their most recent lecturer made biology class test.

7.0 FINDINGS

Table A
Performance of Treatment (M1) and control (M 2) Groups on the Pre-test.

Group	N	$\bar{x}$	SD	Diff. in x	t
Treatment (M1)	70	55.5	16.2	0.3	0.11
Control (M2)	70	55.3	16.3	–	–

Table A indicated that the difference between the means of the treatment and control groups in the pretest is 0.3 and t observed is 0.11 which is less than t, table value (2.06) at 5% level. This implies that there is no significant difference between the two groups. The decision therefore, is that the null hypothesis is accepted showing that the two groups showed no initial difference on the pretest.

Table B
Performance of Treatment (M1) and control (M2) Groups on the post-test.

Group	N	$\bar{x}$	SD	Diff. in x	t
Treatment (M1)	70	75	24	32	8.57 - 9
Control (M2)	70	43	20	–	–

In the post-test, the difference between the means of the groups is 32 and t observed 9 is greater than t table value (2.06) at 5% level thus showing a significant different between the performance of the treatment and control groups in favour of the treatment group. The decision was that the null hypothesis is rejected because MLT had significant favourable effect on the cognitive achievement of the treatment group.

8.0 DISCUSSION

The findings indicated that the treatment group performed significantly better than the control group as seen in Table B. The superior performance of the treatment group according to Bloom (1976) is as a result of:

(i) excellent use of formative evaluation feedback.

(ii) the corrective instruction and

(iii) the use of a variety of learning resources - TAI, study sessions under the researchers supervision, alternative or supplementary materials and a variety of Avaids.

The repeated evidence of mastery as provided by formative evaluation feedback and corrective instruction are powerful reinforcement which help to ensure that the students will continue to invest more effort and interest in the subject. Consequently, the students maintain a positive academic self concept since he is potential achiever being learning goal-oriented. The findings agree with Block and Buns (1976) Chacko (1983) and Bloom (1971).

The study also indicated that MLT can through the use of diagnostic procedures bring a large proportion of students to a high standard of achievement within a regular group based instructional context.

9.0 CONCLUSION

MLT uses diagnostic formative evaluation feedback mechanism followed by specific corrective and alternative resources after the units and objectives seem to account for the excellent improvement observed in the students cognitive achievement. Therefore, mastery learning skills could be rightly called gateway that make for effective teaching and learning. Individual differences which has been used to justify ineffective teaching, (the fact that all cannot learn and some can learn better than others is no longer tenable in view of the findings as proposed by Bloom (1976) and Chacko (1983).

MLT though may not be effective in every situation, it should be part of every teachers skills for use on materials that all students must master. When this is done, MLT will be of immense benefit in the teaching and learning of science and technology in Nigerian schools especially in the Polytechnics.

Furthermore, MLT also will be of tremendous advantage in the field of science and technology for scientific and technological breakthrough in the present millennium if religiously adhered to. So, science and technology teachers in Nigerian schools, the success and failure of these two vital developmental tools in our great nation lies with your utilization of MLT in the teaching-learning process. Our future lies with MLT and the teachers.

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Improving the Employment of the Disabled People Using Information Technology

G. KULANTHAIVEL and S. EKAMBARAM

1.0 INTRODUCTION

Physically disabled people may suffer from problems in mobility, communication or in a lack of social skills and cognitive ability. There is no such thing as a "standard" disabled person, they can be affected to a greater or lesser extent, and may suffer from multiple problems. One thing that is clear is that above all they are people, with all the hopes, aspirations and desires experienced by the so-called "normal" population. In attempting to devise assistive technical systems, attention must be paid to assessing their needs in a global or holistic way, using a multidisciplinary team, in which the disabled person, is the most important member and contributor.

For disabled and elderly people, Information Technology is something far more important than for most others. It is not a question of doing the same thing more quickly or in a simpler way with the aid of Information Technology. It is a question of being able to perform tasks independently, which would be impossible without Information Technology. These can be simple everyday activities such as reading a newspaper, writing a letter, making a telephone call, opening a door, switching on the televisions, going to school or working.

Information Technology has contributed towards the greater independence of disabled people. But at the same time, developments in Information Technology have changed society as a whole. A host of new products and services have become part of our everyday lives. However, only some of these development have benefited disabled people. That things have turned out as they have is not due to the limitations of this technology. It is because the new systems and products have not been designed with the disabled in mind. Therefore, they are often unsuitable for use by these people.

There is a danger that Information Technology will cause greater difficulties for disabled and elderly people, instead of the reverse. Personal service is rapidly

being replaced by Information Technology - based services - automatic teller machines, voice response, traffic information, etc. Nearly all of these Information Technology systems make considerable demands on users in terms of their ability to read and write, interpret information quickly and make decisions. This creates problems for many disabled people. Their handicaps increase.

2.0 PROBLEMS OF THE DISABLED

The areas that disabled people find which restricts their opportunities of achieving employment are as follows:

- Blindness/Impaired vision.
- Deafness/Impaired hearing.
- Speech Problems.
- Physical disability such as being paralysed in a wheel chair.
- Transport problems to and from place of employment.
- Access to buildings may be restricted for disabled people such as those in a wheel chair.
- Social inhibitors (perceptions and attitudes towards the disabled).

3.0 ASSISTIVE TECHNOLOGY

This section deals with the problems outlined in the previous section and discusses the technology that is available to assist the disabled with access to computers. It is this technology that enables disabled individuals to gain computer knowledge and acquire various skills that until recently were not available to them. As a result, they will gain more training and this could lead to future employment in areas that were not before possible.

Physical Disability

In order to obtain computer knowledge and skills that may improve employment prospects computers must be made accessible to disabled people. People with physical disabilities may have problems using the mouse and/or the keyboard due to restricted movement. The use of keyguards will help with the use of the keyboard as they prevent the user from accidentally pressing other keys when typing. This can be implemented with the use of physical aids such as a mouth or head stick which enables the user to press keys using head movement alone. There are also many alternatives to keyboards that are available such as voice recognition, a major development in modern technology. Dragon Systems, the Natural Speech Company have many products on the market that allow hand-free access to computers, particularly useful in cases where hand movement may be a problem. Examples of their products include "Dragon Naturally Speaking" which allows the user to speak to the computer naturally and without the use of keyboards etc. "Dragon Dictate" which may be run on Windows also

allows the user to create letters, spreadsheets and more without using the keyboard. The use of switch controls such as pressure pads, suck/puff switches joysticks etc., provide other alternatives. For example, Origin Instruments have developed a head controlled pointing instrument for computer access to those who may not have been able to access a computer previously.

Visual Impairment

Some people will require assistive technology to enable them to read text and graphics. For the completely blind the existence of Braille computers which allow Braille input and Braille or speech output will help them acquire computer knowledge and skills and thus improve training and job opportunities. The development of speech synthesis is perhaps the most important development in this area although it is as we speak in its very early stages. Some computer based speech products currently available include "Write: Outloud" and "Talk: About" from **Infogrip**. "Write: Outloud" is a taking word processor with a talking spell checker which tells the visually impaired user when he/she makes a mistake. "Talk: About" is a conversations software anabling the user to communicate effectively through computers without having to type a word.

Another company that develops low vision software is Ai Squared whose products enable visually impaired individuals to read text and graphics despite their disability. Their products include "Zoom Text Xtra" which is specifically designed for low vision users, integrating magnification and screen reading; and "Vis Ability", a low vision reading system.

Hearing Impaired

For these with severe hearing problems, substantial progress has been made in the field of telephone communications. The introduction of flashing and vibrating ringers and amplification will help those with hearing difficulties to lead a more normal life, enabling them to answer and make calls despite their problems. Furthermore, the deaf will be able to communicate more easily through the operation of text telephones.

Learning Difficulties

People with learning difficulties will not be able to access computers and acquire skills through the use touch screens, for example. Touch screens will enable disabled people to interact directly without the use of a mouse or keyboard, especially where co-ordination between hand and eye movement may be a problem. Spell checkers and thesaurus are also available which may be helpful in cases od dyslexia, for example.

Overall, these methods of assistive technology do help overcome some of the problems disabled people encounter when

looking for employment in that they allow individuals with disabilities to gain access and make full use of computers and IT which as a result will give them more experience and training opportunities and thus the possibility of future employment. However, it does not overcome all problems. For example, assistive technology will not solve the travelling and access to buildings problems. These are dealt with in the Teleworking and Disability section.

4.0 TELEWORKING AND DISABILITY

Disabled people encounter numerous problems when competing with the non-disabled in employment. For example, they may have problems travelling to and from work; they may have problems accessing certain parts of building due to their disability; employers may be of the opinion that they will require special attention and more assistance than able bodied people and therefore treat them differently; the disabled may be discriminated against although laws in recent years have helped reduce this problem. Teleworking is a further method which gives disabled people more options and chances in employment as it overcomes the various barriers mentioned above. Teleworking has many advantages especially for the disabled:

- It enhances flexibility in that employees can work from home and they can work their own hours. This would be good for the visually impaired for whom dark nights may be a problem.
- It overcomes the problems of getting to and from work.
- It provides potential for wider recruitment opportunities for the disabled who without the availability of teleworking may not have much of a chance of obtaining employment.
- The technology involved and associated with teleworking can also help overcome some of the disadvantages of disability.
- Self-perception may also be facilitated.

However, there are a number of key issues that need to be addressed before teleworking can be implemented. These issues are not necessarily disadvantages of teleworking. However, if they are not taken into account certain problems may arise causing the entire process to run less smoothly.

- Employers and fellow employees may look upon the disabled as different and as requiring more assistance. These negative attitudes need to change so that disabled people can be integrated into the organization without problems.
- Isolation is a problem that may occur once teleworking is implemented.

Disabled people are isolated enough by their disability and do not need further isolation.

- Disabled people will require additional facilities for social interaction.

- Technology may provide a further barrier in that the operation of assistive technology for the disabled will be expensive to install and therefore there may be a reluctance on the part of the employer to pursue teleworking.

- Architecture needs to be adapted for disabled users, providing access for them when they might have to go to the central office for meetings, for example.

- Training is another issue that must be considered. For example, due to their disability, disabled employees may not have as much experience as able bodied employees and therefore may require more training. This may increase training cost both in terms of time and money.

If these, and other issues, are considered and it is implemented correctly, teleworking will provide a viable option for the disabled and employers to consider. Teleworking looks to be the way forward for employment for everyone in the future, not only the disabled, although it is a more important development for disabled individuals because they have opportunities that they would never have had without the introduction of teleworking.

5.0 TRAINING THE TRAINERS/SUPPORTERS

One of the factors limiting the extent, to which technology can be deployed to users, is the ability of those same people to avail of support services. Supporters must provide the on-going training, monitoring, find tuning and other adjustment that is required as the user's skills improves, as they meet changing needs or as they encounter an equipment problem. Part of the solution, lies in providing efficient communication links between the user and their expert centre. Emerging technical communication systems can often be employed. Users require local supporters or trainers that they can call upon for face to face, day to day matters. At present, the necessary skills to train these trainers are very limited. It is felt that the required skills were currently scarce especially among in-service professional staff, and set out to identify the skills needed. The lack of knowledge and skill directly affects end-users of assistive technology and Information Technology.

Professional service providers have a particular expert knowledge, which is located within a specific domain area of the model, but little fundamental education and awareness of the other areas. Most professionals are lacking education in one

or more area of assistive technology; in methods of service provisions; user characteristics; or the content of other disciplines. End-users have only basic knowledge of each area, but are interested in increasing their awareness of assistive technology and information technology issues. Usually, this leads to two problems that have to be solved as soon as possible. These are:

- Professionals and service providers involved in design, adaptation, prescription and service of human and technical aids for disabled people still tend to focus their attention on specific aspects according to their individual knowledge, and do not follow a more holistic approach that fits the needs of end-users.

- End-users are still unaware of emerging or even existing technologies and services that are available locally.

Different methods of delivery are to be required, depending on the nature of the contact, its importance, and the level of technical or other infrastructure that may be available for the purpose. Suitable modules of assistive technology training should be included in the professional courses, currently being studied by undergraduate professionals. This allows for a good solid foundation in assistive technology principles and practice to be taught in context with other subjects. Appropriate linkages can be established at the earliest possible stage.

Due to the fact that many of the receivers of the training will be living and working in the community, many some considerable distance from the nearest expert centre, distance teaching methods are particularly suitable. The normal mechanisms of post and telephone are available, but can be complemented with newer techniques such as electronic mail, video or satellite conferencing.

It is quite reasonable to consider linking the tool to the supporting organi via a technical communication link. The computer (multimedia, internet) forming the heart of the assistive technology mechanism could therefore be linked to the Internet and the National Support Centre. This approach would allow for remote diagnostics, updating/modification of systems and access to constantly updated help files.

Internet access is now a cheap, easily accessible option. By including a modem into the assistive technology system, access to help and support can be an easy and transparent process. The user is also given access to the Internet in its own right, allowing them use it as a work, research or leisure system. This medium allows for direct access to expert Centres and local supporters Increasingly, programs have their help files linked to a web location allowing for access to the

most up to date information, and the two-way flow of questions and responses.

6.0 CONCLUSION

To conclude. Information Technology will substantially increase the employment prospects of the disabled. In order to achieve a greater degree of participation for all, the new technology must be made more accessible and usable. This is perfectly feasible - once we decide to do it! It is possible to develop technology to make it possible for a blind person to surf the Internet without hindrance, for a deaf person to communicate over the telephone network using sign language, for a person with severely impaired mobility to write and fax off a letter simply by dictating it into a computer, for an intellectually impaired person to plan their day with the aid of pictures and simplified instructions, or for elderly people to feel more secure in their homes thanks to good alarm systems which do not impinge upon their personal freedom.

Therefore there must be conscious efforts to increase accessibility to systems and to improve the relevant technical aids. This is a challenge for society; to exploit the possibilities offered by Information Technology to design more flexible systems and products. Companies have a responsibility to ensure that their products may be used by as many people as possible; this will boost their markets. Society can encourage and, to a certain extent, direct their efforts by means of financial support, legislation and establishing standards for public sector procurement.

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Introducing Flexibility in Technical Education

B.S. SAMAGA

1.0 INTRODUCTION

Basically the system of education should motivate and enthuse the teacher and the taught for achieving quality and excellence. The methodologies of training, learning and evaluation change from time to time depending on the changes in the socio-economic environment in the country. Today, engineering study is basically oriented towards utilisation of resources to increase the national productivity and economy, and to improve the quality and comforts of living for the people. These needs are rapidly changing and the main tasks and challenges facing the coming generation will be different from what it is today. Apart from generation of Technical man power for increasing our exports with sharp competition with multinationals, our Engineering education of the future will have the responsibility of delivering the benefits of industrial advancement to our large population without, however, the disadvantages of resource depletion and environmental degradation. This means that the professional engineer of the future will be required to have an adequate knowledge of atmospheric sciences, environmental biology, social sciences and appropriate technology, in addition to his technical skills. Training each student in every subject is impossible in the limited duration of any professional course and hence it becomes necessary to introduce flexibility in our system of education at the undergraduate level.

2.0 NEED FOR FLEXIBILITY

In our present system of engineering education. Engineering is divided into several specialised disciplines such as Civil, Mechanical, Electrical Electronics, Computer Science and others. These disciplines are being further cut down into some more branches such as Information Technology, Ceramic Technology, Rubber Technology, Biotechnology, Textiles, Leather Technology etc. Such courses are structured in tight compartments and have very limited access to elective subjects from other branches. As such, if a student gets into some branch of engineering by force of circumstances, which is not his choice, it is as good as no engineering course at all for him and hence he will be frustrated and disappointed. He would therefore register for some external

courses on Computers, Management, etc., and would derail from his main engineering course. Specialisation into narrow fields also has the disadvantages of limited employment, if the admission strength to these courses are not adequately planned in relation to the man power requirement in such specialised areas. These factors stress the need for providing flexibility in our undergraduate education.

3.0 BASIC CONCEPT

In principle, flexible system allows, a student the freedom for a wide choice of elective subjects in addition to the specified number of core subjects pertaining to his main discipline. The introduction of electives can start from the third semester itself in a Eight semester engineering degree program after the first two semesters of studies which will be common to students of all disciplines. The overall ratio of core subjects to elective subjects from third to eighth semester can be fixed at say 1 to 1.5 and 50% of elective subjects can be offered from other disciplines, including some general subjects of professional interest. Each student can judiciously choose elective subjects which fall in his area of interest and which, in his opinion, would give him the necessary support for employment or self employment. Subjects which are commonly sought after by many engineering students are Management Science, Computer Software Engineering, Automatic Control, Flexible Manufacturing systems, Environmental Management, Entrepreneurship, Human resource development, Biosciences, Appropriate Technology, Re-engineering concepts, CAD/CAM, Multimedia Technology, Microprocessors, Personality development, Professional Communication and such others. Unlike the present system wherein he, being in an air tight compartment, is denied of taking up such courses from other disciplines, is now free to choose any of those electives to the extent of numbers specified in each semester. Thus, this flexibility of choice, makes him free from frustration, since he can now take up interdisciplinary subjects though he has joined the wrong discipline due to his inability to procure a seat in a more coveted discipline. Thus, the student during his studies will be exposed to such an atmosphere which enthuses and motivates him to pursue his profession as per his ambition and plans.

4.0 BASIC REQUIREMENTS AND CONSTRAINTS

1. Faculty training: For the flexible system to be effective, several elective subjects in advancing technology and professional engineering should be offered by the colleges, which needs necessary man power and faculty training in the areas of specialisation. Short term courses, summer/winter schools and academic work-shops will be very useful in this regard, and the pace setting Institutions should organise such programs which may be either government funded or self-supporting.

2. Industry Institute tie-ups must be strengthened by identifying resource persons in industries in specific areas of Technology and inviting them for expert lectures to the students to support the courses offered by the regular internal faculty. In exchange, the Institute faculty should be encouraged to work in an industry with necessary financial benefits, for a period of one semester on specific projects.
3. Management should take up necessary steps to generously recruit qualified teachers in various specialised areas in which electives are offered, as otherwise elective subjects become virtually compulsory subjects and flexible system loses its existence.
4. Statutory provision should be made by the University for flow of faculty from any Institution as visiting faculty to other Institutions as resource persons in critical areas.
5. Management has to improve the infrastructural faculties by way of increased number of class rooms and library books in specific areas. Library automation and Internet facilities would be highly desirable.
6. Since each student has a wide choice of electives, duration required for conduct of examinations gets prolonged since in each session only one elective subject can be kept for examination.

This problem, however can be reduced to a larger extent by grouping of electives, say offering 3 groups of electives in each semester, each group containing 4 subjects in any one specific area.

As an example, in Mechanical engineering disciple, the group areas can be Thermal Sciences, Mechanical design, Manufacturing Sciences, Mechanical design, Manufacturing Science, Computational sciences, Interdisciplinary subjects and General subjects.

7. A student will be permitted to take an optional subject only if he has undergone the prerequisite courses, wherever so specified. Placing of elective subjects therefore should be such that the pre-required subject should appear in an earlier semester. Accordingly each student has to pre-plan the choice of electives taking the necessary guidance from his study supervisors.

5.0 CONCLUSION

Flexible engineering education eliminates some of the limitations of compartmentalised systems, reduces possible frustration in students and widens the prospects of employment. However, the constraints and limitations of the system must be carefully studied by the Managements and meticulous strategy must be adopted in order to comply with the requirements for effective implementation of the system.

Importance of Including Environmental Management in Higher Educational Curriculum - An Approach

N. RAMACHANDRAN, V.R. VIVEKANANDAN and R. MANJU

Liberalisation of economics by various countries in the recent decades accelerated the competition in the market. This gave rise to increased awakening to quality concepts and their real-life application. While this development brought about an increased customer focus, it failed to contribute to the upkeep and enhancement of environment.

Advanced nations were quick to address the above situation through establishing implementing and maintaining environmental management systems to ISO 14000 family of standards. One additional step they took was to include quality and environment management in the curricula of higher educational systems. In India, even technical education has not paid attention to both these major elements.

One reason for this situation is that the educational institutions in India have been indifferent to the management system approach to quality and even more so to environment, whereas the rest of the world has considered them important. They are also adding 'Occupational Health and Safety (OH&S)' as a part of this total package directed toward "total quality management (TQM)".

Industry-Institute-Interaction is part of the operational activities and at times an obligation too on the part of the educational institutions. While considering 'environmental management' as a part of the educational curriculum, the scope for the educational institutions for offering consultancy services would become obvious. The striking examples for consultancy opportunities in the context of Indian industry and business are (i) helping industries whose pollution potential is very high as in the case of tanneries, textile factories, plants with pickling and plating operations, thermal plants, steel plants, etc. (ii) constructions industry that affects the natural settings. The resultant advantages include avoidance of closure of such industrial

activities and enhanced competitive advantage in the export front meeting the requirements of the International agencies dealing with pollution and environmental monitoring and financial institutions like Asian Development Bank and International Monetary Fund offering loans to countries for industrial promotion. One of the desirable and results of this step is increased export performance of the nation in the sectors benefiting from this knowledge sharing by the institutions.

The present article reviews the above aspects and highlights the significant contribution of the standards of the International Organi for Standardisation (ISO 9000 and ISO 14000 families of standards) with reference to environmental management in the curricula of the higher educational institutions.

Influence of Environmental Uncertainty and Cognitive Style of Entrepreneurs on Chosen Process of Strategy Making: a Preliminary Survey

R.R.K. SHARMA, NARENDRA K. SHARMA and NARESH BAITHA

1.0 INTRODUCTION

The relationship between personality of decision makers, environment, and strategy making process is complex. Further, organization structure chosen has been known to be determined by the strategy type chosen by a firm (Chandler, 1962). However, Miller (1987) and Frederickson (1984) have argued that organization structure once installed influences the emerging strategy and strategy making process. It is not proposed to explain the complete model showing interaction of all these variables here, but only three variables are explored, namely, the strategy making process and how its choice is influenced by cognitive personality of decision makers and the environment faced by the firm.

Recently there has been a growing subscription to the suggestion that since strategies are conceived in the minds of managers, it is their individual styles of gathering and processing data which influence the strategies and strategy making process chosen by them (Haley and Stumpff, 1989; Nutt, 1993). Ginsberg (1990) has argued that strategic decision choices are made in groups and has developed a framework that related group's cognitive diversity to its diversification performance, but the theory development is yet to be complete.

Strategic decisions for large organizations are made in groups, but for small businesses normally it is the individual entrepreneur who shapes the strategy to be deployed. Hence in a small firm the cognitive style of the entrepreneur is likely to have a strong relation to strategy making decision processes chosen by the firm. This is the line of argument taken in this paper.

A brief review of literature on strategic uncertainty, cognitive styles of managers and strategy making processes used by decision makers is presented in the next section. A framework that relates these concepts is given in the same section. Section three provides an

exposition of the hypotheses, while section four provides data analysis. Finally, section five presents the conclusion and indicates future research directions.

2.0 LITERATURE REVIEW

A brief review on literature of cognitive styles of entrepreneurs' decision making processes used and environmental uncertainly is given to conceive the basis for hypothesis development.

3.0 LITERATURE OF COGNITIVE STYLES OF ENTREPRENEURS

Managerial cognitions have been described in terms of heuristic and associated biases. Hogarth and Markridakis (1981) argued that short cuts are used in processing information, which may at times lead to severe bias and error. A collection of heuristics used by managers and associated biases is given in Schewenk (1988).

It has been documented by Haley and Stumpff (1989) that four personality types as suggested by Jung (1923) use distinctive heuristics to gather and process data. Below are given in brief the interpretations given by Haley and Stumpff (1989) to Jung's categorization of cognitive personality types.

In literature the most widely used model of cognition is the perception/information processing model as suggested by Jung (1923). According to him people use two types of perception modes, i.e., **sensing** and **intuition** (represented by S and N respectively); whereas they process information in two modes; i.e., **thinking** and **feeling** (represented by T and F respectively). Jung's personality theory proposed that people develop dominant preferences for data acquisition: sensation or intuition. Sensation dominant people prefer precise, specific data; they see themselves as realists concerned with immediate problems. In contrast, intuition dominant people seek holistic information that describes possibilities; their decisions use more general data. Thus intuitive people tend to perceive situations by extrapolation. Jung also catalogued two dominant ways of reaching decisions: thinking or feeling. Thinking dominant people stress logic and formal modes of reasoning whereas feeling dominant people form personalistic value judgement; thinking dominant people individuate and emphasize effective and personal process in decision making. Jung has classified two ways in which people receive data and two ways in which they evaluate it to define four personality types: 'sensing-thinking' (ST), 'intuition-thinking' (NT), 'sensation-feeling' (SF) and 'intuition-feeling' (NF). He viewed these personality types as dominant but not absolute modes of expression. Many people exhibit all types of behaviours in their perceiving and judging activities but

most people have a preferred style; style that they use more often particularly in ill-structured situations (Simon, 1957) and in decision making under stress. Below are given brief characteristics of these four personality styles.

ST's are hard core realists who go by what things are as they are. They also use formal procedures such as logic for processing data.

NT's use intuitive processes while perceiving the environment. Hence they are likely to take bold steps into the unknown.

For SF's people's opinion matters substantially. They consult their colleagues frequently before arriving at any decision.

NF's use Gestalt and holistic approach to problem solving and are highly judgemental and hence are likely to take very bold approach to strategy making.

Next the contemporary understanding of strategy making processes used by top level managers of organizations is presented. The discussion is borrowed from Miller (1987) who has presented a nice literature review on this subject. A relationship between these strategy making process and cognitive styles of managers or decision makers is also given.

4.0 LITERATURE REVIEW ON CORPORATE STRATEGY MAKING PROCESS

Miller (1987) has presented a summary of different corporate strategy making processes (SMP) used and documented by researchers. This is briefly reproduced here. The literature has identified three multi-faceted dimensions of strategy making process: 'rationality', 'interaction' and 'assertiveness'. The first dimension, rationality, suggests careful analysis of problems and opportunities, scanning of markets, methodical planning, stress on long term objectives, use of analytical tools in strategy formulation and articulating unified strategies (Ansoff, 1965; Steiner, 1969). It has been referred to as 'planning' by Mintzberg (1973); 'rational' by Miller and Frieson (1984) and 'analyser' by Miles and Snow (1978).

The second dimension of the strategy formulation process is interaction. Men have limited cognitive abilities and organization structure places bound on the rationality (March and Simon, 1958; Simon, 1947) and when faced with complex problems, they only satisfice by doing little analysis and formulate strategies according to disjointed, intuitive, implicit and spontaneous process (Cyert and March, 1963; Lindbloom, 1959; March and Olsen, 1976; Quinn 1980). It has been claimed by these authors that such a non-rational approach is necessary due to wide range of complex problems faced by the organizations and individuals,

and the attendant cognitive limitations and the social and political contexts in which decisions have to be made. Hence politically fragmented firms operate in an adaptive mode (Mintzberg, 1973) where goals and means are discovered through a process of argumentation. This process invariably leads to changes in incremental steps.

The third dimension of strategy making process is assertiveness which is concerned with the riskiness of strategy and reactiveness and proactiveness of decisions. Entrepreneurial firms act ahead of their environments by taking bold decisions; whereas more complex firms often act conservatively by acting only reactively to the environmental changes (Cyert and March, 1963; Quinn, 1980).

5.0 LITERATURE REVIEW ON ENVIRONMENT

Organizational theorists emphasize that organizations must adapt to their environment if they are to remain viable. (Crozier, 1964; Lawrence and Lorsh, 1967). Lawrence and Lorsch have studied how organizations segment their environment into subsectors.

The pioneering contingency research (Lawrence and Lorsh (1967) and Thompson (1967)) has been built upon a central core concept which seeks to capture environment's effect on the organi's function - uncertainty. Duncan's (1972) 13 external environment issues included questions about customers, suppliers, competitors, sociopolitics and technology. Respondents were asked to rate each issue on the scale 1 to 5 according to (1) the importance of the issue, (2) the adequacy of information about the issue, and (3) the predictability of reactions by the specific issue to firms decision. We added an additional dimension of government policies as it was suggested by Jauch and Glueck (1988). We followed an approach similar to Duncan's in measuring environmental uncertainty.

6.0 THEORETICAL FRAMEWORK

The four Jungian personality types may be mapped onto three strategy making processes. Presented below are a few hypotheses in this regard.

ST's stress systematic decision making with hard data. They take less risk than other types do. They want to establish order, control and certainty. They appear to focus on short term problems and use standard operating procedures to solve them. They delve into details and specifics and use logical , step by stp reasoning. When they are encountered with opposition they rarely reanalyze their position. They use anchoring heuristics and possess a functional fixedness bias due to which they prematurely reject feasible alternatives. Hence they are likely to use rational process of strategy making. It may thus be proposed:

Hypothesis 1: ST's predominantly use "rational" process of strategy making.

SF's stress peoples' opinion in decision making and stress on affective and evaluative parts of communication. They focus on short term problems and generally their problems have human implications. They use availability heuristics and posses social desirability bias. Their actions become feasible when people endorse them. They may need constant appraisal/direction for implementation. Hence they are likely to use "interaction" process of strategy making. Thus,

Hypothesis 2: SF's predominantly use "interaction" process of strategy making.

NT's tend to ignore specific and detailed information. They erect nonlinear problems by studying patterns in data (Nutt, 1986). They stress analysis but construction takes bolder leaps into the unknown. They emphasize longer range planning and new possibilities. They enjoy tackling complex problems and reducing them to simpler ones. They stress need for innovation, risk taking and discovery. They use perseverance heuristics and possess positivity and representativeness bias. It is proposed that,

Hypothesis 3: NT's predominantly use "assertive" process of strategy making.

NF's rely on Gestalt and intuitive perceptions and maintain few decision making rules. They stress their judgement and experience, often portraying their personal views as facts. Their interest is in new and institutional forms and human possibilities structure their problems. They spend little effort in getting to know specifics and concentrate more on broad themes with longer term goals and problems that require innovative concepts and theories. They sometimes test their hunches, at other they just state their preferences. They use vividness heuristic, stress reasoning by analogy and have an illusionary control bias. They are likely to use assertive process of strategy making. It may be proposed that

Hypothesis 4: NF's predominantly follow a very strong "assertive" process of strategy making.

Now we briefly state hypotheses that relate environmental uncertainty to strategy making process used.

Low strategic uncertainty encourages detailed analysis and logical process, as situation is nearly deterministic, hence we propose:

Hypothesis 5: A decision-maker uses **rational** type of strategy making process when strategic uncertainty is low.

When environmental uncertainty is high, situation is volatile and a rational SMP is not feasible. As argued in literature decision-maker tends to adapt to the environmental rather than lead it. This

leads to frequent consultations with colleagues. Hence we propose.

Hypothesis 6: A decision-maker uses interaction type of strategy making process when strategic uncertainty is high.

With low strategic uncertainty, "bold" strategy-making process has lesser risk than with environment loaded with high uncertainty. Hence we propose,

Hypothesis 7: A decision-maker uses assertive type of strategy making process when strategic uncertainty is low.

7.0 SCALE PREPARATION AND DATA COLLECTION

We prepared scales for measuring cognitive personality of owner of small firm, strategy making process used by him and the environmental uncertainty faced by the firm. The scale for measuring cognitive personality was borrowed from Hellriegel, Slocum and Woodman (1992:Ch. 4) and it had twenty items. The scale for measuring strategy making process used by firms was picked up from Miller (1987) and it had nineteen items. Finally the scale for measuring environmental uncertainty was developed by authors themselves and had seventy two items. We administered the questionnaire to seventy eight owners of small firms. We ensured that they were sole decision makers and had no qualified management personnel under them to aid them in decision making. We conducted following tests on data to get as reliable information as possible.

Tests on scale for measuring cognitive personality

A forced factor analysis to extract four factors was conducted using the principal component method with varimax rotation for orthogonal factors. The data were organized for 40 questions in order to do this analysis as for each of the twenty question five points were to be split between two groups A and B. The factors explained 42.6 percent of the variance. In view of the sample size of 78, only those variables with factor loading of at least 0.45 were retained. Thus 12 questions out of 40 were dropped. The values of Cronbach's alpha (0.46, 0.44, 0.39 & 0.48) for four factors revealed a moderate level of reliability.

Tests on the scale for measuring strategy making process

A forced factor analysis to extract six factors was conducted using the principal component method with varimax rotation for orthogonal factors. The data were organized for 19 questions in order to do this analysis. We had borrowed the questionnaire from Miller (1987). They reported value of Cronbach's alpha as 0.70 for rational strategy making process which was acceptable level of reliability whereas the value of Cronbach's alpha was 0.713 for assertive strategy making process which revealed that the scale also had a reasonable level of reliability. For interaction strategy making process we had only two questions, which were not sufficient for reliability analysis.

Tests on the scale for measuring environmental uncertainty

We identified socioeconomic, technology, government policies, suppliers and competitors as subfactors of the total environment faced by the firm. For each factor of the environment we asked two sets of questions. First set of questions was about information availability regarding the dimensions of environment. For every question in the first set there was a corresponding question in the second about the predictive ability of the owner about the state of the environmental dimension. The final question was about the importance of the particular factor of environment for the firm. A sample question is given below.

Relevant questions were asked for other sectors

Respondent were asked to encircle on a five point scale from 1 to 5 as given below

1. Strongly Disagree, 2. Disagree, 3. Neither Agree nor Disagree, 4. Agree, 5. Strongly Agree.

The formula we used for computing the environmental uncertainty was

$$A = \left[1 - \frac{\left(\frac{1}{n}\right)\left[\sum_{i=1}^{n} (a_i \times b_i)\, c\right]}{125} \right] \times 100$$

where

A - Environmental uncertainty for a particular subfactor of environment.

n - Total number of questions asked in set one.

a_i - Weight given to the i'th question asked in set one.

b_i - Weight given to the i'th question in set two.

c - Weight given to the last question of the specific factor of the environment.

125 - The maximum possible score on the scale.

For computing the overall environmental uncertainty of an organization we calculate average value based on the six subfactors of the environment.

A forced factor analysis to extract six factors was conducted using the principal component method with varimax rotation for orthogonal factors. The data were organized for 72 questions in order

Sample Questions from the Scale to Measure Environmental Uncertainty

Technology	1	2	3	4	5
I have sufficient information about new technological requirements for my organization.	1	2	3	4	5
I can predict the new technological requirements for my organization.	1	2	3	4	5
I know the importance of technology for my present enterprise.	1	2	3	4	5

to do this analysis. The factors explained 67.08 percent of the variance. All the variables had factor loading more than 0.60. The values of Cronbach's alpha (0.90, 0.93, 0.91, 0.92, 0.89, 0.96) for the six factors revealed that the reliability of the scale was very high. The environmental uncertainty scores for 78 organizations were categorised into two distinct groups with the stipulation that if the score was less than 60, then environmental uncertainty (EU) was low or medium, otherwise environmental uncertainty was high.

8.0 RESULTS AND DISCUSSION

For each owner of the firm we catagorised his cognitive personality style, his preferred strategy making process and found the score of the environmental uncertainty faced by the firm. On five occasions two predominant strategy making processes had the same score and these firms were scored twice, thus making number of entries equal to eighty three. The condensed information appears in table 1.

Table 1: Distribution of Respondents on Cognitive style of Entrepreneurs and SMP Used and EU faced by the Firm

Cognitive Style	Strategy Making Process Used	Environmental Uncertainty	
		Low	High
Sensation-Thinking (45)	Rationality (25)	21	4
	Interaction (11)	2	9
	Assertive (9)	8	1
Sensation-Feeling (25)	Rationality (9)	4	5
	Interaction (13)	0	13
	Assertive (3)	1	2
Intuitive-Thinking (9)	Rationality (1)	0	1
	Interaction (0)	0	0
	Assertive (8)	6	2
Intuitive-Feeling (4)	Rationality (1)	1	0
	Interaction (2)	0	2
	Assertive (1)	1	0

Note: 1. Figures in parentheses indicate the number of respondents in that category.

2. On five occasions owners of firms had same high score on two SMP's used. Hence these firms were included twice in the data. Therefore the total number of firms exceed 78.

Table 2: A Summary of the Results of Chi-Square Tests related to Hypotheses on Cognitive Style/Environmental Uncertainty and Corporate Strategy Making Process Chosen.

Hypothesis Tested	Cognitive Style	Strategy Making Process		Chi-Sq. (df = 1)	Sig. Level	Inference About Hypothesis
1. ST's use rational SMP		Rational	Non-Rational	4.9	< 0.03	Supported
	ST	25	20			
	Non-ST	11	27			
2. SF's use Interactive SMP		Interactive	Non-Interactive	5.8	< 0.02	Supported
	SF	13	12			
	Non-SF	13	45			
3. NT's use assertive SMP		Assertive	Non-Assertive	17.99	< 0.005	Supported
	NT	8	1			
	Non-NT	13	61			
4. NF's use assertive SMP		Assertive	Non-Assertive	0.33	> 0.55	Not Supported
	NF	1	3			
	Non-NF	20	59			
5. For low EU, Rational or Assertive and for high EU Interactive SMP is used.		Rational + Assertive	Interactive	28.62	< 0.005	Supported
	Low EU	42	2			
	High EU	15	24			

Note: 1. All Chi-square tests were conducted with Yate's correction.

2. Data were collapsed over different levels of cognitive style/environmental uncertainty/SMP on the basis of specific hypothesis under investigation. Levels which were collapsed are easily infered from the particular cross tabulation. For example, in case of H1, data were collapsed over SF, NT and NF to get non-ST cognitive styles and over interactive and assertive for SMP.
3. The frequency distribution may be infered from Table 1 and is the observed frequency.

The hypotheses were tested by conducting chi-square tests with Yate's correction. Results of this analysis are summarised in Table 2. As is evident from information given in Table 2, there was absence of interdependence between cognitive style and the SMP used in general, except for Hypothesis 4 stating that NF's use bold SMP. It may thus be seen that there was a general support for most of the hypotheses.

Next we wanted to test if personality had a dominant effect over the environment for influencing the choice of SMP. For this we did a series of chi-square tests for the following propositions:

1. When environment uncertainty is high ST's may still use rational SMP.
2. When environment uncertainty is high NT's may still use bold SMP.
3. When environment uncertainty is high NF's may use bold SMP.
4. When environment uncertainty is low, SF's may use Interaction SMP.

Table 3: A Summary of the Results of Chi-Square Tests Related to Propositions on Dominant Role of Cognitive Personality Style on Chosen Strategy Making Process

Propositions	E.U.	Cognitive Style	Strategy Making Process		Chi-Square (df = 1)	Sig. Lvl.	Inference
1. ST's use Rational SMP.	High		Rational	Non-Rational	0.00	> 0.9	Not Supported
		ST	4	10			
		Non-ST	6	19			
2. NT's use assertive SMP	High		Assertive	Non-Assertive	4.02	< 0.5	Supported
		NT	2	1			
		Non-NT	3	33			
3. NF's use assertive SMP	High		Non-Assertive	Assertive	0.28	> 0.5	Not Supported
		NF	2	0			
		Non-NF	32	5			
4. SF's use interaction SMP	Low		Interaction	Non-Interaction	0.39	> 0.5	Not Supported
		SF	0	5			
		Non-SF	2	37			

Note: 1. All Chi-square tests were conducted with Yate's correction.

2. Data were collapsed over different levels of cognitive style/environmental uncertainty/SMP on the basis of specific hypothesis under investigation. Levels which were collapsed are easily infered from the particular cross tabulation. For example, in case of H1, data were collapsed over SF, NT and NF to get non-ST cognitive styles and over interactive and assertive for SMP.
3. The frequency distribution may be infered from Table 1 and is the observed frequency.

9.0 CONCLUSION

It thus follows that environment and personality have significant effect on choice of SMP (chi-square tests in tables 2 to 6). Chi-square tests in tables 8 and 9 indicate that the personality has dominant effect over environment for influencing the choice of SMP in case of NT's.

It was expected that environment will have a significant impact on chosen strategy making process. However significant finding of the study has been that personality type also has significant impact on chosen strategy making process. The data of the study supports the hypotheses that ST's choose rational SMP, SF's choose interaction SMP and that NT's choose bold SMP. When EU is high, the personality type 'NT' has overriding influence in the choice of SMP as brought out by chi-square test in table 3.

This study brings out that the fact that persons of appropriate "type" must be at the helm of affairs in specific type of environment to ensure that a suitable SMP is chosen. This is an important implication of this study for small businesses.

One of the important limitations of this study has been its small sample size. In future a study with large samples may be conducted.

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Environmental Education for Sustainable Development

G.B. JAIPRAKASH NARAIN

1.0 INTRODUCTION

The qualitative and quantitative assessment of human resource potentials has been receiving the attention of policy makers the world over. The concept of 'sustainable development' is being incorporated as a guiding factor and monitoring tool to measure the degree of human success in maintaining the MAN-NATURE harmony. The concept of "development" must be viewed and understood differently while applying to a developing country like India which ia s mosaic lamina of varying geographical, cultural, economic and environmental problems and issues. A common thread that can entwine and hold the common national interests together should, therefore, be identified and incorporated in our National Policy papers. Towards this goal, the Government of India has identified "Education and Human Resource Development" as the key policy area. Global experiences have underscored the need for evolving a "user-based" rather than "producer-imposed" educational system to ensure a well integrated curricula at all levels and no such curricula would be complete unless it is environment-oriented.

2.0 SUSTAINABLE DEVELOPMENT

"The survival and well-bring of a nation depend on sustainable development. It is a process of social and economic betterment that satisfies the needs and values of all interest groups, without foreclosing future options. To this end, we must ensure that the demand on the environment from which we derive our sustenance, does not exceed its carrying capacity for the present as well as future generations."

In a developing country like India, any discussion on environmental conservation has to be oriented towards strategies for sustainable development. It is becoming increasingly evident that many of our developmental strategies are not sustainable. Till recently, these strategies, involving massive industrialization, maximum exploitation of the natural resources, and accelerating the economic growth at any cost, had been

accepted and fostered unquestioningly, without any thought about their secondary impacts. But recently, we have come to realize that the glamorous gains of this scenario can only be achieved at the expense of considerable degeneration of our environment, the price for which will have to be paid by our fellow human beings, both living as well as unborn. Thus these gains will turn out to be illusory, unless, priority is accorded to the protection of the environment.

3.0 EDUCATION FOR SUSTAINABLE DEVELOPMENT

Such a view of development and environment calls for a new perspective, which can only be achieved through a purposive educational process. The traditional view of the environment as the perennial object of exploitation, 'used' for the pleasure of man, has to change. By the same token, the traditional concept of development as perpetual growth, an ever increasing list of wants, a never ending shopping list of luxuries, also has to change. The accent has to shift from Induced wants to genuine needs, from conspicuous consumption of the elite to the basic requirements of the common folk, from unsustainable consumption practices and production patterns to environment-friendly technologies and values. In short, from mere material affluence to quality of life.

Integrating these values and perspectives into the educational system is indeed a challenging task, and calls for a very imaginative approach.

Environmental education is a very broad concept lending itself to a variety of interpretations depending upon the perceptions of the individual and community. According to "Trends in Environmental Education", a publication of UNESCO, the goal of environmental education becomes the development of a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively towards the solution of current problems and the prevention of new ones.

The publication also observed that to meet this goal, environmental education must convey the following basic concepts:

- The earth's environment is made up of physical components which constitute a complex inter-related life support system called the 'ecosphere'.
- Materials are continuously cycling in ecosystems whereas energy moves through the ecosystems until dissipated.
- Each ecosystem has an ability called "carrying capacity" to support given numbers of each species within it.

- Humans are an integral part of earth's ecosystems and are dependent on these systems for the life support.
- The unique human intellectual capacity produces a moral and ethical responsibility to bring human activities into balance with ecosystem processes.
- The objectives of individual, national environmental education programmes will vary depending on the environmental challenges facing individual nations and the different locations within the nations.

4.0 ENVIRONMENTAL EDUCATION

The success of Environmental Education would depend on internalizing the following principles.

- Environmental education considers environment in its totality.
- Environmental education is not a one shot learning approach. It is a life long process encompassing all levels of education.
- Environmental education is a challenging area requiring both disciplinary and interdisciplinary approach.
- Holistic approach rather than a "piece by piece" subject oriented approach.
- Environmental hazards are controllable and every citizen has a moral obligation and responsibility towards this.
- Concerns of environment are concerns of several agencies. Formal and non-formal educational system and programmes must work in unison.
- Education must cater to all sections of society - the general public, and nonspecialists, socio professionals groups and technologists as well.
- Promote the value and necessity of local, national and interpersonal cooperation in the prevention and solution of environmental problems.
- Help learners discover the symptoms and causes of environmental problems.

There is a paramount need to create a consciousness of the environment. It must permeate all ages and all sections of society beginning with the child.

A nation may take pride in its industrial and economic growth. While investment in a large scale in these sectors would result in increased products, unchecked erosion of environment will nullify the effects of industrial growth. It will create an imbalance in the ecosystem, not withstanding scientific and industrial progress, non sustainable growth, making life on this planet miserable.

More specifically, the objectives of Environmental education are

- Awareness - to motivate individuals and social groups acquire an awareness of and sensitivity to the total environment and its allied problems.
- Knowledge - to train the students to acquire an understanding of the total environment, its associated problems and humanity's critically responsible presence and role in it.
- Attitude - to help the society to acquire social values, strong feelings of concern for the environment and the motivation for actively participating in its protection and improvement.
- Skills - to give hands on experience to engineers and scientists to acquire the skills for solving environmental problems.
- Evaluation ability - to help the administrators and legislators to develop a sense of responsibility and urgency regarding environmental problems.
- Ability to criticize - to analyse situations, discuss and criticize whatever is considered as wrong.

The concept of environmental education for engineers should be multi-dimensional and holistic, but should emphasize those aspects of total environment in which the impact of engineering is particularly critical, notably in the work environment, places of public gathering, transportation and communications, and major life-support systems relating to energy, air, water, soil and food supply.

Environmental education broadly defined is not therefore merely an addition to existing engineering curricula. Although new elements must surely be added, a reordering of the premises and content of engineering education has become necessary. It should be firmly grounded on a foundation of natural and social sciences. More than new additions, a new synthesis is required to equip and engineer with skills of analysis and a set of mind that can be applied to successively changing circumstances throughout his/her life. It is less important that the engineer know more than that he/she know differently. The kind of knowledge vulnerable to obsolescence, or that may be learned as well during professional practice, should be removed from engineering education making room for more lasting and basic skills.

Because the engineer's role calls for effective communication with decision makers, the public, and co-workers and professional colleagues, attention in his/her education should be given to the requirements of effective communication. This not only relates to the engineer as communicator with the respective levels

and sectors of his/her working environment, but also in some measure as an analyst of public needs and perceptions. It is not special technical expertise that is required for this purposes, but rather sensitivity to the needs and values of peoples and avoidance of a technocratic posture in pursuit of engineering missions.

Given the broad framework of environmental education and the various levels at which it can be imparted, one could consider such engineering education in terms of

- environmental education for all engineers.
- comprehensive environmental education of a broad or specialist nature for practicing engineers.
- continuing environmental education of a broad or specialist nature for practicing engineers.
- environmental education for engineering teachers.

The environmental engineering field is characterized by a consistent objective: Protection and improvement of the quality of the environment for the benefit of mankind. The required areas of knowledge have been subject to periodic modification (mostly expansion) because of the increasing intensity and diversity of human activities. The civil and sanitary engineers were the pioneer environmental engineers when environmental quality concerns were limited to safe water supplies, waste water disposal and land drainage. Formal sanitary engineering curricula were introduced as graduate (or post graduate) programmes and included public health engineering, water and waste water treatment as the primary courses to be taken by all graduates. In most programmes a host of related science and engineering science subjects became necessary: chemistry, microbiology, public-health sciences, hydraulics, hydrology, etc.

5.0 NEED AND IMPORTANCE OF ENVIRONMENTAL EDUCATION

India a developing country, is still ignorant about environmental problems of degradation, depletion, conservation and a management of environment. That's why Environmental Education (EE) is the prime need of the hour, to educate people to take appropriate steps for the protection and improvement of environment.

The formal environmental education programmes can be subdivided into those for pre-school and primary level, secondary school level, tertiary level for general students, tertiary level for teachers and programmes for specialists. Non-formal environmental education is also an extremely important activity in increasing environmental awareness among the public and in motivating the community at large for preserving and protecting environmental quality. The non-formal programmes may be subdivided into those for out of school youth and for adults.

EXPECTED CURRICULUM FOR ENVIRONMENTAL EDUCATION AT DIFFERENT LEVELS

Agencies	Target groups	Purpose	Mode of Education
Primary Schools	Young Children	Creating general awareness about environment and nature.	Demonstration and field visits.
High Schools	Children	Creating general awareness about environment and nature.	Demonstration and field visits, A.V. aids and actual involvement of campaigns.
Colleges	Youth	Clear understanding of principles of Ecology, Population Growth and impact of resources, nature, etc.	Involvement of campaigns.

The Role of Educational Institutions in tackling Environmental Issues is presented in Table 1.

TABLE 1 ROLE OF EDUCATIONAL INSTITUTIONS IN TACKLING ENVIRONMENTAL ISSUES

Issue	Level of institution	Potential Role
Drinking water supply	G	Awareness, Public participation, Survey.
	PG/R	Analysis, treatment methods, technology transfer, Economics, Human Resource Development.
Waste water Management	G	Execution of designed systems.
	PG	Designing, Evaluation, Economics.
Solid waste Management	G	Method(s) adoption, Feed back, Policy execution.
	PG	Technology development.
	R	Policy and Planning, Environmental guidelines.
Air quality and Noise	G	Quality Monitoring.
	PG	Control designs, Studies of Effects.
	R	Development of methods, Evolving Standards.
Human Health	G	Survey, Awareness programmes.
	PG	Control measures.
	R	Programme, Policy, Action.

Issue	Level of institution	Potential Role
Human settlement and Ecological status	G	Data Collection
	PG	State-of-art review.
	R	Solutions, Liaison.
Law	PG/R	Evolving standards, Rights, Policy, Participating processes.

G-Graduate; PG-Post graduate; R-Research.

6.0 CONCLUSION

The spectrum of environmental education falls in four major but integrated components-awareness, real life situations, conservation and sustainable development. This has to be matched with the needs of the primary, lower secondary, higher secondary and tertiary and adult education. Awareness includes making the individual conscious about physical, social and aesthetic aspects of environment. There is no denying the fact that human kind is only one of the numerous species, though a very important one is the overall environmental regime. The latter is interlinked with the life support system which in itself has five elements - air, water, land, flora and fauna. It is an indisputable fact that these five elements have a dynamic, continuing and living relationship. However, it is a fact that the consciousness that the human kind has a crucial role to play is yet to develop. The main objectives for the global community are to increase our knowledge of the environment; and to safeguard and enhance the environment for the present, as well as the future generations.

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Effectiveness of Community Polytechnic Scheme (CPS)

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1.0 INTRODUCTION

One of the major mechanisms for reducing poverty and inequality is the provision of employment opportunities for the poor youth. Started in 1979, the Community Polytechnic Scheme (CPS) is expected to act as a focal point to promote science and technology applications in rural areas and provide non-formal technical training and wage employment with minimum additional manpower and financial input from Ministry of Human Resource Development, Government of India.

2.0 OBJECTIVE

The present study was conducted among the youth who had undergone training in different skill areas of the CPS at two institutes in Coimbatore district. The objective was to assess the effectiveness of CPS, especially in terms of satisfaction, impact and the problems involved in the training programme 80 trainess were interviewed.

3.0 FINDINGS

Intended to reduce rural unemployment, it is surprising that only (i) 38.8% of the respondents were engaged in jobs related to training (ii) 28.8% did not take up any job or enterprise relevent to the training (iii) 23.8% were utilising the skills obtained from the training programme at least on a part time basis. (iv) Majority of the respondents were satisfied with the training programme and admitted that it had helped them to improve their economic status. (v) Only 26.3% received bank loans to start their own enterprise. (vi) The training certificate was useful for majority of the respondents. (viii) 36.2% faced difficulties in raising capital. (viii) Procuring raw materials is also a problem for 30% of the trainees (ix) The respondents generally felt that the quality of the training programme should be improved introducing modern technology. (x) Some also feel that the training period should be extended and comprehensive. (xi) No examination is conducted in the CPS, nor there is any syllabus. However, nearly half of the respondents felt the need for examination.

A study on the Transfer of Technology Activities through Community Polytechnic Scheme.

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1.0 INTRODUCTION

In order to accelerate the pace of Transfer of Technology activities under Community Polytechnic Scheme the Institute organised four short courses during 2001-01 as detailed below:

The courses were attended by Project Staff of Polytechnics (Principal/Proj. Officer/Asst. Project Officer). Thee courses motivated the Project Staff to bestow attention on this activity.

As course input literature and details of nearly 20 different Technologies collected from various sources were given to them. Besides lecture - discussion/demonstration of a few important technologies were provided.

2.0 METHODOLOGY

A questionnaire was circulated to all staff who participated in the courses. Specifically their opinion on (i) the most useful technology disseminated (ii) the number of times demonstrations were held and (iii) constraints faced in dissemination were collected.

A total of 72 project staff responded by filling in the questionnaire. The opinions generated yielded the following inferences.

3.0 FINDINGS

(i) A majority of the Project staff agreed that at present non-conventional energy sources are more useful. As many

S.No.	State	Dates	Venue	No. of Participants
1.	Andhra Pradesh	3-5 Oct. 2000	Govt. Poly. for Women Kakinada	35
2.	Karnataka	4-6 Dec. 2000	TTTI, Chennai	24
3.	Kerala	30-31 Oct. 2000	SRGPT, Valapad	44
4.	Tamil Nadu & Pondicherry	8-10 Nov 2000	Periyar Centenary Girl's Polytechnic, Vallam	47

as 58 (81%) opined that in their polytechnics solar devices are available which can be used for demonstration.

(ii) Another view collected is that only technology demonstrations are done; they are not sure of the number of beneficiaries adopting the proven technologies disseminated.

(iii) As many as 45 (26%) of polytechnics implementing Community Polytechnic Scheme in southern region out of 170 polytechnics having the scheme reported that on an average 5 to 6 demonstrations are organised by them.

(iv) The technologies which are quite popular are

- Drip irrigation
- Vermi composting
- Leaf plate making
- Mushroom cultivation

It was also found that in a few Government polytechnics in Andhra Pradesh Rain Water Harvesting pits have been established.

(v) The Project staff felt that this course enabled them to work more in this area. Further the investigators feel the need for a Rural Technology Demonstration/Exhibition Hall at the Institute.

Impact of Advanced Manufacturing Technology on Organisational Structure and Work Attitudes of Blue-Collar Employees (Abstract of Ph.D thesis)

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1.0 INTRODUCTION

Technological change is the thrust in Indian manufacturing industries where Advanced Manufacturing Technology (AMT) has been introduced to have competitive edge in the global market. Despite the claims that attractive benefits can accrue through the use of AMT in manufacturing firms, only modest benefits are reported. High failure rate of AMT has been noticed in developing countries. Productivity of AMT organisation has been found to be low even after several years of implementation of AMT. The reasons attributed for low productivity are resistance to technological change and organisational structure which is not compatible with new technology in most of AMT firms. New technologies are most likely to yield productivity gains when they are coupled with changes in the organisational and human behaviour. There has been substantial research in this area, but much has been in a developed country's perspective and less is known about the implications for a developing country. A systematic empirical investigation of the effects of AMT on employees and organisational structure is required in a developing economy to understand the implications of AMT in an existing environment in the context of their socio-economic conditions. Such a study is important because many firms which have already implemented AMT and invested huge money in their manufacturing operations are unable to move to higher levels of AMT for manufacturing prosperity. Hence this research has been proposed as a quantitative investigation of psychological and performance outcomes of blue-collar employees of AMT firms and change in organisational structure consequent to technological change with a framework to implement new technology in an existing environment, following the behavioural school of thought.

2.0 METHODOLOGY

Data collected through validated questionnaire from 927 blue-collar

employees, supervisors and managers of 27 AMT plants in the region revealed valuable information. The most important psychological barriers to technological change among the blue-collar employees of AMT plants are job insecurity, mis-conception of technological change, techno-uncertainty, problems of learning, techno-phobia, techno-stress, alienation, de-skilling, fear of work overload and loss of role identity. Most of these barriers appear during the implementation of AMT and continue for several years in AMT plants where the planned change efforts are less. These barriers must be diagnosed and eliminated at the earliest in order to improve employees' productivity. Change in technology affects not only work but also organisational structure of AMT plant. Conflicting results are available in the existing literature regarding the change in organisational structure consequent to change in technology. Many research findings support organic structure for AMT organisation which has been followed in this research. Only moderate changes have been noticed in AMT plants where the planned change efforts are high. The changes are decentralized decision making, informal control system, mutual co-ordination, high span of control, high ratio of white-collar to blue-collar employees, economic and non-economic motivation, informal group relations and high skill distribution. These changes do not increase with increase in AMT level. The changes in division of task, communication, supervisory style, operator skills, job description, vertical levels, reward and supervisory skills are found to be insignificant consequent to the technological change. Hence there is no substantial change in the organisational structure of AMT plants even when the planned change efforts are high.

The correlation co-efficients suggested significant negative correlation between the psychological barriers and organisational commitment, psychological barriers and job satisfaction, psychological barriers and organisational index and positive correlation between the organisational index and those variables. Employees' productivity which depends on their work-attitudes in terms of organisational commitment and job satisfaction has been found to be increasing with increase in the planned change efforts. Hence it is manifest that the planned change efforts emerged as an independent, moderating and influencing variable.

3.0 FINDINGS

The major findings of the research are: The psychological barriers to technological change are found to be significantly higher and decreased over a period of time in AMT plants where the planned change efforts are less. The barriers are found to remain constant with increase in the level of AMT which implies that introduction of higher level of AMT will not entail further resistance from the employees. They are found to be insignificant in AMT plants where the planned change efforts are higher.

Wherever the planned change efforts are higher, the psychological barriers to technological change are found to be less and the organisational commitment and job satisfaction of blue-collar employees are found to be significantly higher and hence the employees' productivity. But higher the planned change efforts, moderate are the changes in organisational structure of AMT plants. This impinges on the organisational commitment and job satisfaction of blue-collar employees and thus on their productivity, rendering them moderate.

4.0 CONCLUSION

The conclusion is that technological change cannot be avoided. If AMT has to be implemented in an existing environment, the organisation must be pro-active. Then only the potential benefits of AMT can be achieved expeditiously. If it is reactive, it may take many years to get the benefits. The results of this research reinforces the framework formulated for the implementation of AMT in an existing environment. AMT plants with highly pro-active approach have proved most successful during and after the implementation of AMT and quite deservedly gained the benefits of AMT.

Technopreneurship - A Model for Technical Institutions (Abstract of Ph.D thesis)

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1.0 INTRODUCTION

Having realised the need for promotion of entrepreneurship among our technically qualified persons, several efforts were made, and are being made to turn our technicians and technologists into competent, confident and capable entrepreneurs in large numbers. In spite of the various attempts the number of technical people taking up entrepreneurship still remains far below the expectations and requirements. It is, therefore, important to think of further strategies to accelerate techno entrepreneurship i.e., the process of transforming technical people into either ***'intrapreneurs'*** or ***'entrepreneurs'***. This would not only help in generating employment, creation of new enterprises, infrastructure but will also induce quality value addition in our industrial performance. The literature survey and our experiences in the past, both global and local, suggests that the intervention of educational process as powerful tool/strategy to accelerate the entrepreneurial movement and the transformation of an entrepreneurial society is not only desirable but essential. Experience in the past has also shown that no movement ever could realise its goals without the active participation of educational institutions. The present paper reinforces the hypothesis that Technical Institutions will have to take the lead in promoting ***'techno entrepreneurship'*** and that, they are to play a very active and dynamic role in the process of providing an efficient support system for ensuring continuous growth of technical entrepreneurship.

2.0 TECHNO ENTREPRENEURSHIP - NEED - CONTEXTUAL FACTORS

(i) With liberalisation and globalisation recognised as key factors, industrial structure, economy, employment patterns, have drastically changed. This has consequential effect on our technologies, technicians and technologists. The competence to face the challenges posed by the

putting our technical manpower to real test.

(ii) Industrialisation has gained an important status as a means to usher in, the economic and social transformation. Rapid technological advancements are providing ample opportunities, with a changed outlook of industrial scenario by opening the gates of growth and progress.

(iii) As a sequel of these changes, the advantage of protective and assured market has been taken away from our industry, with a clear message that ***"competition and not protection"*** is going to be the future trend.

(iv) In the new environment, the industry finds opportunities with ***"sky is the limit"*** to grow situation appended with a threat/challenge that it means the ***"survival of the fittest"***.

(v) The Technicians and Technologists will have to look forward to a challenging twenty first century with enormous scope for growth provided they imbibe the qualities like competence, confidence and commitment, and develop the required technical, managerial and entrepreneurial skills.

(vi) Technical Personnel, have a key role to play in running the industries/ enterprises in which they are employed or of their own by way of increasing productivity, operational efficiency through acquired abilities either through their education or by experience. This is precisely what we term as ***'entrepreneurial'*** and ***'enterprise running capabilities'***.

(vii) Massive expansion of Technical Education has taken place in the past decade. The pace of expansion is increased in the recent few years, particularly in the Southern States of India. This has considerably increased the value addition by way of increase in Technical Manpower on one side and created ripples with consequential problems on the other side.

(viii) The depleted job markets for our technical persons, greater need for rapid industrialisation resulted in the emergence of the need for techno entrepreneurship. This, in turn envisages the need to meet the twin requirements of creation of sound enterprises with simultaneous employment generation for our technically qualified people. Techno entrepreneurship will thus, attain significance and will have to provide leadership in transforming our society into a new society, and ***'entrepreneurial society'*** by applying ***"Technology for self-employment"***.

3.0 MODEL FOR TECHNO - ENTREPRENEURSHIP

Taking into consideration the various approaches, models on entrepreneurship development, it is necessary to work out strategies that enhance/accelerate the techno-entrepreneurship. Based on the responses received from the faculty and the findings made by the presenter of this paper (as a researcher) a model is developed with Technical Institution taking a lead in running Entrepreneurship Development Programmes (EDPs) jointly with the support of other agencies integrating the expertise of faculty within and outside. Keeping in view the aims and objectives of the study the following (3) variables have been identified as shown in Fig.1.

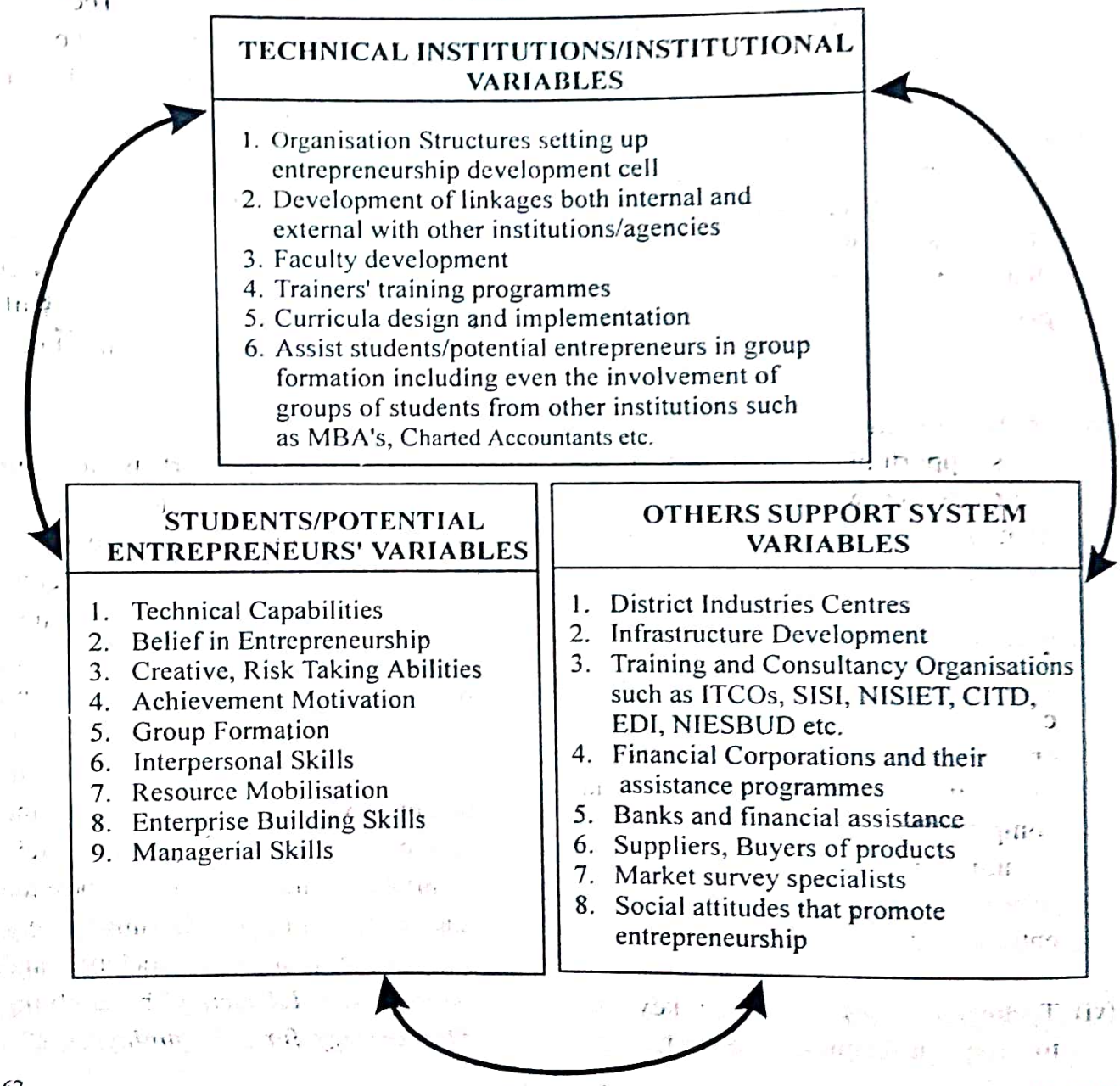

Figure 1

1. Technical Institutions/Institutional Variables
2. Students'/Potential Entrepreneurs' Variables
3. Other Support System Variables.

4. 0 CONCLUSION

The model proposed and the strategies are all based on the research of the presenter and on the field situation. The model, if implemented effectively, will surely help in accelerating *'technoprenerushíp'* with the technical institutions playing a main and meaningful role in Entrepreneurship Development.

MultiObjective Decision Support System Using GIS for Siting Sanitary Landfills (Abstract of Ph.D thesis)

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1.0 INTRODUCTION

The rapid population growth in India and other developing countries has made the task of urban planning and management difficult, which in turn makes the solid waste management more complex. From national perspective, Chennai ranks third in garbage generation. Solid wastes from the Chennai city are dumped in the two dumping sites, the Kodungaiyur in North and Perungudi in the South. Besides the two dumping sites, the city's garbage is thrown into several of the transit stations situated in residential localities leads to obnoxious smell and associated health hazards. In addition, the solid wastes are set to fire at many locations causing air pollution. Apart from organised garbage dumping, civic bodies in and around Chennai conveniently stow away the litter in open places along the coastal line or on street corners and waysides.

2.0 OBJECTIVES

The main objective of this study is to fix appropriate weightages for various factors for siting landfill using MCE and GIS techniques. To identify an appropriate technique in the site selection of sanitary landfills based on MOEF guidelines, the objectives of the study are framed at macro level (regional) and at micro level (village) as follows:

Macro Level Analysis

- To develop Multicriteria Evaluation Models viz. Analytical Hierarchy Process, Factor Importance Coefficient, Artificial Neural Networks and Delphi for priority setting of various themes
- To compare the scores of attributes and themes obtained from MCE models, using Index overlay method
- To compare the overlay techniques - Index overlay method, Boolean logic method and Fuzzy logic method

Micro Level Analysis

- To develop a rule-based expert system based on the guidelines given by Ministry of Environment and Forests, Govt. of India
- To develop Site Suitability Index (SSI) for solid waste disposal for the villages in CMDA

3.0 METHODOLOGY

The study focuses on the methodology for both macro and micro level analysis for landfill site selection. At macro level i.e. regional level analysis, the attribute scores for various themes - Landuse, Geology, Geomorphology, Slope, Soil and Runoff - were calculated from the four models, viz. Analytical Hierarchy Process (AHP) model, Factor Importance Coefficient (FIC) model, Artificial Neural Network (ANN) model and Delphi model. At micro level, i.e. village level analysis, a rule-based expert system had been developed based on Socio-economic, Hydrological, Geotechnical, Geological, and Environmental factors for analysing the existing landfill sites and designing new landfill sites.

One of the major focuses of this research is on finding out the score for attributes and themes by MCE models for locating sanitary landfills. Spatial-AHP technique was applied to find the Relative Importance Weight (RIW) for each decision factor (attribute/theme). In FIC model each factor was considered relative to every other factor, on a pairwise basis, and FIC computed by summing the individual weight assignments was converted as a score for each decision factor (attribute/theme). In ANN model, architecture for ANN-GIS for finding the site suitability criteria had been designed. The linear optimisation model using the assumed criteria had been developed to train a multilayer perceptron using back propagation algorithm for finding the scores for different attribute. The trained ANN was used to estimate the total score obtained by each theme and attributes, which also helps the user to priortise each criterion and its score. Delphi model had been used to develop scores for themes and their attributes, from the questionnaire sent to various experts to obtain their opinion, choice and preferences on different criteria or themes. The qualitative results were converted to quantitative score by using suitable correlation factor. The same correlation factor was used for finding the attribute score for ANN.

Overlay involves the derivation of new maps from pairs of input maps. Overlay analysis using three different methods. viz. Index Overlay, Boolean Logic and Fuzzy Logic, was adopted, From the Index overlay analysis it was observed that the area highly suitable for landfill development by AHP, FIC, ANN and Delphi was 15.34%, 17.33%, 25.91% and 19.13% respectively. Based on the macro level analysis, the 273 villages

were classified into very high (54), high(133), medium (83) and low (3) categories. Using the expert system detailed Environmental Impact Assessment was carried out for Perungudi currently used for solid waste disposal. The SSI for this site is 622.50.

4.0 FINDINGS

From the study, it was observed that MCE models provide solutions to prioritise various issues and to find attribute score for different themes to identify solid waste disposal sites. The developed decision support system will help the Urban Planners, Administrators, and Environmental Managers for analysing the site suitability conditions at macro and micro levels for dumping the solid waste.

Study on Industry Institute Interaction with Emphasis on High Technology Areas (Abstract of Ph.D thesis)

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1.0 Introduction

Among the vast gamut of educational institutions, technical institutions offering Diploma or Degree programs have a unique responsibility in that they need to provide not only the required skills and knowledge to their students, but also practical industrial experience.

Since the courses offered by technical institutions are wholly institution based, they have to be backed up by adequate practical experience in the industry, as noted by Chandrakant. This practice is vital in producing a finished technician ready to meet his professional responsibilities in the industry. The industrial training aspects should complement the teaching-learning process carried out within the institutions.

Presently there is a shift towards high technology in every industry in order to meet the global standards and remain competitive. Every field of engineering witnesses the introduction of high technology equipment, machinery, design procedures and testing and troubleshooting methodologies. The rapid advancements in computer related and electronics industries offer enormous job potentials in these areas. Therefore the interaction of polytechnics with the high technology oriented industries is very relevant.

Over the years the polytechnics have evolved different methodologies of interaction and a study of the interaction process would be of help to identify the present status and its drawbacks. The study could act as a guideline to improve the interaction process. Therefore the problem "Study of Industry Institute Interaction with emphasis on high technology areas" was undertaken.

2.0 Objectives

The following were the main objectives of the study were:

- To study the existing status of industry institute interaction as perceived by the polytechnics in the

states of Tamil Nadu, Karnataka and Andhra Pradesh.

- To compare the polytechnics' perception of the status of industry institute interaction in respect of the states of Tamil Nadu, Karnataka and Andhra Pradesh.
- To study the present status of cooperation as perceived by the industry in the state of Tamil Nadu, Karnataka and Andhra Pradesh.
- To compare the industry's perception of the status of Industry Institute Interaction in respect of the states of Tamil Nadu, Karnataka and Andhra Pradesh.
- To identify possible areas of interaction as perceived by the polytechnic in each of the three states.
- To identify possible areas of interaction as perceived by the industry in each of the three states.
- To conduct case study on polytechnics which have an established pattern of interaction with the industry.

3.0 Methodology

The main objective of the present study was to find out the status of interaction between industry and the polytechnic institutes. A survey through structured interview schedules was carried out for this purpose.

Sample

Twenty five polytechnics each from the states of Tamil Nadu, Karnataka and Andhra Pradesh were selected for collecting data. Thus a total of 75 polytechnics were covered.

It was envisaged at the beginning of the study, that some of the polytechnics, would be carrying out extensive interaction activities with the industry, and would be adopting some very innovative approaches for interaction. In order to capture their unique practices and methodologies a detailed study of 15 among the 75 sample polytechnics were selected for conducting detailed case study.

Twenty-five industrial firms each from the states of Tamil Nadu and Karnataka and fifteen from Andhra Pradesh were taken into consideration for collecting Industry Institution Interaction data. Emphasis was given to collect data from high technology companies.

4.0 Major Findings

1. Significant difference exists between polytechnics of the 3 states of Tamil Nadu, Karnataka and Andhra Pradesh considered for this study in all the 10 categories of interaction.

2. In Karnataka no significant difference is observed in the mean values between rural and urban polytechnics in any of the categories.

In Tamil Nadu significant difference between rural and urban polytechnics with higher mean values for urban polytechnics are observed for 2 categories namely, number of companies conducting campus interviews and industrial product work for students. In Andhra Pradesh higher mean values are observed between rural and urban polytechnics for 3 categories which are number of companies conducting campus interview, the number of students selected by campus interview and number of students getting employed by other means.

3. It appears that in Tamil Nadu no significant difference exists between government and private managed polytechnics in all categories except in the in-plant training for students in which private managed polytechnics have higher mean value.

4. More polytechnics in Andhra Pradesh expressed that sufficient number of industrial firms suitable for interaction are not available in the vicinity of their polytechnic campus. Almost 30% of polytechnics in the present study in Andhra Pradesh do not have sufficient number of companies within about 100 miles of their polytechnics, while in Karnataka it is 15% and in Tamil Nadu it is 13%.

5. It appears that Andhra Pradesh has the highest proportion of polytechnics that have established industry institute interaction cells. About 76% of the polytechnics of the present study in Andhra Pradesh have industry institute interaction cells while 64% in Karnataka and 52% in Tamil Nadu have industry institute interaction cells.

6. It appears that the highest number of entrepreneurship development programs are conducted for polytechnics in Karnataka. About 95% among the 4 branches considered in the study have conducted entrepreneurship development programs in Karnataka, while 80% of branches in Tamil Nadu and 61% in Andhra Pradesh have conducted such programs.

7. The mechanical engineering branch has the highest mean in 5 of the 10 categories of interaction considered in this study, with all the 3 states taken together. The computer science branch has the highest mean in 3 categories and civil engineering has in 2 categories. It appears that the polytechnics interact more with the mechanical engineering industry than with the high growth rate computer related and electronics industries.

8. Considering the activities carried out by the faculty during in-plant training programs, computer aided

design accounted by 40% of the activities in civil engineering and 25% in mechanical engineering branches. It appears that there is a trend towards faculty preferring computer related training in these branches.

9. Nearly half of the student training activity, namely 48% involved production related activities. Only 14% of the student training activities were related to software development. It appears that the preferred area of training for the students is the production related activities.

10. It appears that the industrial visit is the most consistently carried out by the polytechnics in the present study. It has the lowest coefficient of variation in all the 3 states. The activity of industrial firms conducting campus interview is the second most consistent one in Tamil Nadu and Karnataka, whereas the guest lecture is the second most consistent activity in Andhra Pradesh. The consultancy by faculty and the continuing education programs have the highest coefficient of variation and are the least consistent activity among the polytechnics in the present study and would show considerable variation across the sample polytechnics, in all the 3 states.

11. Polytechnics have a Memorandum of Understanding with a specific industrial group has good scope for interaction as they get ready access for conducting most of the interaction activities.

12. Polytechnics having a Memorandum of Understanding with professional bodies like association of industries have even better scope for interaction as such polytechnics get ready access with all the member companies for interaction.

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CALL FOR CONTRIBUTIONS

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