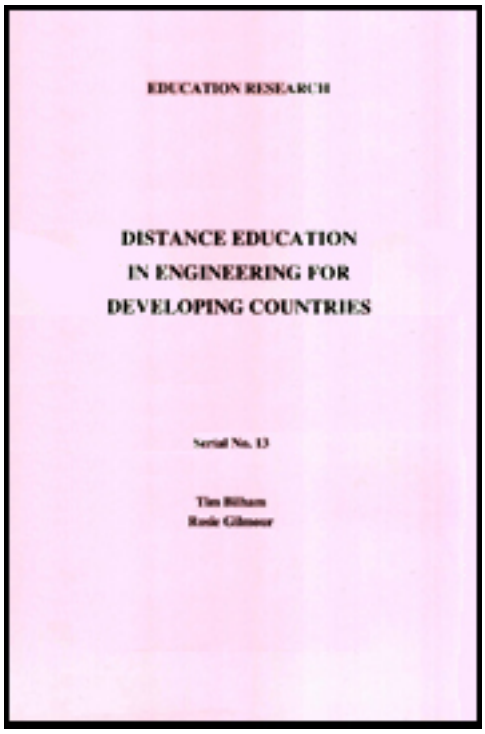
Distance education in engineering for developing countries - Education Research Paper No. 13, 1995, 102 p.



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Tim Bilham
Rosie Gilmour
University of Bath

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Overseas Development Administration

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Appendix B - References

Education papers

This is one of a series of Education Papers issued from time to time by the Education Division of the Overseas Development Administration. Each paper represents a study or piece of commissioned research on some aspect of education and training in developing countries. Most of the studies were undertaken in order to provide informed judgements from which policy decisions could be drawn, but in each case it has become apparent that the material produced would be of interest to a wider audience, particularly but not exclusively those whose work focuses on developing countries.

Each paper is numbered serially, and further copies can be obtained through the ODA's Education division, 94 Victoria street, London SW 1E 5JL , subject to availability. A full list appears overleaf.

Although these papers are issued by the ODA, the views expressed in them are entirely those of the authors and do not necessarily represent the ODA's own policies or views. Any discussion of their content should therefore be addressed to the authors and not to the ODA.

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Serial No. 6	Lewin, Keith. 1993 'EDUCATION AND DEVELOPMENT: THE ISSUES AND THE EVIDENCE' ISBN: 0 902500 66 8
Serial No. 7	Penrose, Perran. 1993 'PLANNING AND FINANCING: SUSTAINABLE EDUCATION SYSTEMS IN SUB-SAHARAN AFRICA' ISBN: 0 902500 67 8
Serial No. 8	(not issued)
Serial No. 9	Brock, C and Cammish, N.K. 1991 'EDUCATION RESEARCH: FACTORS AFFECTING FEMALE PARTICIPATION IN EDUCATION IN SIX DEVELOPING COUNTRIES'
Serial No. 10	Rogers, Alan. 1994 'USING LITERACY: A NEW APPROACH TO POST-LITERACY METHODS'

Serial No. 11	Mcgrath, S. King, K. et al. 1995 'EDUCATION AND TRAINING FOR THE INFORMAL SECTOR' Vol. 1 and Vol. 2 - Case studies. Vol. 1 ISBN: 0 902500 59 7 Vol. 2 ISBN: 0 902500 60 0
Serial No. 12	Little, Angela. 1995 'MULTI-GRADE TEACHING: A REVIEW OF RESEARCH AND PRACTICE' ISBN: 0 902500 58 9
Serial No. 14	Barnett, E. de Koning K., Francis, V. 1995 'HEALTH & HIV/AIDS EDUCATION IN PRIMARY & SECONDARY SCHOOLS IN AFRICA & ASIA' ISBN: 0 902500 69 4
Serial No. 15	Gray, C. Warrender, A.M. Davies, P. Hurley, G. Manton, C. 1995 'LABOUR MARKET SIGNALS & INDICATORS' ISBN: 0 902500 70 8
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All available free of charge from ODA Education Division, 94 Victoria Street, London SW 1E 5JL

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However, if any inaccuracies, misunderstandings and misinterpretations remain in the report they are entirely the responsibility of the authors.

Tim Bilham
Rosie Gilmour
University of Bath
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Distance education in engineering for developing countries - Education Research Paper No. 13, 1995, 102 p.

Executive summary

For many countries distance learning is the most important mechanism for effective continuing education currently available. For others it holds immense potential. Its ability to reach large numbers of students at low cost, to reach groups that have previously been excluded from educational opportunities, and to do so with a curriculum which is consistent in content and quality makes distance education pre-eminent throughout the world as effective continuing education.

In developing and emerging countries where economic development is of fundamental importance, training for industrial growth is essential. Consequently, the initial education and the continuing professional development of engineers at all levels is paramount.

This paper summarises the findings of a major study carried out during 1994 on behalf of the Overseas Development Administration. The study involved a survey of the current provision of engineering distance education from the major providing countries. This was followed by an in-depth investigation of the need for engineering training and the potential of distance education in satisfying those needs in three countries: the Czech Republic, Sri Lanka and Zimbabwe.

Supply

The study identified over 28,000 distance education courses available around the world, of which about 5,000 are in engineering areas. In the UK, 122 organisations are listed as providers of engineering courses by distance education.

It was found that engineering distance education courses are increasingly being exported. In some cases, the providing institutions operate the programme 'at a distance', in other cases they collaborate with a local provider or agency.

The majority of courses are currently text-based, with surprisingly few institutions offering more than one or two audio- and/or video-cassette tapes as back-up materials. Computer-based training is slowly being introduced in a few instances.

All providers agreed that student support is as important for the success of a distance learning course as the materials themselves. Effective support is essential to keep students motivated as they deal with problems such as lack of time, isolation, learning in a language that may not be their first language or concepts perhaps alien to their own culture.

The study found that the issues related to engineering distance education were different in kind from non-technical education and could not easily be explained just by text; students needed to have someone to talk to, especially if they did not come from a technological society. A local centre or point of contact can also help to improve communication.

Demand

The study found a universal need in all three countries for updating in engineering, although the extent, level, subjects and immediacy of the need varies, depending on the country. In most cases, however, there is little support from industry with regard to updating, as there are often more pressing concerns, such as survival, at the top of the agenda.

At the professional engineering level, numbers in individual countries requiring updating in any specific subject are smaller, so that the economies of scale brought about by distance education are less advantageous. In these cases and where the training requirement is common, specialist courses should be produced or adapted and used to serve more than one country.

At the level of craft and apprentices, the practical skills aspects of the job are dominant and distance education becomes less appropriate. The greatest need lies at the technician level where the large number of people allows for significant economies of scale compared to the smaller numbers of engineers at a higher level. Zimbabwe in particular needs to focus on the application of skills.

In each country, priority is being given to export competitiveness, which implies a market-led approach, increased productivity and continuity of supply and efficient management. Yet there is a universal need and a great demand for the management skills required to bring about competitiveness: entrepreneurship, quality and quality assurance, communications, engineering management training, project management etc.

The study found significant complexity in the assessment of both cost-effectiveness of distance education and learning effectiveness of training generally. However, given certain conditions, distance education can clearly be delivered at lower unit cost.

Conclusions

- For developing countries it would almost certainly be more cost-effective to buy in existing distance learning courses where possible, rather than to develop new courses in-country. These would need to be modified and tailored to suit local demand with the providing organisation working closely together with an internal one. Translation might be required in the case of Sri Lanka and the Czech Republic.

- In all three countries, there are networks which could profitably and cost-effectively be used to help support the infrastructure necessary for any successful distance learning course. Student support would be fundamental and where possible there should be a local tutor.

- The networks often provide existing facilities which could be used for the practical instruction necessary for engineering training, thereby increasing the cost-effectiveness of the course.

- The establishment of a programme of distance learning in a country for the first time would need to take account of the local availability, readability and usability of the appropriate media of delivery, as setting up a reasonable level of infrastructure would be crucial to the success of a course.

- Practically-based subjects such as engineering can be taught effectively by distance learning if the practical issues are taught locally in suitable facilities. To that end the curriculum should be carefully analysed and the medium of delivery utilised accordingly. This will reduce the time spent on the practical aspects of an engineering course with obvious cost advantages and more effective utilisation of plant and facilities, allowing greater numbers of students to be trained.

- The use of modern technologies such as video or satellite broadcasting as a medium of delivery would allow large numbers of students to be instructed in practical techniques.

- Any distance learning programme should be priced realistically in accordance with the means of the local population.

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Distance education in engineering for developing countries - Education Research Paper No. 13, 1995, 102 p.

Section 1: Introduction

This report is the result of a research project, carried out during 1994 and funded by the Overseas Development Administration, into the effectiveness of distance learning techniques for the teaching of engineering and the training of engineers for developing and emerging countries.

The initial phase surveyed the provision of engineering distance learning education worldwide and specifically the views of major providers of distance education in the United Kingdom. Subsequently three countries were selected for in-depth investigation - the Czech Republic, Sri Lanka and Zimbabwe.

1.1. Definitions

For the purposes of the project **Distance Education** is defined as education or training which is communicated via a variety of media which might include any combination of text-based materials, audio, video, radio, TV, satellite, and computer-based learning, but which has limited face-to-face contact between students and teachers compared with that provided in conventional teaching.

For the purposes of the project, **engineering** was defined as covering the following categories selected from the ICDL (International Centre for Distance Learning) database:

1. Engineering - general
2. Civil, structural engineering
3. Electrical engineering
4. Electronics engineering
5. Mechanical engineering
6. Materials engineering
7. Mining, minerals, chemical engineering
8. Production engineering/manufacturing engineering

9. Systems and control engineering
10. Telecommunications

1.2. Scope

In the UK, the research focused primarily upon a survey of distance education provision. Using the ICDL database as a source it considered the scope and quantity of the provision in engineering subjects and their suitability for delivery to developing countries. The research also looked in detail at the experience of providers in other subject areas. In particular it ascertained what features are likely to make distance education effective. UK engineering companies and corporate trainers were consulted for an industrial view on the cost-effectiveness and efficiency of distance learning. The views of the Professional Bodies in Engineering were also sought regarding recognition and professional formation. (1)

Three countries were then selected for further in-depth study: the Czech Republic, Sri Lanka and Zimbabwe. The selection was made against a set of criteria chosen as indicators of likely short-term success if distance methods were to be introduced for engineering education and training, namely:

- a reasonable in-country infrastructure for communications and transport
- reasonable levels of literacy
- an established, technical educational system
- command of, or a propensity for, English
- likely cultural adaptability to distance learning
- reasonable political stability.

The countries were also selected as being potentially representative of trends in totally different parts of the world. They were not chosen to form the basis of a comparative study.

The reforms currently taking place throughout Eastern Europe are bringing about enormous changes in the education systems. The Czech Republic was selected as an emerging country representing central or Eastern European countries. Similar political and social changes are affecting developing countries in many other parts of the world. Sri Lanka was seen to be reasonably representative of the Indian sub-continent and Zimbabwe likewise in Southern Africa.

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Section 2: Terms of reference

2.1. Overall aim of the research

"To provide information on the cost-effectiveness, effectiveness and efficiency of distance learning in engineering education and training for developing countries"

2.2. Methodology

The research investigated the distance learning programmes in engineering provided by UK universities, colleges and private providers available to developing countries at technician, undergraduate and professional levels. It looked at the suitability of engineering distance learning in terms of level, delivery mechanisms and format, interactivity, student support, feedback and cost. Criteria were established to indicate the effectiveness and cost-effectiveness of courses potentially suitable for developing countries. Three developing or emerging countries suitable for further investigation - the Czech Republic, Sri Lanka and Zimbabwe - were then identified.

In the case studies, the research examined the educational and training structures for engineering - including distance learning - and sought to take a long term view of the potential for effective practical skills training in distance learning in the context of the present and future needs of the engineering industry. In proposing distance learning models which might be relevant, efficient and cost effective in meeting the needs of the engineering sectors in the three countries, the project also attempted to estimate the appropriateness of, the level of interest in and the potential take up of distance learning in each case.

Appendix A lists the UK institutions and organisations involved in the research, while appendices attached to each of the case studies indicate those organisations which were specifically involved in the Czech Republic, Sri Lanka and Zimbabwe.

Section 3: Trends in education

3.1. Education and training

The distinction between education and training is often blurred. Education is usually perceived as being broader than training, not specifically task- or goal-orientated, but as an essential building block for personal development. While qualifications are an integral and important part of education, future and potential employment has not usually been an issue, until recently. Increasingly in the developed world and substantially in the developing world employment prospects are seen to be very strongly dependent upon educational success and qualifications.

On the other hand, training focuses very much on the goal and the end product. It can be defined more narrowly than education (of which it may be considered a subset) and usually offers a direct 'learning path' which is often skills-based. It frequently implies a short but intensive process undertaken to improve work-capability and often with promotion or employment in mind. It is seen by employers as more directly relevant to their business needs.

Increasingly, those involved in the business of education or training are having to define their target markets and ask themselves whether they are offering education or training or both, and to what end - as potential buyers are now much more concerned with such issues. In the face of growing unemployment, industrial restructuring, and the use of information technology in many parts of the world, purchasers of education and training are becoming more discerning about what they are purchasing and whether it will offer them an effective solution to their problems and a good return on their investment.

This also applies at governmental level. In the context of economic development, governments are having to take decisions, often on economic grounds, as to whether to offer education *per se*, or whether to concentrate on job-focused education or training with a view to employment. For example, in Sri Lanka and Zimbabwe education is both highly valued and in great demand, but as a result of the urgent unemployment problems there is a fundamental question of whether people should be educated "for education's sake", or whether the education system will have to begin to address the high unemployment problem amongst men and women, especially at the tertiary level.

Such decisions obviously have a great impact on the kind of education or training available within a country, and to whom it is offered, at what level and at what cost. Industry and business are generally more interested in targeted training, while students themselves are often - although not always - more attracted by a broader education. In the three countries investigated, the majority of younger students appeared to be more interested in studying the arts and humanities than in technical subjects such as engineering. In meeting these needs and demands, educationalists and trainers need to show both flexibility and responsiveness to the market place. Evidently this also applies to providers of distance education.

The education/training distinction is often further blurred by the current trend of considering whether learning should be trainer- or learner-centred. Trainer-centred learning typically involves a more traditional approach with the trainer offering direct instruction, while in a learner-centred system the learners learn for themselves through access to resources, demonstrations etc. Good distance learning is a learner-centred process integrated with active student involvement.

3.2. Increasing demands and expense

Demands on education systems are constantly increasing as the world's population grows and as people require ever more training to keep them abreast of technological changes. Traditional systems are becoming ever more expensive and cannot be used solely to deal with the increase in demand. This is partly because of the high costs involved and also because of the sheer logistics of educating such large numbers. Tertiary education in the three countries studied is a case in point: the proportion of students in relation to the population is much lower than, for example, in most European countries, yet each year there is a huge over-subscription for places in higher education with thousands of very well qualified Czechs, Sri Lankans and Zimbabweans being refused places. If this demand is to be met cost-effectively other methods of delivery will have to be considered.

3.3. New technology for distance education

There is no shortage of modes of delivery offering alternatives to the traditional full-time methods of education: distance, flexible, open learning, dual mode, day release etc.. The mode adopted depends very much on its cost, accessibility, applicability and appropriateness in each case. It is widely accepted that distance learning will have an increasingly important role to play in education and training thus new technologies - such as the use of satellites and fibre optic cables - will no doubt have a profound influence on education in the future. (2)

3.4. Financial implications

Education which can be produced, delivered and gained by electronic means may be a potential solution to the problems of costs and logistics. As Knight (1994) argues:

> *'While the relative price of conventional education is rising, the digital revolution has been decreasing the cost of storing, manipulating and transmitting information by 50% every 18 months, with no end in sight'* (3)

In theory it should be possible to offer education and training to everyone on earth using electronic media. However, as Knight points out:

> *'The "hardware", and perhaps more importantly, the "software" of social, political, economic and organizational arrangements to permit this are lagging well behind the technological potential.'* (3)

However, although the delivery cost may be increasingly cheap, the development costs of electronic delivery, the costs in terms of time and effort, are high. To produce one hour of multimedia training can take up to 100 hours. However, the investment can and should be cost-effective in the long term as long as the development has been made following a thorough feasibility study and market survey.

3.5. Current usage

The use of electronic media in education is growing rapidly: increasingly tutors and students are interacting by E-mail and computer conferencing is being explored. Satellite education is an expanding field. It is used in many countries: in the United States by organisations as the Institution of Electrical and Electronic Engineering (IEEE) and the National Technological University (NTU), in Europe through organisations such as EUROPACE and EUROSTEP and in China:

'The whole Chinese distance education system centred on CRTVU (China's Central Radio and Television University) now makes use of a Chinese satellite capable of reaching all of China plus neighbouring countries in Eastern, Central and Southeast Asia. With 146,000 entering students, 300,400 students matriculated, and 120,000 graduates in 1992, the CRTVU is probably the world's largest University' (3)

These statistics indicate the vast numbers of students who can be reached by means of broadcast, provided they have access to the hardware.

However the opportunity for mass education offered by broadcast television is not universal as Laaser (1995) points out:

"...in many non-socialist countries TV is private (and even if in public hands it may have a similar attitude) air time is almost unaffordable for public educational institutions. Therefore the use of TV for mass distance education seems to be not easily transferable to other developing countries." (4)

Radio may be a cheaper option. Interactive radio programmes which prompt a student response every few seconds through home-study activity and printed worksheets have been used in various Latin American countries and some in Africa and Asia. They are seen to be highly effective, especially in rural areas where they demonstrate lower drop-out rates than conventional education. The limitations of the fixed broadcast hour can be overcome by audio cassettes, whilst the need for visual and written support material can be very effectively solved through the use of specially prepared audio-vision packages. Audio-vision is one of the most effective but most neglected and underused technique available to the distance educator. Furthermore it has been demonstrated to be particularly successful for technical subjects where students can be 'talked through' complex scientific or technological concepts. The major feature of audio-vision is that it is highly interactive in the way it involves the student.

For electronic education to be really effective, it too has to be interactive. This is possible with new electronic technologies such as CD-ROM interactive disks and multi-media hypertext available through such systems as Mosaic and the World Wide Web. Video conferencing is another form of Internet technology which can be used in distance learning. The system allows people physically separated by thousands of miles to participate, and as Galitsky et al. (1994), have indicated:

'(The) costs of organising Internet conferences can be much less than transmission of broadcast TV learning programs.' (5)

The proposal that student access to electronic resources can be expanded is also confirmed by Shapiro and Hughes (1992) [6]

3.6. The way ahead?

The use of multi-media is often perceived as an integral part of distance learning. However, the majority of courses produced in the UK are currently text-based, with surprisingly few institutions offering more than one or two audio and/or video cassette tapes as back-up materials. Computer-Based Training (CBT) is slowly being introduced in a few instances. It is important that the materials match the technological capabilities of the country where the programme might be introduced. There is no point in offering CBL or CBT if the population is generally not computer-literate; a video is a waste of time for the student who does not have access to a video machine. The way a course is presented should be appropriate to the country's technological infrastructure.

However, it seems fairly certain that electronic distance education will be the major delivery method in the future, but it is difficult to predict the pace at which this will happen and when it might become available for developing countries. Evidently this form of education is more likely to be introduced initially in countries which are more advanced technologically and have the necessary infrastructure and economy to put it into practice. Organisations like the World Bank have already taken an interest by supporting China's CRTVU through a loan and by supporting the Russian Electronic Distance Education initiative (Knight, 1994). Other organisations may follow suit and the World Bank may extend its own support in the field, but it may be many years before such educational opportunities become financially and practically feasible in countries which lack the know-how and infrastructure.

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Section 4: Features of distance learning

It has taken some time for distance learning to be accepted and acknowledged in the UK as a credible alternative to full-time or part-time education. It is now a growth market, especially in the business and industrial sectors where it is perceived as an effective form of training. According to one respondent,

> *'All our clients think it's the most effective way of training: they've been sold the benefits of not losing man-hours, not missing opportunities.'*

However, this recognition is not universal: in the US, distance learning is still viewed as a second class option, and in many developing countries, some people still need to be convinced of the benefits of this form of learning.

4.1. Perceptions of distance learning overseas

Perceptions of distance learning vary considerably across different regions of the world and are influenced by many factors; economic, political and social. Clearly a country's philosophy for education and the historical development of its educational systems play a significant part in determining how distance learning techniques are perceived and received. In many cases terminology is a barrier: many people who are not familiar with the philosophy of modern distance learning and the frequent use of educational technology presume that it is similar to a correspondence course. Central and Eastern Europeans for example tend to equate the old Soviet-style correspondence courses with modern distance learning techniques, to the detriment of the latter.

The potential importance of distance education in Eastern Europe is however borne out

by the EC initiative PHARE, which, from its annual budget of 1105 million ecu, typically provides 70-80 million ecu to support distance learning. The PHARE programme applies to 11 eligible countries: Albania, Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia. The initiative aims to build a network for distance learning to support education.

Distance learning is rapidly gaining credibility overseas: in the countries studied, there was a high awareness of this form of learning. Indeed, amongst the industrial and business communities there was arguably a greater awareness of distance education in the three countries than amongst equivalent organisations in the UK. This was most obvious in Sri Lanka and Zimbabwe.

In all three countries, open universities/institutions are high on the agenda: Sri Lanka has had its own Open University for 14 years; in the Czech Republic a National Centre for Distance Learning was to be established in January 1995; in Zimbabwe a Presidential Commission is currently producing a report on how and when (nb. rather than 'if') an Open University should be established.

It will no doubt take time however for distance learning to be accepted in developing countries. Given the traditional conservatism of most established universities, it is unlikely that they would welcome its introduction (as originally happened in the UK when the Open University was established), and it would be some time before they lent their support. This would be particularly true in the Czech Republic.

A recognised qualification from a well-known and reputable institution is extremely important overseas. This is also true in terms of the acceptance of distance learning programmes; indeed foreign degrees from overseas distance learning institutions often have more cachet than an equivalent in-country degree.

4.2. Perceived advantages of distance learning

The advantages of distance education were generally well known by the individuals and organisations consulted during the project. Particular features and benefits which were identified included:

For students:

- Flexibility in terms of time and location - students have more choice

over where and when they study

- Flexibility between modes of delivery-distance education tends to be delivered in a modular form which better accommodates systems for credit accumulation and transfer

- Opportunities for individuals to gain a qualification without loss of salary

- The performance of students on project work and continuous assessment are generally better for distance learning students than for those on full-time courses

- It is a form of study suitable for women and other groups or individuals unable to leave their families or homes to study. In view of the home-based role of many women in developing countries it is especially appropriate as a means of training.

For employers:

- Cost effectiveness - employers do not experience an 'opportunity cost' created from working-time being lost to training. The project showed that buyers of distance learning often perceive this as an advantage without necessarily having evidence

- Students can apply newly-acquired skills to their work immediately they gain them rather than employers experiencing a time-lag between training and application

- Higher retention of acquired knowledge - the high level of interactivity between learner and course material which is designed into the best examples of distance learning produces better long-term retention of knowledge and skills

- Distance learning students are frequently more committed and more highly motivated than other students.

4.3. Disadvantages of distance learning

At higher levels, Bryner (1986) points out that (in Australia) through distance learning

it is not possible to:

- provide close supervision of advanced project work
- present advanced papers to others
- access library resources [7]

Engineering also presents particular problems in the form of the practical requirements.

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Section 5: Special requirements in engineering

In view of the practical and skills requirements of the education and training of engineers, at a first glance engineering might not necessarily be perceived as an ideal subject for distance learning delivery-indeed, as a result, some institutions avoid developing engineering course materials in favour of less technical subjects such as management. However, the experience of the UK Open University and of other distance learning providers shows clearly that technology and engineering can be very successfully delivered at a distance.

Experience indicates that if the curriculum is carefully analysed and the medium of delivery selected accordingly, the actual need for the practical hands-on component can often be significantly reduced - although at the craft and apprenticeship level where the practical skills aspect of the job is dominant, distance education certainly becomes less appropriate. The reduction of the time spent on the practical element of an engineering course has obvious cost-advantages and produces more effective utilisation of plant and facilities. This in turn allows greater numbers of students to be trained.

5.1. Engineering by distance learning

Even after careful analysis of course curricula in order to select the most appropriate medium of delivery for each element, inevitably some face-to-face or "hands-on" requirement will remain. The problem of providing this experience as part of a distance education programme can be overcome by the use of:

- residential schools (often annual)

- day schools and weekend workshops
- practical home experimental kits
- a local organisation or laboratory acting as a practical centre to which the student would have access
- programmes designed to meet employer needs and which incorporate in-company, on-the-job practical skills training.

Many providers of distance learning feel that a residential element on a course is usually desirable and beneficial although not necessarily essential. Other options include:

- videos as a substitute for laboratory work
- the use of simulators.

5.2. UK provision of distance learning

In the course of the research, 17 institutions in the UK were identified as offering courses in engineering by distance, open and/or flexible learning. Their target markets reflect the different levels of delivery of the training: from technician to postgraduate and including professional updating.

Many of the UK institutions which deliver courses overseas (not necessarily in engineering, although many of them will have a practical element) do so to companies, government bodies or agencies and to individuals. Many have strong links with the former British Colonies and run courses in various countries in the Far East and Africa, New Zealand and Canada. Countries or regions frequently named in the course of the research were (in order of frequency):

1. Hong Kong
2. Singapore
3. Malaysia
4. Zimbabwe
5. Kenya
6. Nigeria
7. South Africa
8. Middle East
9. Tanzania

10. Caribbean
11. Pakistan
12. Australasia

There is potentially a demand for engineering by distance education at various levels in several subjects. For example, in the three countries studied, the greatest need lies at the technician level, where the numbers of people requiring training allow for significant economies of scale. In many cases it would seem that distance learning might be the only practical way of meeting that demand.

At the level of professional chartered engineer, numbers in individual countries in need of updating in any specific subject are smaller, so the economies of scale brought about by distance education are less advantageous. In such cases, and where the training requirement is common, specialist courses should be produced or adapted to serve more than one country.

5.3. Professional bodies and accreditation

In the UK, most of the chartered engineering institutions and some of the incorporated institutions are authorised by the Engineering Council to accredit educational courses and approve training programmes. This is unlike other European countries where government departments approve courses. Moreover, in mainland Europe, once an approved diploma has been awarded by an educational establishment, the recipient is considered fully qualified, whereas experience counts for much more in the accredited training of engineers in the UK, the US and in the English speaking part of the Commonwealth.

The UK is a member of FEANI (Fédération Européene d'Associations Nationales d'Ingénieurs) which, the Engineering Council considers, has made progress towards accrediting courses in Bulgaria, Hungary and Poland, although not in the Czech Republic. UK Chartered and Incorporated Engineers are included in the EU's 1st Directive and can work in Europe subject to conditions defined by the appropriate body for each country.

The UK professional institutions only carry out accreditation visits abroad if requested to do so by an overseas university. There has to be an institution in the country to ensure the minimum standards are met. Currently, courses provided outside the UK are considered on an individual basis, whereas in the UK the Engineering Council approves the providing institution rather than the individual courses.

Although engineering degree programmes by distance learning are not currently

accredited by the Engineering Council, the Council is persuaded by the advantages of this form of learning.

5.4. Distance learning, continuing professional development and the professional bodies

Distance learning is becoming increasingly accepted by the professional bodies. (8) The Institution of Chemical Engineers is currently approving a distance learning course in Chemical Engineering, while the Institution of Mechanical Engineers runs a Diploma in Engineering Management by Distance Learning which is jointly sponsored by 4 institutions. This Diploma is also accepted for CPD points.

Continuing Professional Development (CPD) is also now gaining a much higher profile than previously. The Institution of Electrical Engineers has initiated a voluntary CPD scheme. In the IEE publication *Engineering Success* - CPD (9), distance learning is identified as an acceptable method of delivery for CPD provided their students undertake an examination or assessed work.

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Section 6: Criteria for effectiveness

In the distance education process, there are typically four players:

1. The teaching institution
2. The student
3. The company or employing organisation
4. The financial sponsor (which could be 2 or 3 above, or an external organisation)

Clearly, different views on effectiveness and cost-effectiveness are taken by each of these players. As Calder (1994) indicates:

> *'One of the main problems in trying to determine the effectiveness of anything is that you need to be clear not only about what it is you want to achieve, but also what relative weightings you would attach to each of those goals.... In looking at the effectiveness of different types of education and training provision in relation to learning, the problem is compounded because of the number of stakeholders involved, and because of the range and often contradictory nature of the goals which they hold for a particular course or training programme.'* (10)

6.1. The distance learning provider

The institutional provider of distance education often considers effectiveness as meaning **learning effectiveness** i.e. the success of the instructional programme in

achieving its objectives or pre-determined outcomes.

From the point of view of the teaching institution this is invariably measured in terms of performance indicators such as assessment of student work through continuous assessment and examinations and in the form of course evaluation conducted by in-course and end-of-course questionnaires. Such course evaluation is commonplace. Rowntree defines it thus:

> *'Evaluation is the means whereby we systematically collect and analyse information about the results of the students' encounters with a learning experience.* (11)

In a review of the research evidence currently available on learning effectiveness of open and distance learning, Calder (1994) states that the criteria most commonly used by distance learning providers in assessing the effectiveness of their training programmes are:

- extent to which access to courses is facilitated
- extent to which study skills are acquired
- the use of deep (as opposed to surface) learning by students
- extent to which students operate as self-directed learner
- course retention rates course pass rates

A typical checklist for assessing learning effectiveness is shown below:

- Will the learners Understand what is expected of them?
- Will the learners have difficulty achieving any of the listed objectives?
- How long would they be expected to take over each section?
- Does the material seem pitched at the right level of difficulty and interest?
- Do the examples, analogies and case studies seem relevant and illuminating?
- Are any sections likely to cause problems (for example, for a different culture)?
- Are new terms adequately explained?
- Are there sufficient activities and self-tests?
- Are the activities worthwhile and practicable?
- Is there appropriate assignment and follow-up activity?

Evaluation before, during and after training should answer many of the above questions and the collection of information via student and/or employer questionnaires is a

common technique. However the study identified examples of monitoring of student opinion and performance which stopped short of data analysis and evaluation with the consequence that course modifications were not made and recommendations not acted upon. To be effective and useful, course evaluation should be more than a 'public relations' exercise. Indeed, the process of evaluation and the modification of material, especially for rapidly changing bodies of knowledge like engineering and technology, should be a key and inviolate part of a distance learning provider's service.

A common indicator of success frequently used by distance learning providers is a measure of student drop-out from courses. The use of this indicator is fraught with problems and ambiguities and more mature distance learning providers believe that there are more effective measures which can be used to describe, for example, completion and non-completion rates and which take into account students who postpone and then re-enter the system. The Open University of Sri Lanka, as an example, would be advised to consider alternative methods for the measurement of student participation and satisfaction.

6.2. The student

For the student, success in achieving the qualification is frequently seen as the prime measure of learning effectiveness, thus laying great store by the providing institution's examination and assessment procedures.

Central to the model of a learning process is the interaction between the student, trainer and the learning materials. However the primary stakeholders are the learners. This learning effectiveness should not be reduced to goals or outcomes as frequently considered pre-eminent by students; the quality of the learning process must be recognised as a crucial factor in the assessment of learning effectiveness.

6.3. The employer

For the employing organisation effectiveness is more likely to be viewed in terms of 'problem-solving' and acquisition of skills.

Within companies, success in 'passing' the course is less of a concern, training often being undertaken following an employee's appointment or promotion; so to a certain extent 'success' has already been achieved. Training needs often arise through appraisal of employees and again there is an expectation of 'success' in the training process. Learning effectiveness is assessed primarily in terms of improved work processes or safe and correct working practices.

A 1989 report from the Department of Employment, 'How to Profit from Open Learning Company Evidence', indicates that 94% of the 50 firms involved in the survey regarded their open learning programmes as successful.

Those companies that used open learning identified a number of benefits, including:

- higher pass rates than before
- line manager satisfaction
- better retention of information
- a better record of promotion
- an increase in the number of employees working toward vocational qualifications.

However there was little systematic evaluation of the programmes involved - frequently because even conventional training was not evaluated, thus providing no basis for comparison.

6.4. The financial sponsor

For the sponsor, effectiveness is likely to be measured in terms of the extent to which their own (often wider) objectives have been achieved.

6.5. Relevance to the workplace

Few of the indicators used to assess effectiveness are concerned with the benefits to the employer. Indeed, there is little evidence of distance education producers analysing in depth the skills necessary to complete tasks in the workplace in order to design programmes to satisfy these needs - despite the fact that employers are frequently the sponsors of training and their primary objective is that the training should impact positively on the student's work performance. There is clearly considerable scope for an in-depth study of the specific benefits of training on task performance.

To date very little work has been done in terms of measuring effectiveness and, by extension, the cost-effectiveness of training.

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Section 7: Cost-effectiveness

Cost-effectiveness analysis is the evaluation of alternatives taking into account both their costs and their effect in producing an outcome or set of outcomes. Clearly the measurement of cost-effectiveness is normally a complex science. This is even more true in distance education where not only is it extremely difficult to assess or to place a value on the outcomes; even the appropriateness of the choice of the set of outcomes is not universally agreed. Furthermore, as the last section demonstrated, different outcomes are deemed to be more or less important by different stakeholders.

7.1. The distance learning provider

For the teaching institution, cost-effectiveness of distance education is often measured in terms of factors such as the number of students taught per unit cost compared with conventional teaching and, for instance, the payback period of capital development costs.

However, the financial systems of many of the UK Universities make it extremely difficult to assess merely the cost of distance education, let alone its cost-effectiveness. This is particularly true of institutions operating in mixed-mode where distance education costs may not be easily disentangled from conventional teaching costs. This problem was also identified by Sharrat and Foster (1991):

> *'It was extremely difficult to measure in any meaningful way how much a particular course or programme cost'* (13)

7.2. The purchaser

For sponsors of students on distance programmes (individuals, employers or other organisations) costs are invariably measured in comparative terms with conventional face-to-face courses. Cost-effectiveness on the other hand, is seen as very subjective. Sharrat and Foster indicate that

> *'Many of the benefits associated with DL do not translate into direct economic benefits for the consumers.'* (13)

This is confirmed by the 1989 Department of Employment study:

> *'The cost-benefits of open learning could not be judged simply by the cash outlay on open learning versus the cash spent on more traditional methods. The improved logistics of training were at least as important.'* (12)

The report goes on to say that not only was open learning found to be substantially cheaper, the most frequently cited reasons for employers choosing it were:

- trainees on multiple sites
- trainees working different shifts and work patterns
- line managers reluctant to release trainees
- large numbers being trained in a short period
- alternative forms of training not available.

There were also significant business advantages:

- financial performance improved in 70% of branches (Building Society)
- error rates in manufacture down by 3%
- reduced customer complaints
- 41% increase in success rate of calls (sales engineering)
- 25% fewer 'helpline' calls (microcomputer firm)
- sales increased by 50% (chemical industry).

7.3. Importance of student support

Many of the cost savings identified by employers as arising from distance methods are those achieved through the use of trainees' own time as they study independently, frequently at home. It is clear, however, that there are dangers: independent study can easily become isolated study and carries the risk of delayed/slow completion and of dropout.

Support for the learner is therefore vital. This should be provided either by the educational institution or through an integrated and structured company training programme which might involve some form of mentoring. Good distance education practitioners would employ student support strategies routinely in the form of: academic tutors, personal tutors, telephone and face-to-face sessions, newsletters and other networks. Such support tends to be labour- and therefore cost-intensive, but lack of support for open learners can actually reduce overall cost-effectiveness by contributing to an increase in dropout rates, or delayed/slow completion of training programmes through demotivation and isolation from tutors and from peer groups.

7.4. Benchmark measurements

One of the reasons why it is difficult to evaluate the cost-effectiveness of engineering distance education training is the absence of a realistic benchmark measurement. Within companies indicators such as reductions in down-time, wastage and absenteeism are used, as are increased quality and productivity. However, it is difficult to attribute these benefits directly to training, since the process implies many assumptions and also requires long-term measurement.

Very few organisations appear to have carried out such a survey, with the exception of some UK academic institutions including the Cleveland Open Learning Unit (COLU), the OU and the Open College which have measured some outcomes of courses. COLU in particular was able to attribute significant improvements in the areas mentioned above to their training programme.

However no work has been identified which has undertaken a longitudinal study of the effectiveness of engineering distance education, and little, if any, work comparing the cost-effectiveness of distance as opposed to conventional learning in relation to improved work performance.

7.5. Student fees

Many employers and students consider distance and open learning cost effective purely on basis of actual cost. Student fees for distance learning courses generally compare favourably with full-time costs. Taking into account the fees for a conventional course together with the working time lost, open learning can cost between 70% and 80% less than traditional training.

However, the greatest obstacle to the increased up-take of distance education by the mass population in developing countries remains the cost. In the UK, fees often amount

to the equivalent of a few weeks' or months' salary to the average worker. In Zimbabwe and Sri Lanka, as in most other developing countries, the same fee is prohibitive, being equivalent to perhaps 10 years' full salary to the average worker. The gap also appears to be widening and, of course, the growing numbers of unemployed also have no realistic access to this level of education. Ability to purchase can be slightly improved by in-country development of courses but, as governments cut back on education budgets, the means to deliver quality distance education continues to decline. As Fagbamiye (1995) points out:

> *"The problem is thus to continue to increase access where the means available to beneficiaries continues to dwindle at an alarming rate.* (14)

However exporters of distance education need to be more aware of the economic circumstances of individuals and organisations in developing and emerging countries. The low penetration into overseas markets from (especially UK) distance education providers is a direct result of this lack of appreciation of the price-sensitivity of courses abroad. The adherence to 'UK prices' results in an almost exclusive 'expatriate' enrolment or a reliance upon company-sponsored students. As a result the large resource of distance education materials available in the UK is having little impact on satisfying the high demand for education in developing countries.

Initiatives such as 'exporting Education' from the Overseas Projects Board of the Department of Trade and Industry can help considerably. In addition, and for certain circumstances, aid agencies might need to consider direct subsidy of course fees.

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Section 8: Models for production and delivery

Most developing countries recognise that distance learning provides the only credible and economically possible method of providing sustainable education and training for their mass population of educationally disadvantaged.

Many, perhaps the majority, seek to achieve this objective through the establishment of their own open universities. The alternative to in-country production and delivery is the import of pre-prepared and proven materials, some models of which involve a varying degree of collaboration between the originating and the delivery institution.

Of the three countries in this study, Sri Lanka established an Open University in 1981, and both the Czech Republic and Zimbabwe are in the process of creating organisations for the production and/or delivery of distance education.

8.1. Models of open universities

For centuries, traditional higher education has relied totally upon placing a requirement on students to attend at predetermined times and places to allow direct interaction between tutor and student. In all these campus-focused institutions, physical plant and organisational infrastructures place constraints upon the delivery of teaching and upon

the educational process.

The establishment of the Open University in the UK provided the first alternative to this traditional approach. Its success has generated not only a massive awareness of flexible and distance forms of student learning but also a large number of institutions either solely or partly involved in the production and delivery of distance education. These institutions can be broadly grouped in the following three classifications:

- single mode
- dual mode
- mixed mode

8.2. Single mode institutions of distance education

In this form the teachers and students are separated by both distance and time. Learning materials are produced and are used repeatedly over several years in order to recoup the initial high cost of development. These open universities avoid the structural constraints of traditional higher education but in doing so place significant demands upon those responsible for the development and quality assurance of the learning materials. This distance learning model also places a high expectation upon students who must be highly motivated, self-learners.

The UK Open University is the prime example of this model and there are many institutions which have sought to replicate their success including, for example, the Indira Gandhi National University in Delhi and the institution included in this study, the Open University of Sri Lanka in Colombo.

Despite the massive investment required to establish an open university *ab initio*, many developing countries aspire to have their own single mode institution of this type. Zimbabwe is an example, where this option is under active consideration by a specially formed Presidential Commission.

Many developing countries would be better advised to consider alternative, and less resource intensive, models for the provision of distance education.

8.3. Dual mode institutions

Traditional teaching and distance teaching have come together in many universities

around the world. In this model, on-campus students continue to be taught by conventional methods whilst off-campus students study separate and often different programmes using distance methodologies. Some examples of this model show a university-wide strategy to deliver distance education, others merely a single departmental or single course initiative. All examples evolve from conventional universities who recognise the opportunities that distance education courses provide for them and for their students.

In some cases there is minimal synergy between on-campus and distance courses, often because staff focus on only one mode of delivery.

There are several examples of this model in the developed countries; Australia and New Zealand have well established dual-mode institutions. In emerging and developing countries this mode can operate in one of two ways:

- the institution develops its own materials
- the institution imports materials whilst providing student support and course administration.

The University of Zimbabwe exhibits both these modes in two separate subject disciplines: education and agriculture. Similarly, the newly established National Centre of Distance Education in the Technical University of Brno in the Czech Republic aims to establish distance education initially through co-operation with other providers and ultimately through its own resources.

8.4. Mixed mode institutions

A newly emergent model which is establishing itself, and growing out of the dual mode approach, can be described as mixed mode. In this model, learning materials, and often educational methods originally created for distance education, are also used by on-campus students. This mode has been developed by Universities who can see the economic advantages of using high quality distance materials to deliver on-campus education. It requires a modular course structure and in a modest way is allowing new learning methodologies to challenge the established and entrenched approaches to university teaching. Good examples of this approach in the UK are the Universities of Bath and Luton (15).

An alternative mixed mode model applies when a traditional university incorporates imported learning materials within its on-campus programmes. This variant on the mixed mode model was explored with universities and polytechnic institutions in the three countries of this study and gained some initial and enthusiastic support. It is

clearly worth further consideration for developing countries where the assured standards and accuracy of subject content implicit in pre-prepared materials can go some way to alleviate the profound problems caused by the low quality and low morale of teachers in some institutions of higher education, most notably in this study, in Zimbabwe. There are also benefits in using this approach for engineering courses, where the practical and 'hands-on' course components can be covered on-campus in short, intensive modules. This allows more student cohorts through the system, thus increasing the total number of students in training through better utilisation of plant and facilities. This approach found particular favour in the Bulawayo Polytechnic in Zimbabwe, where it could be used as a solution to both the problem of training large numbers of engineers and also the under-utilisation of laboratory and practical facilities.

Thus a mixed mode approach could not only allow for an expansion of student numbers by providing distance learning courses but could also benefit the education of conventional students in the system.

8.5. Models for collaboration

The establishment of a distance education capability in a developing country through either a single or dual mode institution requires both subject expertise and distance learning expertise. Collaborative models which involve the importing of materials or expertise can be far more attractive both economically and pedagogically.

In a briefing paper for UNESCO, Timmers (1988) (16) identified four different forms of collaboration in distance education:

- local
- bilateral
- multilateral
- knowledge industry.

Local collaborations can produce some remarkable projects. As an example, local government funds and involvement in planning created the Open Learning Institute in Hong Kong. Interestingly the Institute then adopted a policy of importing existing distance learning material from providing institutions, particularly the UK Open University. Timmers finds that bilateral institutional collaboration is the most common. This is also the view of an early report on Commonwealth co-operation (Coffey et al., 1988) (17).

Successful bilateral collaboration frequently seeds multi-lateral models. The Commonwealth of Learning is a high profile example of this model. Daniel (1987)

indicates that the costs of collaboration (both monetary and non monetary) are exponentially, rather than linearly, related to the number of partners [18].

'Knowledge industry' is used to describe entrepreneurial and sometimes opportunistic provision of learning opportunities [19] Examples include larger-scale providers such as the National Technological University in the US. It might also include speculative single course entry into overseas markets without the involvement of a 'local' partner, although this latter mode would almost certainly fail to satisfy any of the criteria for effectiveness for either provider, student or employer.

8.6. Forms of collaboration

The three most common forms of collaboration (Coffey et al.) are described as:

- consultancy model - where expertise is transferred in order for the recipient institution to develop its own capability in production or delivery

- joint development - of course or service by equal partners

- fully devolved approach - where there is parallel development by the partners of similar schemes. As distinct from the consultancy model, this is facilitated through the exchange of information and staff.

This has been alternatively analysed as four levels and twelve kinds of institutional collaboration (Feasley, 1995) [19] as follows:

Level 1:	**Passive cooperation**	- exchange of information and experience
		- personal contact
Level 2:	**Active cooperation**	- staff exchange
		- exchange of learning materials
		- exchange of experience (e.g. through workshops)
		- advice to students and referral to other providers
Level 3:	**Transfer**	- use of or, where necessary, adaptation of learning materials

		- use of physical plant
Level 4:	**Pooling**	- co-production of learning materials
		- joint curriculum planning and credit transfer
		- student exchange
		- joint provision of technical and physical support.

8.7. Donor strategies

The development of distance education opportunities in some developing countries has been substantial. Even so, this impressive quantity of provision has only scratched the surface in terms of demand and need. Furthermore, there are some developing countries which have yet to benefit.

The development of distance education for and in developing countries has been heavily influenced by donor countries. Most, if not all, development projects receive some form of initial funding.

Laaser (1995) identifies a number of lessons that should be learnt from past donor policies, notably:

- a criterion for choosing distance learning projects should be that they support on-going national projects
- they should provide administrative and organisational support for a considerable period rather than short-term translation of existing materials
- local staff should be trained in materials development
- priority should be given to projects which address local needs related to labour market demand
- low cost technology should be used
- the use of mass media can serve to motivate and provide publicity for programmes

- projects should emphasize self-organised group learning
- projects should respect cultural patterns of learning
- projects should foster co-operation between distance teaching institutions and local conventional educational institutions. (4)

8.8. Benefits of cooperation

In view of the high costs of developing distance learning it is essential to achieve economies of scale by attracting large student numbers to course programmes. The research indicated that a severe impediment to achieving economies of scale can be caused by non-communication between institutions. The result of this is that materials and/or courses are often produced competitively, markets are split, resources are not shared and the costs increase as a consequence. Whereas this free market philosophy may be the norm in developing countries it is clearly inappropriate and wasteful for developing and emerging economies, or in circumstances where limited aid programmes would be better focused on development projects where the resulting courses have wide utility. The value of cooperation is particularly obvious in Sri Lanka where the technical and vocational education sector is extremely fragmented and lacks coordination. The Czech Republic and Zimbabwe would also benefit significantly from increased cooperation and coordination between institutions and from links between industry and academia.

There are many engineering subject areas which might have only relatively small markets in single countries, but where cooperation amongst providers and other agencies would allow major economies of scale to be achieved through making them available to a number of recipient countries. It is clear that a more detailed study is required of the opportunity that this level of cooperation would provide for engineering training.

8.9. Importance of a local point of contact

The establishment of a local collaborative partner is invaluable, not only for developmental purposes but also in the delivery and the provision of local systems for student support. Such a partner will provide assistance in certain crucial areas such as:

- pricing the course realistically in accordance with the means of the population

- targeting the right market at a suitable level
- ensuring that the materials are accurately translated if necessary
- advising on an appropriate presentation of the materials
- advising on the use of existing networks to support the infrastructure of the course or helping to set up a new network for that purpose.

The three country case studies indicate instances in which some of the above could be applied:

- The introduction of a distance learning programme into any country would need to take careful account of the local availability, reliability and useability of the appropriate media of transmission. For example, the use of modern educational technology would be extremely useful in helping to 'sell' the idea of distance learning to the Czechs, and the country certainly has the infrastructure for distance learning. More investment would be required in Zimbabwe and to a lesser extent in Sri Lanka with regard to implementing the use of modern technology.
- In all three countries, there are networks which could profitably and cost-effectively be used to help support the infrastructure necessary for any successful distance learning course. Moreover, the networks often provide existing facilities which could be used for the practical instruction, thereby increasing the cost-effectiveness of the course. Imaginative rescheduling of traditional courses would free up practical engineering facilities in existing universities and polytechnics for use by distance learning students, thereby optimising the use of expensive plant and facilities that are typically in short supply in developing countries. Realistically, however, gaining the necessary agreement from all the institutional and governmental vested interests might be an insurmountable hurdle for this visionary solution.
- With the exception of courses aimed at senior management, materials would probably have to be translated for the Czech Republic.

When a programme is being launched in a specific country, it is therefore essential for the UK institution to have a local point of contact and/or a liaison officer who can smooth the way and give advice on in-country matters. In most cases, this is currently achieved by working in collaboration with a local academic organisation.

8.10. Meeting local needs

A potentially effective approach to establishing a distance learning programme overseas may perhaps be summarised in the maxim:

> *'Think global, act local.'*

In many cases an existing course will have to be modified to be made attractive and relevant to an overseas market. As a result the materials should be tailored and delivered according to local requirements. This is especially relevant at lower educational levels, although less so at the postgraduate level.

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Section 9: Development and sustainability

In many cases the importing of pre-existing distance education courses will be impractical, either because the appropriate material to meet the identified need simply does not exist or because modification to suit local and cultural need is not possible. In these circumstances *ab initio* development will be required. Where a local university exists it is likely to be the developing agent. Where there is no such institution, or where a course is being jointly developed for a number of countries, as would be the case for some specialised areas of engineering, some form of collaboration will be likely.

Despite the obvious benefits of collaborative development, in practice it is most uncommon. There are two major reasons for this. Firstly, the 'not invented here' syndrome of many academic institutions who prefer their own material to the adoption of others, secondly the lack of structures that facilitate joint working and transfer of expertise from established providers to potential partners in developing countries. Such structures although espoused by organisations such as the Commonwealth of Learning are little evident in practice. Donor agencies would be well advised to consider the benefits of establishing such arrangements. For engineering, in particular, there would be considerable advantages from the involvement of the UK Engineering Council, which is enthusiastic about the potential of distance education in such an arrangement. They would be able to play a role both in the coordination of industrial training and in ensuring appropriate standards are achieved in relation to satisfying the requirements of

the professional institutions.

9.1. UK providers

While all of the UK academic institutions involved in the study have links with industry and/or commerce, the majority of them admitted to being product- rather than market-led. Distance learning courses are often conceived on the basis of the personal interest of one or more staff members, or they are developed from pre-existing full-time courses. In some instances, they are developed on an intuitive basis, from successful short courses. These institutions rarely conduct market research to ascertain their markets before developing courses.

The same does not apply to nearly such an extent among the more 'commercially aware' academic or private institutions, many of whom work primarily with companies. For them it is evidently imperative to tailor their products to match their clients' needs.

9.2. Market research

The high capital cost required for the development of distance learning courses makes market research essential. Before committing funds, developers and sponsors of distance education must have a comprehensive picture of the size of the market, their potential market penetration and the existence of competitive courses. Market surveys can also play a crucial role in ensuring that the eventual product matches the educational or training requirement. Thus market research can also be used as a needs analysis.

9.3. Donor agencies

For aid agencies which seek to commission either a new distance learning programme or indeed a modification of existing materials, the conclusions of Sharrat and Foster (1991) are important:

- The number of students required to break-even is, in general, higher for distance learning courses than for 'conventional' face-to-face, whether study is full-time or part-time. However, once the break-even is reached then distance learning becomes progressively more cost-effective

- The cost of developing a distance education course is less for a mixed-mode institution than for a wholly distance teaching institution, although the size of the UK Open University compared with other institutions

involved in distance teaching is so great as to make sensible comparison difficult

- The conversion of existing courses is cheaper than *ab initio* development [13]

9.4. Sustainability

The high capital cost of development of distance education generally requires large student numbers to justify the investment. These students are often recruited over a longish time period so distance education providers invariably plan for their programmes to be sustainable over the same time period or longer. Sustainability is important for two main reasons:

- student support - since study periods are typically longer for distance students, the relationship between student and tutor/support assumes a high importance and must be maintained during the student's entire registration

- materials up-dating - all courses need to be regularly reviewed and updated. Depending upon the teaching media employed, the cost of up-dating distance education courses is usually higher than conventionally taught courses. The impact of this can be offset by a large enrolment. It is also one of the reasons why distance education is perhaps more appropriate for the unchanging fundamentals of subjects (e.g. statistics, engineering science, management theories), rather than rapidly changing fields of knowledge.

9.5. Sustaining the tutor-student relationship

Many distance learning courses, for instance at MSc/Postgraduate Diploma level, allow the students up to five years for completion. Given this length of time, it is vital that a good tutor-student relationship be maintained. Institutions offering good distance courses achieve this in a number of ways: by regular phone or fax contact, by the tutor or the administrator contacting the students on a regular basis and not simply when they suspect they might have dropped out, and by permitting the students reasonable flexibility with assignments to allow for the contingencies of their work or private lives.

9.6. Residential schools

Many current distance learning courses employ residential periods to deal with the need for practical, 'hands-on' experience or to provide opportunities for group interaction.

Most students enjoy attending a residential school. Not only does it give them the opportunity to meet their tutors and fellow students, it can also offer a strong motivational element.

Among developing countries, attendance at residential schools invariably poses financial problems. To counter this, if the numbers justify an in-country residential course, it should be held locally wherever possible, or at least in a neighbouring third country, rather than in a distant developed country such as the UK. Students may not be able to attend a course abroad otherwise. An exception may be necessary for some aspects of engineering, where certain practical facilities are only available in certain locations.

If a residential component is compulsory it should be made as easy as possible for students from developing countries to attend: by offering advice regarding financial support available, by providing the cheapest possible accommodation and by making bursaries available. Such measures will help to make a course more sustainable from the point of view of the students.

9.7. Maintaining practical facilities

For most engineering courses, practical facilities are crucial. This is equally true for engineering distance education even though a student's practical experience might be concentrated into short face-to-face (or residential) periods.

The study identified a significant problem in developing countries which, if not addressed, will prejudice the future success and sustainability of engineering distance education. Funds from aid agencies have frequently been used to purchase technical equipment. However the lack of maintenance of this equipment means that over a period of time its efficiency is reduced and ultimately it falls into such a state of disrepair that it is unusable. There were a number of examples, especially in Zimbabwe, where this has occurred. There are four main reasons for this, although the solution may be less easy to identify:

- cultural attitudes
- lack of management awareness and of direct supervision

- low remuneration of technical and maintenance staff
- aid agencies not including a maintenance allocation in the support of capital purchases.

The importance of this cannot be underestimated: if the facilities are not maintained, no distance learning course in a practical subject such as engineering can be sustained in the long term.

9.8. Updating of materials

Materials can now be easily updated and modified using high-tech print runs and Just In Time (JIT) principles. This technique also facilitates tailor-made courses. Few academic institutions use such technology and the updating of materials is not necessarily given a high profile. If a course is to be sustainable in the long term, however, the materials must be relevant and up to date. Moreover, regular updating of materials provides a strong promotional advantage.

9.9. Prioritising needs

In analysing the needs of a country for engineering distance learning, it is necessary to prioritise in order to achieve maximum efficiency in the long term. This might not always imply initially offering the course for which there would seem to be the greatest need in terms of numbers. For example, in Sri Lanka and Zimbabwe the greatest need in the field of engineering is at the technician level. There is however also a general need for managerial skills, and it may prove more effective in the long term first to provide managerial training by distance learning. Educated managers would then be in a position to encourage training lower down in the hierarchy and would have an understanding of what the distance learning process required. This would reinforce the crucial role which employer support can play in the success of a course.

In all three countries, priority is being given to export competitiveness. This implies a market-led approach, creating increased productivity, continuity of supply and efficient management. There is also a universal need, and a great demand, for the management skills required to bring about such competitiveness: entrepreneurship, quality and quality assurance, communications, engineering management training, project management etc.. Given all three countries' priorities, responding to this universal need would provide a more sustainable programme.

Similarly, privatisation and the private sector are extremely important in all three cases. This is especially true in the case of the Czech Republic where the privatisation of its national industries is occuring at a tremendous pace. Environmental issues are also

important but especially crucial in the Czech Republic where these issues have acquired a high profile in the privatisation process. Training in environmental matters is therefore much higher up the Czech agenda than in the other two countries, a fact which should be acknowledged when distance learning programmes are considered.

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Section 10: Prerequisites for successful engineering distance education

The study has identified a range of parameters which need to be satisfied if engineering distance education is to be successful and to provide real solutions to the training needs of developing countries. Some of these issues are identified in each of the individual country reports. Others are more generic and are collectively described in this section.

10.1. Cultural adaptability to distance learning

This is central to the acceptance of distance learning outside the UK. Views on cultural adaptability are very often subjective but some generalisations can perhaps be made.

- In general, people from former British colonies seem to adapt well as they are used to a British style of education and often utilise British systems of engineering and professional formation. Countries not using British systems have to align with their own engineering professional bodies in terms of validation and qualifications, and this can cause problems for some UK-based providers. Commonwealth Bodies however often do line up with the UK

- Language is crucial to the success of a distance learning programme, and assuming that the programmes would be delivered at least initially in English, there tend to be fewer language barriers in the ex-colonies. This also applies to industrial sectors: the oil industry, for example, largely speaks English except in the former USSR

- The Chinese, because of their work ethic and book-oriented learning culture, adapt very well to distance learning, although they might have difficulties with some areas such as law

- Eastern Europeans also adapt fairly easily to distance learning with their culture well suited to this form of training.

Distance educator in industrial countries has similarities in its presentation with industrial modes of development, production and distribution. Furthermore, it is historically based on the written word. In contrast, cultural patterns in many developing countries, especially in Africa and Latin America, emphasise communalism and the spoken word. Therefore group learning, face-to-face tutorials and audio and audio-vision gain more importance. This poses some restrictions for engineering training and usually increases the costs of delivery.

10.2. Attitudes towards distance education

Before any engineering distance learning programmes were introduced into a developing country, a substantial amount of work would need to be done to raise awareness of this form of learning and to improve its profile and image amongst engineering employers. Examples of companies already employing such techniques for its employees would serve as an effective model to other organisations and to individuals within the population.

Outside industry, distance learning is a well known process in many developing countries. Specifically, it is well-known within both Sri Lanka and Zimbabwe, and there would be less need to raise its image there than in the Czech Republic where there is inherent suspicion of anything vaguely resembling Soviet correspondence education.

The way it should be marketed will vary from country to country. There may need to be more or less emphasis on such aspects as modern technology, the professional qualification awarded, the relevance of the materials, the awarding institution, the convenience of this particular learning process etc. Overall, distance learning needs to be seen to be efficient and to work well in order for it to acquire and sustain a good image: there have to be efficient and maintained networks and training has to be

adapted to suit local conditions and to meet community needs.

10.3. Local point of contact

For a distance learning course to be successful overseas it is seen to be essential to invest in a local point of contact for the students. Student isolation was often acknowledged as a severe problem and a local point of contact can help significantly to alleviate this. Moreover, several of those interviewed felt that the problems related to engineering were often quite formidable and could not be explained just by text: students needed to have someone to talk to, especially if they did not come from a technological background. A local centre or point of contact can also help with practical problems such as obtaining reference materials. Such a solution is, however, expensive. In the view of one respondent:

> 'In developing countries, the support framework is more difficult and more expensive to put in place. That needs longer term investment ...(It is necessary to) invest in infrastructure, then buy in materials to realise the value of the materials through **your asset, the infrastructure.**'

10.4. Implementation

From the outset, the planning and design of distance education materials must take into account the end-user: how will the materials be used, by whom and under what circumstances physical location and cultural environment. As Laurillard (1993) puts it:

> *'The most brilliantly designed educational materials can fail completely if the same care is not given to the way they are used. Research and development projects in educational media pay quantities of hard cash for development, lip-service to evaluation, and no attention to implementation. There is never enough cash to equip a decent programme of piloting, dissemination, and staff training that would be needed properly to establish an innovation.* (20)

Not only must the planning process be thorough and comprehensive but resources must be identified for the implementation phase, which includes the important aspect of student support.

10.5. Student support

The research indicated that student support is crucially important. All respondents

agreed that it is as important for the success of a distance learning course as the materials themselves. Effective support is necessary to keep the students motivated and to deal with problems such as lack of time to study, isolation, learning in a language that may not be their first language, concepts perhaps alien to their own culture etc. Effective support can take many forms:

- tutors being easily available to answer queries
- contacting students on a regular basis
- student networks, newsletters, self-help groupings
- well-trained administrative staff
- constructive and encouraging feedback on students work and assignments
- high quality and well-trained tutors
- appropriate facilities
- being responsive to course evaluator and student feedback.

Student support also adds value to a course and may be seen in a commercial sense as customer service, something which potentially distinguishes it from the competitors.

Many UK-based distance learning institutions get round the problem of the lack of appropriate local contact by encouraging a system of mentoring, using mentors from both UK and overseas. Some UK institutions offer training to mentors if required; some vet them; others take a more laissez-faire approach. It is certain however that a mentoring system can be of enormous benefit to students and it can also prove to be a very cost-effective approach. The use of mentoring is growing rapidly among companies in the UK, a trend which may well be followed in developing countries.

The problems which distance learning students face are different from those encountered in conventional learning. The students require a great deal of motivation and discipline and need strategies to deal with the isolation they may experience. They need to be offered guidance and training in the necessary study skills for distance learning to help them get through the course, particularly in the first year when the greatest drop-out typically occurs.

It is also true however that although the students' motivation needs sustaining, a distance learning student often starts with higher motivation than the normal (UK) 18 year-old university entrant. In the British market, mature students perform better in many subjects than their younger counterparts, with those in the 30-45 age range typically doing well. This might not however be reflected in overseas markets where levels of motivation among the various age groups might be different.

In the three countries studied there would be a need to train all three main players: the

teachers and trainers, the producers and developers of the materials and courses, and the students enrolled on distance learning courses.

10.6. Qualifications and accreditation

These are universally seen as vital in a distance learning programme, both for motivating students and for providing a target. Many foreign students are keen to get a qualification from the UK, particularly from a well-known university. This helps to "sell' distance learning, showing it to be the equivalent of a full-time course and not a poor relation.

10.7. Good practice in distance learning

A course is most likely to be successful if there is a perception of application of good practice. This research indicates the following as key elements of good practice:

- production of high quality teaching materials designed to be user-friendly, written by experts and consumer-tested
- a clear outline of the specific goals, competencies and learning objectives to be gained from the course
- use of appropriate media to their best advantage
- provision of a dedicated and good quality distance learning administration which is responsive to students and provides local support, good back up, and regular monitoring and evaluation
- personal concern for the students: maintaining contact and checking progress
- clear instructions in relation to assessment - constructive and rapid feedback
- committed and well-qualified tutors, well trained in distance learning techniques
- local tutorial and practical support

- guidelines to students on study skills

- flexibility of study time and opportunities to alter speed of study and allow the possibility of deferment

- careful needs analysis of students and employees before the development of a course

- regular feedback from both students and/or employers during the course.

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Section 11: Summary

11.1. General conclusions

• Distance education is an increasingly important mode of education and training and is gaining ever more stature and recognition as a practical and potentially cost-effective way of learning and training in the UK and overseas.

• Distance learning is as subject to market forces as any other product or service. Providers and sponsors need to bear in mind that the notions of added-value and customer service apply in this field as in any other. The average distance learning student tends to be older, more mature, more experienced and potentially more demanding than the average full-time student. He/she will also be more isolated in terms of the study. The provider will therefore need to use a whole range of strategies to keep this person both satisfied and motivated.

• A major factor which encourages companies to use distance and open learning rather than traditional face-to-face instruction is the notion of "opportunity cost", which leads to the perception of distance education being cost-effective. Indeed, buyers of distance learning perceive it as both effective and cost-effective without necessarily having evidence of this. Little if any cost-benefit analysis is applied to training in any form.

• Employers familiar with open or distance learning are very ready to recognise the many practical benefits and results of the training, but the

primary advantage to them is the use of the learners' own time for studying. Paradoxically, this is also the biggest disadvantage to open/distance learning due to the increased risk of slow or non-completion and drop-out.

- Distance learning courses generally require higher 'break-ever' numbers than conventional courses but offer the opportunity of greater economies as numbers increase. It should be noted however that low unit cost of training does not imply long-term effectiveness: the cost of training has to be examined in a much wider context.

- There is a considerable amount of distance learning material on the market; some excellent and indeed some of poor quality. Buyers/sponsors must not consider just the course contents, they must also scrutinise the potential provider for application of good practice and quality support systems.

- Most of the-UK engineering distance learning courses offered to overseas students appear to require relatively little "hands on" and are primarily text-based. It would appear that the lack of other support materials is due primarily to production costs. Funding is also the barrier to the lack of a local point of contact.

- Distance learning courses in engineering must offer participants the opportunity to gain a qualification, preferably one of international standing.

- Good distance learning is a learner-centred process integrated with active student involvement.

- Good student support enables students to study effectively and is vital to the potential success of a course. It requires significant investment of time and money if support is to be offered at a satisfactory level throughout the course. Some form of face-to-face contact may be considered important and is likely to increase student motivation.

- Investment in local infrastructure including an efficient local point of contact, will contribute significantly to the success of a distance learning programme. A system for mentoring would be a relatively inexpensive step in the right direction.

- Distance education by electronic means should ultimately be an extremely cost-effective way of training or educating considerable numbers of students. It does, however, require significant investment in hardware and courseware. There needs to be a strong belief in the system and the will to make it work: applying it by half-measures will not achieve cost-effectiveness. Nevertheless, the use of modern technologies such as computer-based learning, videoconferencing and satellite broadcasting as a medium of delivery could very effectively allow large numbers of students to be instructed in practical techniques.

- If distance learning materials are exported they may need to be tailored to suit local requirements and the local culture: judgement, experience and local opinion should be used with regard to the tailoring process. There will of course be trade-offs between the developmental costs, the quality of materials, the extent of modification and the shelf life of a course.

- Investment in market research is likely to ensure a programme is more applicable to the needs of potential clients and therefore ultimately more successful and effective. There has to be evidence of a large market to justify developing a new course. Modification of existing material is a much cheaper solution.

- Potentially promising areas for delivery of engineering training by distance learning would appear to be Eastern Europe, China (in the longer term), countries from amongst former British colonies, including the Indian sub-continent, the Caribbean and some African countries.

11.2. Conclusions from the three country studies

The Czech Republic, Sri Lanka and Zimbabwe are three very distinct countries in different parts of the world and affected by very different local, regional and international trends and developments. Evidently each country has its own priorities, goals and objectives. On the face of it there are few if any links between the three, yet there are several notable and striking similarities between them. Some of the similarities are broad, others are more specific and directly relevant to the project.

Broad similarities

- The people of all three countries share a respect for education and place high value upon it.

- This is borne out by the huge over subscription for places in tertiary education: each year, thousands of qualified Czechs, Sri Lankans and Zimbabweans are refused places in higher education. There are huge demands on the existing systems.

- In all three cases the proportion of students in higher education in relation to the total population is much lower than for example in most European countries.

- The students in each country appear generally to be more interested in the arts and humanities than in technical subjects such as engineering.

- Accredited, recognised qualifications are important in all three countries. Foreign degrees from acceptable and well-known institutions often have more cachet than an in-country qualification.

- Privatisation, the private sector and small and medium-sized enterprises (SMEs) have an extremely important role to play in all three economies. It is acknowledged in all three cases that training in these areas would be beneficial.

Requirements specific to engineering training

- There is a universal need for updating in engineering although the extent, level, subjects and immediacy of the need varies depending on the country. In most cases however there is little support from industry with regard to updating as there are often more pressing needs such as survival at the top of the agenda.

- At the professional engineering level, numbers in individual countries requiring updating in any specific subject are smaller, so that the economies of scale brought about by distance education are less advantageous. In these cases and where the training requirement is common, specialist courses should be produced or adapted to serve more than one country.

- At post experience/professional engineering levels, there is a need for technical updating, although less so in the Czech Republic.

- The greatest need lies at the technician level where the numbers of people requiring training allows for significant economies of scale compared with the smaller numbers of engineers at a higher level. Zimbabwe in particular needs to focus on the application of skills. Management skills are less important for the technician group.

- At the level of craft and apprentices, the practical skill aspects of the job are dominant and distance education becomes less appropriate.

- In any case, students on craft courses or apprenticeships tend to be younger than engineers at higher level and for this reason, and also their limited previous educational experience, are not as well suited to the style of being an independent learner.

- In all three countries, priority is given to export competitiveness which implies a market-led approach, increased productivity and continuity of supply and efficient management. Yet there is a universal need and great demand for the management skills required to bring about the competitiveness: entrepreneurship, quality and quality assurance, communications, engineering management training, project management etc.

- Each country expressed an interest in management, information technology, environmental issues (especially the Czech Republic) and improving production.

Distance learning

- There is an awareness of distance learning in all three countries, more so in Sri Lanka and Zimbabwe than in the Czech Republic where the concept is often erroneously equated with the old Communist correspondence courses. In each case however there would need to be a programme to raise awareness of modern distance learning focusing on the philosophy, its participatory nature and benefits, and the use of modern educational technology.

- In all three countries, open universities/institutions are high on the agenda. In Sri Lanka the Open University has been established for 14 years, in the Czech Republic a national Centre for Distance Learning is to be established in January 1995, in Zimbabwe a Presidential Commission is currently producing a report on how and when an Open University

should be established.

- In all three countries, students would require training and briefing in distance learning methods and study skills.

- In view of the traditional conservatism of most established universities, it is likely that they would not welcome the introduction of distance learning (as happened in the UK when the Open University was established) and it would be some time before they would lend their support. This would be particularly true in the case of the Czech Republic.

- In all three countries there is a need to train both the producers and developers of distance education materials as well as the tutors and administrators who support the delivery of the programmes.

Effectiveness and cost-effectiveness

- In the three cases, it would almost certainly be more cost-effective to buy in existing distance learning courses rather than to develop new courses *ab initio*. These would need to be modified and tailored to suit local demand with the external organisation, working closely with an in-country partner. Translation might be required in the case of Sri Lanka and the Czech Republic.

- In all three countries, there are networks which could profitably and cost-effectively be used to help support the infrastructure necessary for any successful distance learning course. Student support would be fundamental and where possible there should be a local tutor to help the students and to discourage drop-out.

- Moreover, the networks often provide existing facilities which could be used for the practical instruction.

- The establishment of a programme of distance learning in a country for the first time would need to take account of the availability, reliability and useability of the appropriate media of transmission.

- Practically based subjects such as engineering can be taught effectively by distance learning if the practical issues are taught locally in suitable facilities. To that end, the curriculum should be carefully analysed and

the medium of delivery utilised accordingly. This will reduce the time spent on the practical aspects of an engineering course with consequent cost-advantages and more effective utilisation of plant and facilities, thus allowing greater numbers of students to be trained.

- The use of modern technologies such as video and satellite broadcasting as a medium of delivery could very effectively allow large numbers of students to be instructed in practical techniques.

- Any distance learning programme should be priced realistically in accordance with the means of the local population.

11.3. Similarities between Sri Lanka and Zimbabwe

In economic terms there are some striking similarities between these two countries: the GDP per capita is virtually the same, and a good growth rate is predicted for both economies. Unemployment is high in both countries, especially in Zimbabwe.

As a result of the urgent unemployment problems in Sri Lanka and Zimbabwe, there is the fundamental question of whether people will be educated for the sake of being educated or whether they will be educated with a view to employment. Neither government seems to have successfully addressed this question.

- Both countries need to establish links between industry and academia and to provide courses tailored to the needs of potential employers, targeting the training and making it more relevant to industry and of higher quality. A degree or training in industrial engineering by distance learning might well initiate productive links.

- In both instances, the problem of high unemployment amongst women needs to be addressed. Distance education may well be a way of reaching this group.

- Both countries need to focus on manufacturing and maintenance engineering and there is a need for more mechanical engineers. There is an acknowledged lack of skilled manpower including managerial skills in this sector in both Sri Lanka and Zimbabwe.

- Technical education has been neglected in both countries.

- The need for training in both countries lies primarily at the technician level.

- There is a severe shortage of competent teachers at many levels; the teacher training colleges are not producing sufficient numbers of effective teachers. In Zimbabwe, the situation is exacerbated by the poor conditions of employment which cause teachers to seek work elsewhere. As the ZINTEC programme in Zimbabwe has shown however, distance learning can be used effectively in the training of teachers.

- The distances and poorer infrastructures in these two countries imply a greater need for distance education than in the Czech Republic. This form of learning would enable those living in rural areas to receive some form of further education.

- The current system of distance education appears to be more formalised in Sri Lanka than in Zimbabwe, but there is scope for improvement and Sri Lanka, like Zimbabwe, needs stronger regional centres.

- Distance learning is well known as a concept in both countries and is acknowledged as a potentially useful form of training. There is much less need to raise the image of distance learning than in the Czech Republic, but there would have to be efficient and maintained networks in both countries, and training would have to be adapted to suit local conditions and to meet community needs.

- In both countries there is a need for training in engineering at a postgraduate level.

- There is a need for training in electronics in both countries.

11.4. Czech republic - Special points

The Czech Republic is very different from the other two nations in that it is not a developing country and economically and educationally has a very different background. It does not need any help with technical engineering matters except those to which it has had little if any exposure over the last 40 years: IT, software engineering, environmental engineering etc.

It does however have greater needs with regard to retraining and updating in order to

bring its engineers up to date with modern technology.

Environmental issues are important for all three countries, but especially so in the Czech Republic as it is literally a question of the health of the nation - and its wealth, in view of the importance which these issues have acquired in the privatisation process. Training in environmental matters is therefore much higher up the agenda than in the other two countries.

The Republic is also different in that the whole of Czech society is undergoing an attitudinal change. The effects of the transition to a market economy and a consumer society are likely to be far-reaching in the Czech Republic, since for decades it has had no exposure to Western concepts such as customer service. Management skills are therefore crucial. It is likely that these would be applied quicker and more effectively than in the other two countries as the Czechs are keen to catch up quickly with their European neighbours and have set themselves the goal of entry into the KU.

It would not be easy to introduce distance learning into the country because of the inherent suspicion of anything that might vaguely resemble the Soviet correspondence system of education. Considerable work would be needed to raise the profile and image of modern distance learning. There is, however, a strong interest in modern educational technology which would help.

Whilst the interest in distance learning may not be very high at the moment, it may well increase dramatically in the Czech Republic in the relatively near future, implying that programmes should be set in train sooner rather than later. Other European nations (notably France and Germany) are presently working to develop distance learning in the Czech Republic.

It is beyond the scope of the current study to speculate upon the potential transferability and applicability of the training which the Republic seems to require most. However, there are strong indications that the conclusions of this report would apply to many other Central and Eastern European nations.

11.5. Sri Lanka - Special points

Sri Lanka is distinctive in that it has an existing Open University and therefore established distance learning systems. However, there is considerable scope for improvement in several areas, such as course production and presentation and student support, especially in ways to reduce the high level of drop-out. The system needs to be improved to attract and to keep the students if it is to maintain credibility. The country does suffer in particular from non-communication between its training institutions and

this could prove to be a barrier to the establishment of an effective distance learning network.

11.6. Zimbabwe - Special points

Zimbabwe has a serious problem with AIDS. There is going to be a huge demand for training simply to replace those lost to the workforce with middle management suffering most. There will also probably be a need for more teachers to be trained as the disease is also affecting that group. Distance learning could well be a timely solution to this impending training problem. Zimbabwe may well turn to UNISA where possible for its needs in this area, but will probably have to look elsewhere for programmes in engineering.

Zimbabwe is also differentiated because of the recurrent droughts which affect it. Management of water in all forms therefore has a much higher profile than in the other two countries and specific training is required in that area and in agriculture. Horticulture is a promising area of development and also might result in a higher rate of employment for women.

The Zimbabwean Government is constrained by the tight monetary policy within which it is working as a result of ESAP. This has specific implications for educational policies.

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Distance education in engineering for developing countries - Education Research Paper No. 13, 1995, 102 p.

The Czech republic: A country report

Report on visit to Brno 7 - 9 September and Prague 26 September - 1 October 1994

1.0 BACKGROUND INFORMATION

1.1 Population

The Czech Republic is a small country of 78.8 thousand sq. km. with a fairly equal population distribution amongst the regions. Its population stood at 10.3 million on 31 December 1993 with a low population growth rate (the average annual rate between 1950-1990 was 0.6%).

Composition of the population: 95% Czech, circa 3% Slovak, 0.5% Polish, 0.4% German.

Major cities: Prague (1.3 million), Brno (400,000), Ostrava (330,000) Pilsen (1 75,000).

The Czech Republic is primarily industrial. In 1990, circa 10% of the working population were employed in the agricultural sector, 46% in industry and 44% in the tertiary sphere.

1.2 Political stability

The Czech Republic is governed by a centre-right coalition government centred around the Civic Democratic party headed by Václav Klaus, the current Prime Minister. He is very much in control of the Parliament and the opposition parties are not posing any strong challenge. It looks very much as if the government will remain in power for the

foreseeable future.

2.0 ECONOMIC BACKGROUND

2.1 Economic stability

In the eyes of many, the Czech Republic, Hungary and Poland are becoming Europe's version of the so-called 'tiger economies' of Asia. The Czech Republic stands out among the Central and Eastern European countries for its political stability, low inflation (the 12 month inflation rate in March 1994 was 9.4%) and low unemployment (3.4% in April 1994). The Czechs have the region's fastest falling inflation and have been running a balanced budget for several years. Prague currently stands 16th on the Financial Times' ladder of European cities with favourable business opportunities due to its stability and its population who are perceived as hard-working, educated, skilled and capable of manufacturing high quality products for considerably lower wages than those of their Austrian and German neighbours. (2) One informant did however point out that in his company the labour costs per unit product were higher in the Czech Republic than in the UK due to low productivity: the wages are one third of those in the UK, but productivity is only 10% in comparison. The company's solution is to move towards performance-linked wages.

The budget balance stands at 0.1% of GDP while the foreign exchange reserves have almost trebled The government aims to make the crown (koruna) the region's first fully convertible currency. (3)

The Czech Republic is seen as adapting well to Western economies and within the region as constituting the smallest risk for investors. The top foreign investors are in order of importance: Germany, the US, France. The main areas for foreign investment are:

1. Transport
2. Construction
3. Food
4. Banking (4)

British investment in the Czech economy is as yet relatively low. Interest in investment in the near future has however been expressed by such companies as Midland Electric, British Steel and British Gas. (1)

The Bankruptcy Law was introduced in April 1993. It is expected in the long term that significant re-structuring of the old state-owned industrial sector will follow as a result. It is also likely that this law will cause unemployment to grow.

2.2 Gross domestic product

In 1993 the nominal GDP was estimated at U5$9.5 billion with a real growth rate of -0.3%. The OECD projection of GDP growth for 1994 is 2%. In January/February 1994 the growth rate in the main industrial areas was:

- Industrial output: 23.5% (down by nearly 10% from 1993)
- Construction output: 16.3% (down by nearly 12% from 1993)
- Retail trade: -30.2% (down by over 34% from 1993) (2)

The largest industrial sector is manufacturing and services to industry worth 473 billion kcs (£11 billion) and contributing 50% to GDP. Energy contributes 20% and agriculture less than 10%.

2.3 Exports

Before 1989 the market for Czech products was primarily the former Soviet Union. Czech exports shifted west in 1992 - shipments to the former USSR dropped by 50% and those to other Eastern European countries fell by 26%. At the same time, the OECD share of Czech exports rose by 10% to 47%, while Western Europe took a 52% share of the exports in the first three quarters of 1993. (3)

2.4 Privatisation

Much of the fall in industrial output can be attributed to the upheavals the country has undergone in the five years since the Velvet Revolution, including the separation on 1 January 1993 from the Slovak Republic, and to the changes in the export market.

An extensive and highly successful scheme of privatisation has been carried out via the sale of vouchers to the public, and the private sector constituted 52.1 % of GDP in the last quarter of 1993. The goal is to privatise 90% of the country's assets by 1994. (5) The majority of all registered companies are classified as medium-sized businesses, while the giant monopoly enterprises account for only 2.4% (November 1993).

The big companies are now struggling to survive, while the SMEs are generally doing well and are helping to hold the Czech economy in shape, although they also are fighting for their lives, but in a different way.

3.0 MAJOR INDUSTRIAL SECTORS

Prior to World War II, Czechoslovakia ranked amongst the most wealthy and prosperous countries in Europe. Many Czechs appear confident that they will regain this position relatively quickly. The current priorities are to reinforce market mechanisms, to enhance the private sector, thereby strengthening its role in the economy, and to cement relations with the West. The goal is to qualify for membership of the EU in the near future. (2)

The transformation to a market economy is not easy. In some companies, production has been reduced by over 60% with staff being laid off. This has coincided with a boom in small private organisations which have taken on those made redundant. Companies are now seeking to raise their productivity, having solved the immediate problems of balancing their costs and income from sales.

3.1 Engineering

Czech engineering has been respected internationally for years. Names like Tatra, Skoda Plzen and Vitkovice are known all over the world, and Czech engineers and technicians can hold their own with the best in the world in terms of quality and skill. Engineering is-the most important sector of Czech industry even though it is currently beset with problems: sales have plummeted since the collapse of the majority of their erstwhile markets (6) and the sector requires massive restructuring to enable it to compete with modern economies. All Czech engineering companies will be privatised.

The industry consists of heavy engineering, transport engineering, high current electrical engineering, electronics and electrotechnology, chemicals, pharmaceuticals, construction and light industry such as textiles, leather and footwear and glass and ceramics. (6) Weapons are still manufactured for the arms industry, but these tend to be light weapons, unlike in the Slovak Republic which produces heavy weaponry such as tanks.

The heavy engineering sector produces systems for power engineering and metallurgical plants, and heavy machinery for mining, transport and construction. (6)

Transport engineering has received heavy investment from abroad in recent years, most notably the Skoda Automotive Works in Mlada Boleslav which is now 49% owned by VW, a share which will be increased to 70%. Other foreign investors are Knorr-Bremse in Ateso (manufacturers of air brakes) and Ford in Autopal (a components manufacturer). (6)

Production in high current electrical engineering is concentrated in areas such as cables and conductors, electric motors, electrical devices, switchboards and the installation of electrical engineering systems. The companies are competitive in the field due to their

track record, low labour costs and skilled work force. (6)

In 1991, the major fields in electronics production were (in order of importance): automation and computer technologies, electronic components, electronic consumer goods, telecommunications and radio communications. The industry has the technological and manufacturing capacity to produce hardware and systems for telecommunications, electricity, environmental protection applications and medical applications. (6)

The main priorities for the chemical sector include modernising plants and reorienting the sector towards R&D, increasing the processing of crude oil, expanding the plastics industry and improving its quality and working on an environmental construction programme.

The Czech pharmaceutical industry is currently struggling with outdated machinery and technology, low automisation, high energy consumption, little experience in marketing and quality control and difficulties in dealing with ecologically harmful production waste.

The construction industry has undergone major restructuring since 1990, when market-oriented reforms were introduced. Two thirds of the industry were privatised in 1992 and construction started to recover. The construction of small buildings, renovation, modernisation and finishing work are now the main activities of the industry. (6)

3.2 Energy

The Czech Republic is known for the low grade brown coal which it burns in huge quantities and at great cost to the environment due to its high sulphur content. The coal industry is gradually declining, however. Gas is viewed as the energy of the future. The Czech power gas distribution network is also being privatised. (7)

There is a nuclear industry, but its future is uncertain in view of environmental considerations.

3.3 Tourism

This is now a major contributor to the economy and is rapidly expanding. In 1993, over 71 million tourists visited the Czech Republic, spending US$1.4 billion. In August 1994 alone, 13 million visited the country, a 34% increase on August 1993.

3.4 Telecommunications

Most of the Czech telecommunications network is in the hands of the state-owned monopoly SPT Telecom. It is antiquated and overloaded: the national average of phones is 19 per 100 people. This ratio is much higher in Prague, but falls to 8 per 100 in the northern town of Liberec. The average waiting time for a phone is 2.7 years although some people have waited considerably longer. Private companies are now challenging the monopoly of Telecom. (8)

It is anticipated that by the year 2000 there will be a 35-40% increase in subscribers lines with 75% of the network digitised, 70,000 data stations, 170,000 public radio phone stations and 165,000 fax subscribers. (5)

3.5 Communications Infrastructure

The postal system operates efficiently in the Czech Republic and many people now have access to fax machines. Radios, televisions and videos are widespread and the use of computers has grown enormously in recent years with increasing numbers of Czechs becoming computer literate. E-mail is also growing significantly in usage.

4.0 ENVIRONMENT

Environmental problems have now caught up with all of the so-called Visegrád countries (the Czech and Slovak Republics, Hungary and Poland), but the Czech Republic is the most severely polluted country of the region due to 40 years of industrialisation and lax emission controls in addition to contamination from neighbouring countries (Germany and Poland). The worst areas in the country are northern Bohemia, Moravia and Prague. Awareness and education in the environmental field are growing, but the problems are still huge. Environmentally, the country is said to be 20-30 years behind the UK.

4.1 The danger to health

Pollution is one of the main reasons for low life expectancy in the Republic. This is not limited to air pollution. Fertilisers, often below world environmental protection standards, have entered the water supply and food chain, endangering the health of Czech citizens, particularly due to the increase of carcinogens in food. The Republic had the highest number of deaths from cancer among 150 member states of the UN in 1988. (6)

4.2 Pollution

The primary sources of pollution are power plants, chemical factories, surface mines

and heating plants. The major air pollutant is sulphur dioxide; combustion processes causing 93% of the emissions. (9) There is no desulphurisation equipment in common use (October 1993) and as much as 70% of the forests has been affected by acid rain. As ever, the problem is one of old technology and out-of-date equipment.

The systems for processing drinking water are seen as totally inadequate for several of the major cities including Prague, while the land has suffered due to agricultural and forestry activities and contamination. (9)

There are problems with hazardous and toxic waste: approximately 1,400 unauthorised dumping sites have been located in the Republic. (9) Moreover, the EIU Business Report (4th quarter 1993) states that according to local statistics, about 80% of the toxic waste generated by Czech industry has not been stored safely. (6)

There are now problems surrounding the disposal of nuclear waste which in the past was shipped to the former USSR. (9)

4.3 The Government's approach

The government is now making attempts to address the problem through new laws on environmental protection and is subsidising certain clean up projects such as the renovation of old water mains and the conversion of residential heating from coal to non-polluting fuels. (10) There are reputedly disputes between the Minister for the Environment, Frantisek Benda, and the Prime Minister, Vacláv Klaus, over environmental controls. (7) Benda wants more governmental involvement in the environment, whereas Klaus takes the view that it should be more a matter for individual rather than governmental concern. Many individuals are more concerned, however, with the survival of their businesses than with the environment.

4.4 The effect on foreign investment

In 1992, the OECD and the World Bank carried out a survey of 1,000 of the largest Western manufacturing, mining and construction companies operating in the Visegrád countries. The survey found that environmental liability was of greater concern to investors than political stability or infrastructure problems. (2) As a result, the cost of cleaning up an enterprise is generally deducted from the purchase price. It has also been estimated that if indemnities absolving foreign investors from liability for past pollution were stopped, it could in effect halt the privatisation of large enterprises. (2) Determining the scale of environmental damage and the responsibility for cleaning up is therefore a central topic in privatisation

4.5 Need for environmental training

Generally, there is a need for the Visegrád countries to build their domestic environmental engineering and business sectors, concentrating on the management, financial and marketing skills needed to fulfil the environmental objectives of the region in a cost-effective manner. (2)

The need for training in this field is acute and urgent in view of the scale of the problems. For example, everyone who wants to work in Environmental Impact Assessment in the Czech Republic must be issued with a licence by the Czech Ministry of the Environment. The examination for the licence is difficult and applicants need appropriate training.

5.0 MANAGEMENT

There is obviously a lack of top managers used to Western methods in the Czech Republic. However, this situation is now changing: Czechs are beginning to take over the jobs initially done by outsiders, and the need for foreign advisors and consultants is decreasing. The majority of Czech managers have studied at the Czech Technical University in Prague or at the University of Economics, and the skills which they now most need are in sales, finance and marketing. The greatest need is at the level of middle management. (11)

Many private organisations now offer managerial training and several institutions offer MBAs including Sheffield University which offers an MBA, financed by the 'Know How' Fund, on a part-time basis through the Masaryk Institute of Advanced Studies, part of the Czech Technical University. The managers pay circa £2,150 for a three year part time course.

6.0 THE EDUCATION SYSTEM

The Czech education system has undergone considerable changes this century. All the Czech higher education institutes were closed during World War II, and following this, higher education fell under the control of the Communist state authorities in the years 1949-1989. Research and teaching/learning activities were based on Marxist-Leninist ideology and directive methods of control were used.

The Czechs have a long tradition of education of a very high standard and have always placed a high value on education. One informant commented on their intellectual curiosity, on the fact that they needed to learn.

6.1 Secondary education

Secondary schools are divided into:

- **Gymnasia**, where students receive a general education which prepares them for university

- **Specialised secondary schools and conservatories**. The specialised secondary schools prepare secondary level specialists such as technicians, nurses etc. The schools are divided into technical schools (specialised again into engineering, construction, power engineering etc.) and schools for economists, librarians, etc.

- **Secondary vocational schools**, which are practically oriented and prepare the students for an occupation. For occupations such as power engineering, there is a four year curriculum after which the students can apply for university. Studies at these schools are completed with an apprentice exam (and for four year graduates a matriculation final exam) (12)

6.2 Vocational training schools

The training of craftsmen and apprentices is both very good and very formal in the Czech Republic and, in the view of one of the informants, the basic workforce is better trained than in the UK.

As of September 1993 there were 727 vocational schools in the Czech Republic. Many of these run sandwich-type schemes in which apprentices work in companies for a specified number of days per week. The numbers of those completing a practically-oriented three year training including apprenticeship is far greater than those completing a more theoretical four or five year course which would then enable them to apply for a technical university: 224,000 as opposed to 30,000. These numbers compared to the numbers of students at university or tertiary level indicate a very high rate of participation at the apprentice level, but a corresponding low rate at the tertiary level. (13)

The apprenticeship scheme is currently experiencing difficulties as employers involved in the programmes are not paying the vocational schools for their services. There are also problems for the employers in that the students are not now obliged to work for them on completion of their training and may accept a better offer elsewhere. (11)

The Confederation of Industry completed a survey in 1994 of 1,200 of their members which indicated that 72% of the respondents employed apprentice graduates, but that

only 53% considered that they ought to be responsible for vocational training. 50% were prepared to contribute financially to the training of apprentices, but only 24% would fully cover the costs of in-company apprentice training.

As companies respond to the pressures of the market economy, they are reviewing the number of apprentices they need. Skoda-VW has, for instance, reduced the number it employs by 55% in four years, while production of cars is planned to rise (without the introduction of automation) by 75% in the next two years.

There is a gap in education between secondary school and university which does create problems in that people come out of school at different levels and with different skills. Training to fill this gap would be useful.

7.0 HIGHER EDUCATION

The number of students in higher education increased during the 40 year period of Communist rule, although it remained substantially lower than in other comparable European countries. But the development of higher education did not match the demands of society, especially during the 1980s. A new Higher Education Act was introduced in May 1990 designed to address some of the problems. It focuses on the self-governing of higher education institutions and restricts the control of the state over them.

Charles University, one of the oldest in Europe, and the Czech Technical University in Prague are amongst the best universities in Central Europe. These two certainly have the academic standing and reputation to deal with validation and accreditation of courses, although many Czechs still see the cachet of a foreign degree as an advantage. There are consultancies and entrepreneurs in Prague offering courses in aspects of management by distance learning, but these cannot be validated, however good they might be, as the organisations are too lightweight academically. Course accreditation by a *credible* institution is very important to the Czechs, although the process of accreditation is really only just beginning. Professional institutes in engineering did not properly exist in the Communist era as they would have been perceived as a threat to the system.

7.1 Composition of higher education

The Czech Republic has 23 higher education institutions consisting of:

- eight multidisciplinary universities
- four technical universities
- one veterinary university

- one economic university
- two universities of chemical technology
- two universities of agriculture and forestry
- one higher school of education
- four academies of art.

The majority of these institutions are located in Prague and Brno. (14)

Between them, these higher education institutions have 27 faculties of engineering. The number of overall faculties in the institutions grew by 20% between 1990 and 1993 as the system adapted in an attempt to accommodate demand. (14)

Higher education is organised either as full-time or part-time study, although part-time is seen as a second class form of study, and the number of students studying in this way is considerably smaller. Of the total student body of 109,500 (September 1993), just over 14,000 were studying while still at work.

Level of study amongst the total student body:

• three year bachelor degree	13,500
• four to five year 'magister' or 'engineer' degree	94,300 (Masters equivalent)
• postgraduate doctoral degrees	1,600 (13)

7.2 Student demand

In the 1970s and 1980s, there were considerably fewer students enrolled for the natural sciences and the humanities in comparison with the majority of advanced industrialised countries, while almost 50% of all students studied engineering or agriculture. (14)

Since 1989, this trend has been reversed: those studying engineering have fallen from 38.5% to 32.3% (1992), while the field of humanities, theology, social sciences and law has increased by nearly 80% to 16.2% of all students. (14)

The percentage of female students is circa 45% of the total. Only about 16% of the 18-23 year old population are in higher education as compared with 25-30% in West European countries. (15)

A major problem in the Czech system is that the universities have a system of 'numerus clausus' which limits the number of students who can be accepted. This means that each

year there are large numbers of qualified students who simply cannot get a place. This year, for example, Charles University had 32,000 applicants but could only accept 6,200.

7.3 Engineering education

It is widely acknowledged that the Czech engineers are trained to exceptionally high standards technically. They are especially good in the following areas:

- mechanical civil
- structural
- mining
- systems and control

Currently they tend to lack skills in areas of rapid change such as: electrical engineering, telecommunications, manufacturing and production and information technology. It is in these areas where there is the greatest need and opportunity for updating.

To be granted the academic degree of engineer ('Ing'), students must study for five (maximum six) years at institutions offering technical, economic or agricultural subjects. (14)

7.4 The cost of study

Until 1993, study of higher education was free in the Czech Republic. Students were awarded scholarships of different amounts depending on their achievements and also their social conditions.' (12) The-government now plans to introduce fees for higher education under a new law which would supersede that of 1990. The fees would be implemented in 1995 1996 and would be about one seventh of the average annual income. The government expects that around 75% of students would postpone payment. (16) Many university leaders and academics are opposed to the scheme. (11)

Under the same law, the government also plans to create a national system of vocational higher education and to allow private universities. The new system would provide people with a practical vocational training to bachelor level in three years. (16)

The cost to the state of an engineering student is 37,000 kcs per annum (*circa* £880) while, due to the use of small group teaching, an arts student costs 100,000 kcs per annum (circa £2,380).

7.5 Changes in students' attitude

Engineering was the most popular area for study under the Communists. There has now been a reaction with students much keener to study new areas such as law, economics and the humanities. There has been a drop in applicants for such subjects as electrical engineering and especially mechanical engineering, and as a result it is now much easier to get a place in one of the technical universities than, for example, in Charles University. There has also been a large decrease in the number of women engineers.

However, there is unlikely to be a shortage of trained engineers in the short term. The Czech Republic still has a large number of engineers in the working population and it still produces significant numbers; for example it produces 10 times as many electrical engineers as Holland and in the Czech Technical University in Prague (CVUT) civil engineering still remains the faculty with the largest intake.

Students are now interested in combinations of courses, such as information technology combined with environmental studies. There is also a substantial demand for new subject areas such as biomedical engineering, cybernetics, laser technology, environmental engineering and software engineering. The universities are responding to a certain extent: the CVUT, for example, has started environmental management and would like to extend it to a full curriculum.

8.0 CONTINUING EDUCATION

8.1 Re-qualification

The system for re-training does not work well on a national level in the Czech Republic. Three Ministries are responsible for various aspects of training (those of Economy, Education, and Labour and Social Affairs) and have a joint committee which controls the progress of retraining, but they have no influence on its implementation and receive no feedback.

The whole concept of retraining is new in the Czech Republic but is something that the people are coming to terms with as they face up to the idea that they will not necessarily have a job for life. The CVUT, for example, offers one week re-qualification courses which are very popular.

8.2 Updating

Updating is taking on an increasingly higher profile in the Republic. For example, by 1996 every civil servant will undertake compulsory Continuing Professional Development (CPD).

The view within the Ministry of Education is that there is a need for CPD and that distance learning could be useful for the retraining of engineers.

Some faculties in Charles University provide short courses for industry. The CVUT used to run postgraduate courses of one or two years funded by the state-owned companies. Overall, however, there is little provision for updating unless it is offered within individual companies.

8.3 Potential areas for training

Given the changes to the political and economic system, the Czechs require training in areas to which they have not been exposed over the last 40 years: management (at all levels and virtually of all types including project management), economics, especially finance and accounting, business administration, marketing, sales, computing and information technology, educational technology, environmental issues and foreign languages (not Russian!). Generally, there is a need for professional reorientation towards the market and towards customer needs. This includes areas such as quality, the ethics of the market economy and customer service, all of which are new concepts to the Czechs. Since the accident rate in the Czech Republic is 10 times that of the UK, training is long overdue in the area of health and safety. There is also a need for training in more specific areas such as construction management, although the owners of the companies are reputedly not convinced of this.

We were told on several occasions that Czech managers are not good at communication either between departments or between themselves and their workers. As a result there is no flow of information between those who, for example, write a specification and those that put it into practice. Quality is therefore lacking, and communications is another area in need of training.

While there is a pressing need for training in management techniques, particularly at the level of middle management, it was also pointed out to us that everyone was keen to teach management techniques to the Czechs! There are a large number of western training organisations and educational institutions currently seeking markets in the Republic.

Some of the areas where there are the most pressing needs include:

- the retraining of teaching and academic staff

- the development of programmes for large industries and service organisations for example, courses in entrepreneurship, marketing,

production, advanced technology,

- engineering the development of programmes for adults to improve their current educational qualifications (17)

There may also be a demand for training by distance learning for employees of SMEs who cannot be released for training by traditional methods.

9.0 DISTANCE LEARNING IN THE CZECH REPUBLIC

Interest in continuing vocational education in the Czech Republic is increasing and people are becoming more aware of the relationship between knowledge and salary. As a result, the prospect of distance learning is more palatable than it might have been hitherto, as people begin to acknowledge the role which it can play in furthering their education.

9.1 Awareness of distance education

The Czechs are familiar with distance learning as correspondence courses (the 'consultation model') were widely used under the Communists. The programmes were print-based with no specially designed materials and little if any student support and were accompanied by face-to-face consultations at the university or at a consultation centre. The quality of these programmes is disputed and even though the success rates were high and the students enjoyed substantial advantages (paid days off work and subsidised transportation costs), the use of the so-called consultation model started to decline in the 1970s as numbers began to fall. (17)

This model of distance education is discredited, in part because of doubts about its quality and also because it has been identified with the politics and economics of the Communist period. (17) Only those who conformed politically could study under the scheme. As a result there is fairly widespread scepticism in the Czech Republic about the value of distance education, and there is very little knowledge about the way in which distance education has developed outside the former Soviet bloc. Moreover, some private companies have started distance learning correspondence courses in which the quality is variable.

There is therefore a reticence to embrace this form of education, although it could help alleviate the pressures on the educational system and could help to meet the education and training needs which are linked with the transition to a market economy and democracy.

Care has to be taken when discussing distance learning in the Czech Republic as there

is confusion between the old type of correspondence courses and the new style of distance learning: not everyone makes a distinction between the two. Some faculties, for example, describe evening classes as courses in distance learning. We were told that very few people (only perhaps 10%) would be familiar with modern distance learning.

9.2 Existing networks and providers of distance education

There are a certain number of networks which already exist in the Czech Republic and which could be used to deliver distance learning programmes. There is, for example, CADUV (the Czech Association of Distance Teaching Universities) which has 29 members throughout the country. This is a new organisation in which all of the members have a common interest in distance learning, and to date they have compiled a list of the courses available by distance learning in the Czech Republic.

In addition there is the Jan Amos Comenius Academy (formerly the Socialist Academy). Previously this offered correspondence courses in which the content was heavily influenced by Communist ideology. The Academy now offers non-graduate distance education to adults who have graduated from either secondary or higher education. There are evening courses in such subjects as business and languages (primarily English and German), but the Academy is now preparing a management course by distance learning targeted at middle management, both for those in work and for those seeking managerial posts. It has links with the Mission Board in Examining in Management in England. The Academy has a network of 70 adult education centres throughout the Republic which could be used to support distance education programmes.

The following institutions, amongst others, provide distance learning packages:

- **The Faculty of Medicine, Charles University, Pilsen** (now part of the University of West Bohemia).

  This delivers distance education courses via radio broadcasts.

- **Technical University of Liberec**

  This offers five year degree distance courses in the mechanical engineering faculty in machine-engineering technology and in machine construction. New courses are being prepared in marketing, mathematics and ecology, and distance learning in the Faculty of Education is being restructured.

- **The Distance Learning Information Centre in Brno**

This is a newly developed centre which is part of the Technical University in Brno. It has close ties with the German Fernuniversität in Hagen and offers courses in German developed by the FeU. The Centre is interested in delivering well prep area distance learning courses probably developed, at least in the initial stages, outside the Czech Republic. It is currently preparing a tender for the Ministry for Social Affairs to prepare and deliver distance learning courses targeted at trainers at the local level.

- **The Faculty of Civil Engineering in the Technical University in Brno**

This is preparing diploma courses by distance learning in such areas as project management but without the backup of such elements as student support. It currently has 20 students studying in distance learning form.

- **Faculty of Philosophy in Charles University**

9.3 Governmental views of distance learning

Within the government, distance learning is currently a 'hot topic' about which the Minister for Education has requested information. At the moment it is practised in four universities: the Technical University at Brno, Masaryk University in Brno, Olomouc University and Liberec University. A Centre for Distance Learning is to be established in January 1995 in Brno, legally separate from the current Distance Learning Information Centre but closely linked to it. The Centre will be responsible for producing, modifying and translating materials and will collaborate with any interested university on the basis of agreement. Its role will also be to accredit and evaluate materials. Within the Ministry, the view is that the focus of future distance learning programmes will be in the humanities and in the managerial field.

9.4 PHARE

The main sectors for EC PHARE aid planned in 1991-1992 were: enterprise restructuring and privatisation developments of SMEs, labour marketing restructuring, the environment, energy, telecommunications and TEMPUS (the programme for the reform of Higher Education). In terms of the money allocated in 1992, the environment and nuclear safety ranked highest followed by transport and TEMPOS. Much less was earmarked for energy and telecommunications. It is acknowledged that both the public and private sectors have a very real need for training. (18)

The CEC PHARE programme recently funded a feasibility study on the development of a regional distance education network in Central and Eastern Europe. (19) The study points out that there is potentially a huge demand for distance education, as more than half of the interested and qualified applicants for a university place in some countries have to be turned away and also that there is a lack of resources in universities and colleges.

Official representatives of all PHARE countries agreed in October 1993 that a Regional Network for Distance Education should be set up in the Central and Eastern European countries. The priority would be to develop programmes directed towards vocational and professional learning needs, targeting amongst others professional groups, civil servants and those in need of retraining. Potential training areas which were identified and which are relevant to this report are: engineering, information technology and the environment. (19)

The Czech Republic has already acknowledged the potential importance of distance education: in 1991, the National Board for Distance Education was established by the Ministry of Schools and Education, with representation from the Ministry, 15 Universities and the Comenius Academy. This instigated in 1992 a large project to develop distance education focusing initially on language courses. (19)

9.5 Sources of potential impetus for distance education

The views of many of those we talked to during our visit seemed to confirm the findings of the 1992 TEMPUS feasibility study, namely that the impetus for distance education is unlikely to come from the traditional universities, but that it will probably come from new institutions, either in the private sector or recently established by the State. (19)

The universities are having to deal with urgent problems such as restructuring the curricula and lack of funds, and many university academics appear to have a somewhat negative or 'cautious' opinion of distance learning, although some do acknowledge that there are huge possibilities in certain areas. One of the objections voiced in the context of the changes in the Czech Republic is that students have to be totally immersed in a new environment if their fundamental attitudes are to be changed, and that this will not be achieved by distance learning.

In the traditional environment of the well-established universities, distance learning will not be easily accepted. For it to be accepted, it would need to focus on high demand courses and it is most likely to be successful if there is no full-time course available as an alternative.

9.6 Delivery

Given that the Czechs are generally not yet in a position to develop and deliver their own distance learning courses (there are apparently less than 20 individuals able to design open learning materials), franchising existing courses from organisations abroad is the best current solution. For the foreign institution, however, this can be very labour intensive and expensive. The Open University, for example, is concerned about the costs arising from its management diploma courses in the City University of Bratislava (CUB) in the Slovak Republic, a course which has proved extremely popular.

There was general agreement that if a distance learning course were imported and adapted for top level management there would be no need for translation into Czech. If however the course were targeted at middle or lower management, translation would be necessary.

Conclusions

The whole fabric of Czech society is undergoing dramatic changes, economically, politically, culturally and socially, and in a remarkably short time scale. For 40 years the Czech people have, by and large, been cut off from concepts such as competitiveness, company and individual productivity, responsibility and accountability in the work place, initiative at work, health and safety, customer service and care, reward based on knowledge, effort, skill and achievement, quality control, communication between workers - to name but a few. They are not going to gain a full understanding of these new concepts overnight, but there is a need for training to facilitate this process and to help bring about the necessary change in attitude.

There is little doubt that the changes will be brought about successfully and quickly: the Czechs are industrious, enterprising and keen to get on. They have embraced many of the principles of capitalism with little if any reticence and show every sign of adapting to democracy and a market economy with remarkable ease. Their focus is definitely westwards, but they do have their priorities, and these have to be borne in mind when considering what their needs might be:

- Many industries and business concerns are either fighting to survive or to get off the ground. Consequently training is not a high priority.

- The Czechs are very conscious that theirs is not a developing country, and they should not be treated as if it were.

- Many people are perhaps somewhat jaded in view of all the advisers

and consultants who have bombarded them with information about what their needs are for the last five years - they do not now need to be told this and seem rather weary of that whole process. It would appear that they need some time to absorb the information and to decide about their own requirements now that they have seen what is on offer, what they might gain by it and how it might be applied.

There is however a growing appreciation of the value of training and the returns on it, and perceived cost-effectiveness and learning effectiveness will no doubt count for a great deal when sectors, industries, organisations and business concerns make decisions regarding training.

Potential demand for distance learning

The Czech Republic certainly has the infrastructure for distance learning and there is little doubt that the people have the motivation and capacity for learning. For distance learning to be acceptable and successful however certain conditions would have to be fulfilled.

- The image of distance learning would need to be improved. The concept would have to be well marketed and presented as something new, modern and completely different from the old-style correspondence courses. The use of modern educational technology would be a useful selling tool. The support of industry and business would be useful to increase credibility.

- Distance education would have to be perceived as cost-effective, of benefit to both the individual and the employer, and worth the investment of time and money. Costs would have to be realistic for the Czech Republic.

- Any training would have to be designed, modified or adapted specifically for the needs of the Czech Republic, and if developed by a non-Czech organisation, would have to be produced in close co-operation with Czech colleagues.

- Subjects for which there is an urgent need for training and for which there is little if any current provision would have to be targeted: the environment, information technology, health and safety, telecommunications, project management, marketing etc. There would be no point in offering distance learning in traditional engineering, given the current lack of interest in the subject and the saturation of graduate

engineers in the market.

- Translation would be necessary unless the course were for top level management.

- Any course would have to be accredited by a respected institution: the name of a reputable collaborating foreign institution would be a useful selling point.

It is unlikely that there will be a demand for distance learning at the apprentice level.

There will be an optimum time to introduce distance learning programmes in order to gain the support of the established academic institutions. This will probably not happen for several years, regardless of the fact that vast numbers of qualified applicants have to be turned away from many of the universities each year and that there is a gap between education at secondary and at tertiary levels. In the meantime, attempts to introduce distance learning should be targeted at the retraining and updating areas where it is likely to be most useful and most cost-effective.

Appendix 1.1 - Organisations/institutions consulted

Engineering Companies

Higgs & Hill
ICL Czech Republic
Shell Czech Republic
Skoda Automobiles
Toptel Ltd
Bovis
British Gas, Prague

Other organisations

Association of Manufacturers and Suppliers of Engineering Techniques

Central European University, Prague

Charles University

Czech Society for Adult Education, Charles University

Czech Technical University of Prague

Embassy of the Czech Republic, London

Institute of Electrical Engineering, Academy of Sciences, Prague

Institute of Radio Engineering and Electronics, Czech Academy of Sciences

International Centre for Distance Learning, Open University, UK

International Relations Department, Ministry of the Environment of the Czech Republic

Masaryk Institute of Advanced Studies, Czech Technical University of Prague

Ministry of Education, Youth and Sport of the Czech Republic

Ministry of Industry and Trade of the Czech Republic

Open University, UK

City University of Bratislava

Department of Physics, Institute of Mining and Metallurgy, Technical University of Ostrava

Distance Teaching Service, Technical University of Liberec

Faculty of Electrical Engineering and Computer Science, Technical University of Brno

Institute of Environmental Engineering, VSB Technical University of Ostrava

Technical University of Brno

Comenius Academy, Prague

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Sri Lanka: A country report

Report on visit 17-21 October 1994

1.0 BACKGROUND

1.1 Population

Sri Lanka has a population of 17.7 million (mid 1993) growing at a rate of 1.0% per annum (compared with 1.8% in 1978). It is a largely agricultural country of 62.3 thousand sq. km. with a quarter of the population in the Western Province, the remainder being fairly equally distributed. The largest city is Colombo - population 650,000.

Composition of the population: 74.0% Sinhalese, 12.6% Sri Lankan Tamils, 5.5% Indian Tamils, 7.1 % Moors.

A very high proportion of the population (>50%) live in poverty, yet there is an impressive literacy rate of 88.6% (of people aged five years and above), one of the highest in Asia.

1.2 Political stability

Sri Lanka is a parliamentary democracy with an elected executive President. There are 225 members of parliament elected by a complicated proportional voting system. The general population of Sri Lanka is an extraordinarily politically aware community.

The present Prime Minister Mrs Chandrika Bandaranaike Kumaratunga, Peoples Alliance Party, was elected in July 1994. Her family has formed a political dynasty in Sri Lanka.

The visit coincided with the run-up to the Presidential Elections on 9 November in which the Prime Minister is a candidate from one of the five political parties. (1) She is a clear favourite, committed to ending the on-going ethnic war, eradicating communalism and building a unified country. She is also proposing the abolition of the Executive Presidency. (nb. November 7 saw a resounding victory for Mrs Kumaratunga. The winning margin was by far the biggest there has ever been in a Presidential election and she became Sri Lanka's first woman president).

To call Sri Lanka politics turbulent would be an understatement. The general atmosphere is extremely tense and during the visit the opposition leader and UNP presidential candidate Mr Gamini Disanayake was assassinated in a bombing which also killed over 50 people. (2)

2.0 ECONOMIC BACKGROUND

Sri Lanka is a small, poor, but rapidly growing country with an impressive record of meeting the basic needs of its population. The base of its industry is agriculture. 1993 GNP per head was US$510, placing it near the top of the World Bank's 'low income' category. According to a Central Bank survey, the Sri Lankan economy demonstrated a 'robust' performance in 1993. (3)

2.1 Gross national product

In 1992 GNP stood at US$9.6 billion with a real growth rate of 6.9% in 1993 compared to an average of 4-5% over the previous years. (3)

2.2 Unemployment

Over the last ten years unemployment has risen steeply. Presently, there are over one million unemployed (16% of the labour force). Furthermore, the better the level of qualifications obtained the higher the rate of unemployment. Beyond graduate levels, unemployment rates fall again. Girls enjoy equal participation in education as boys, but female unemployment is 2-3 times higher in those groups with qualifications from lower and upper secondary education. (3,4)

As elsewhere in the Third World underemployment is also a major problem. Job-sharing and consequent inefficiency is rife. Arguably, engrained attitudes over job-sharing are more difficult to change and have a greater impact upon the economy.

2.3 The 1994 budget

Despite a warning about the continuous costs of the war in the North and East, the 1994 Budget was optimistic [5]. The emphasis was on the promotion of savings and investment, the control of public expenditure and an export-led growth. It was well received by business although with scepticism, especially from workers' organisations about the control of inflation.

3.0 MANOR INDUSTRIAL SECTORS

Traditionally, agriculture dominated the economy and in 1992 contributed 21% of GDP whilst employing 45% of the labour force. It is however now declining in percentage terms against significant growth in the manufacturing and service sectors. The service sector now accounts for 51% of GDP and a third of employment. Industry provides almost 30% of GDP manufacturing 18.5%, construction 6.9%, mining 2.3% and around a quarter of the employment. [3]

3.1 Agriculture

In this sector, favourable weather conditions in 1993, alongside new commercial management arrangements, resulted in increased yields in the major crops, tea, rice and rubber, as well as in most of the subsidiary crops. Rice is the largest crop in terms of production value, following equally by tea and coconut, with rubber production fourth. Minor crops include maize, chillies, cocoa, cinnamon, pepper and other spices. Paddy fields in Sri Lanka are higher per hectare than other Asian countries.

3.2 Manufacturing

Production in 1993 was reported to have increased by 9% with significant improvements in chemicals, petroleum, rubber, plastics, non-metallic minerals, paper, textiles, garments and leather goods. Manufactured products now account for nearly 75% of the country's export earnings. [5] These are primarily garments.

3.3 Garments

The industry expanded rapidly two years ago with the creation of 200 new factories each with 500 employees. There are now 300,000 directly employed in the garment industry, totally in the private sector, contributing 40% of total exports. Much of the machinery being used is second-hand and cheap imports mainly from India are making life difficult. Also, the present quota system for production will not last forever and the future for the industry is unclear. What is clear is the total social upheaval that would occur were the industry to collapse.

There is presently a severe shortage of skilled workers including those with managerial

skills, a problem which is being addressed by the University of Moratuwa, albeit within limited resources.

3.4 Tourism

The political situation has had a negative effect on tourism. Nevertheless, it is still a key sector, still the second largest foreign exchange earner and currently employing 67,000 people. A boom is predicted if the civil war were to end. (5)

4.0 EDUCATION

Education is free in Sri Lanka - from primary level through University. The sole exceptions being a few private institutions and the Open University.

The state provides school places to almost the whole population at primary level and there are widely available places at lower and upper secondary levels. Education is compulsory up to lower secondary level and is taught in the pupils' home language - Sinhalese and/or Tamil (6).

The view of education as a fundamental right of everyone is very strongly held in Sri Lanka (7). This is both a demonstration of the high value which educational qualifications carry in the society and, at the same time, an attitude which constrains reform.

Education is the sole means of job access and mobility for most of the population and so important is it viewed that even students in the age range 16-20 who complete their study without passing O or A Level examinations are considered drop-outs. Nevertheless, even though education is so highly prized, employers complain of a negative work ethic amongst students and of inappropriate skills.

The constraints to reform mean that the opportunities to redirect resources may be difficult to achieve in practice (7).

The major educational problem facing Sri Lanka at the present time is the reconciliation of the high demand for education with the need for relevantly trained personnel.

The country has outstandingly high levels of literacy and school participation and some excellent educational establishments. However, there are high levels of unemployment, and furthermore unemployment levels increase with increased levels of education, only reducing again at post-graduate levels (3). Yet employers frequently cannot recruit staff with appropriate skills.

'The existence of substantial numbers of unemployed with high educational qualifications is not a reason to cut back the capacity of the education system, but rather to improve the quality, relevance and content of education and training; if the economy is to develop it will need more rather than fewer well-educated people.[7]

Demographic trends, notably a reduction in the size of the primary school age group, provides the opportunity to reallocate limited funds into other sectors, specifically vocational training. Resources could also be released through increased efficiency and more cost-effective provision, for instance using distance education methods.

'The country needs education and training strategies that will provide for the needs of a modern democracy with a tradition of high standards of social care, for a development effort oriented towards export-processing and tourism, for the needs of the overseas employment market, and for traditional economic activities including agriculture.[6]

4.1 Language

In general, students study in their mother tongue - Sinhalese or Tamil, and indeed they complete their 'A' level examinations in their own language. Burgers, Eurasians and Muslims can study in English.

The Government abolished English as a compulsory subject in 1956, with the result that although literacy rates are extremely high, 90% of the 4.3 million children cannot read or speak English [8]. Clearly, the legacy of this political decision has severe implications for the future, especially since English is the universal technical language and, in the context of this study, since much distance learning material is in English.

There is now compulsory English from Year 3 in school (age eight) but the quality of the teachers is variable - as a result of the paucity of English teaching over the last 28 years.

The major providers of English Language Teaching in Sri Lanka include the World Bank and the Ministry of Education. The British Council is also a key provider and will have a major part to play in the future. Most of the British Council provision is funded by the ODA.

4.2 Complexities of the training sector

Unbelievably, there are 26 Government Ministries all of which have their own training

units totalling a staggering 1512 different units. Yet this represents only half of the total number of tertiary and vocational training institutions in the country. [10, 11, 12] The other training units are provided by the private sector and trade associations.

5.0 NATIONAL EDUCATION COMMISSION (NEC)

The NEC was established in July 1992 with a remit to examine all policy issues related to the education and training sector and report directly to the President. The NEC has a staff of 18 and is empowered to make recommendations at all levels from pre-school, through school and University, to adult and continuing education. To date, they have reported upon general education, teachers, management of education and the curriculum. At present they are looking at Higher Education (due to be published before the end of 1994) via a World Bank Project.

5.1 Higher education

The Chairman of the Commission expressed some clear views on higher education in Sri Lanka. Fundamentally, the sector is very conservative, with courses being unchanged over decades. Thus the curriculum will need radical changes to make it much more relevant to the country's needs - this change being market driven and necessitated by changes in the economic structure.

The NEC wish to strengthen the University sector, both in terms of infrastructure and physical plant, and to improve the quality of staff through staff development. They wish to increase the intake from 2% to 4% and eventually to 6%. At present, some 150,000 students sit for 'A' levels each year, with 30,000 achieving the qualifications necessary to enter University, yet only 8,000 places are available. Thus, low unit cost education, typified by distance methods, is essential if a greater number of the qualified school leavers are to be allowed access to higher education.

5.2 Technical education

Technical education has been neglected in the past. There is a crucial need to develop it in order to:

- reach larger numbers of students
- increase the number of courses
- diversify the curriculum to include business and commerce as well as technical subjects

The aim is to quadruple the numbers of students from the present 2,000 to between 7,000 and 10,000.

The present technical colleges are not efficient and the present teaching staff are inadequate. There is a severe shortage of good teaching staff and the National Teacher Training College is ineffective at present and will be required to work to targets in future. It is considered that the mixed mode approach offered by distance learning could have an important role to play.

5.3 Distance education

The Commission believes that distance learning materials could be produced by both adapting existing UK material and by developing their own indigenous materials. The latter could be done either by the existing conventional universities or by the Open University of Sri Lanka. Materials arising from either would need support in the form of laboratory experience (for engineering courses) and tutorial support. Staff involved in providing such support would require training in distance education techniques.

Facilities are less of a problem - three of the Universities teach engineering, there are 25 technical colleges and the Technical Teacher Training College has good laboratories with practical facilities in areas such as automobile engineering, materials science and fluid dynamics.

However, the present school education system does not suit pupils well for resource-based learning or distance education and there will be a need for students to gain these skills.

5.4 Needs of industry

There is a mismatch between what industry needs and what the universities currently provide. This cannot be rectified overnight. The present industrial needs are in areas such as ceramics, textiles, light engineering and tea planting. This mix will inevitably change with time but the educational system must be able to change to suit. Sri Lanka also needs a partnership or link between industry and education.

In terms of provision, having substantially satisfied the need for civil engineers (transport and highways) [13] there is now a need for mechanical engineers. In future there will be greater demand in agriculture and food-related industries and there is some limited potential for electronics.

5.5 Language in higher education

Students at university prefer to learn in English. Decisions in the late 50s to abolish the compulsory teaching of English are now creating difficulties. The major constraint

upon future plans to shorten University education from four to three years is the necessity of a four year period in order for students to achieve competence in English.

6.0 HIGHER EDUCATION

Sri Lanka has:

- nine universities (including the Open University)
- seven Affiliated University Colleges (consisting of 10 centres)
- one technical training college
- two private sector institutes of higher education (fee paying)

6.1 Universities

The high standard of general education has created a demand for places in universities which is largely unfulfilled due to the limited expansion of universities over the last two decades. Of the 30,000 or so students who qualify for places via the 'A' level route only around 8,000 gain places, leaving a substantial number of highly motivated and ambitious yet disappointed students. Distance Learning would provide this group with an opportunity to access higher education.

For many years expansion and change has been strongly resisted by the universities as they attempted to protect the status quo. There is evidence now that this is changing with the National Education Commission's target of doubling the participation rate and the University Grants Council's imperative to require university education to meet social and manpower needs.

The universities sector contains about 26,000 students, only 2% of the relevant age group, which is much lower than that of comparable developing countries, c.f. 8% for the economically advancing nations of Asia. (7) 53% of university students study arts subjects, 15% science, 15% medicine, dentistry and veterinary science and 4% agriculture. Less than 12% of students are enrolled in engineering or technology courses taught in three of the universities - the University of Peradeniya, the University of Moratuwa and the Open University.

Civil unrest and student insurrection in 1987-1989 led to the universities being closed for two years. On re-admitting students, larger numbers than normal were accepted in order to satisfy some of the demand. This has led to an 'excess' of students graduating in 1994 adding to the problem of graduate unemployment.

6.2 The University of Peradeniya

Peradeniya is a large university, based in Kandy, which has been the traditional place to study engineering. It has six faculties, with 20% of its students following engineering or technology, approximately one half studying science, agriculture or medically-related courses and the remainder in social sciences, humanities and the arts.

Geographically remote from Colombo, distance learning techniques could increase choice and access for students.

6.3 The University of Moratuwa

Established in the 1970s, and previously an Institute of Technology, Moratuwa has approximately 1,800 students in two faculties:

- Architecture - including Town & Country Planning and Building Economics

- Engineering - Civil, Mechanical, Chemical, Electrical, Electronic, Computer Science, Materials Science, Mineral & Mining, and Textiles

It operates four year undergraduate programmes, the two year National Diploma of Technology, as well as a number of postgraduate courses including construction management and environmental engineering and management.

Enthusiasm for distance learning was restricted to post-graduate courses following the 'laying of a good base in engineering at the undergraduate level'.

6.4 Affiliated University Colleges (AUCs)

The AUCs were established in 1991 to provide two year vocationally oriented courses as an alternative route at post-secondary level. They are affiliated to universities with directors who are members of the university Senates. They have Boards of Management comprising academic staff and local employers and official representatives.

Latest figures (December 1993) show 1,300 enrolments at the AUCs studying subjects such as agriculture and animal science, accountancy and finance, hotel management, travel, tourism and culture, enterprise and small business management and English (14).

The AUCs have suffered from criticisms levelled at the universities responsible for them notably the weakness of the planning and quality assurance functions of the universities and their resistance to change. The establishment of the AUCs outside the

technical college system, many of which are reasonably well-equipped and under-utilised, was opposed by College staff and students. Furthermore, their physical location was chosen for reasons of geographical equity rather than educational need and this has created further problems [7].

Consequently, the AUCs have had little impact on the overall problems facing higher education, nor have they encouraged the universities to adapt themselves to the new prevailing circumstances.

7.0 THE OPEN UNIVERSITY

The Open University of Sri Lanka (OUSL) was established in 1980 and is the only recognised University in the country where students are able to pursue further and higher education by distance learning.

7.1 Development

On its establishment, OUSL incorporated two previous distance study institutions, the External Services Agency (ESA) and the Sri Lanka Institute of Distance Education (SLIDE). ESA registered external candidates for courses of the former University of Sri Lanka and simply provided examinations with no instruction. SLIDE has provided part-time study at Certificate and Diploma level in management, mathematics, science and technology. It employed a variety of techniques - written course materials and assignments, face-to-face teaching, short practical periods and use of cassettes, films and slides at regional centres. It also had a system of counselling. When it was absorbed, OUSL inherited 5,000 students on five programmes.

The main objectives of OUSL are:

- to provide continuing education for both those in employment and as a 'second chance'
- to relieve pressure upon conventional universities where demand far exceeds available places

7.2 Course and Admissions

OUSL consists of three faculties - Humanities and Social Sciences, Natural Sciences, and Engineering and Technology.

The main campus is in Colombo. In addition OUSL has a network of four regional centres and sixteen study centres. These centres provide limited facilities for face-to-face teaching, opportunities for reference to text books and distribution of course

materials. They are also used for counselling purposes and for conducting examinations.

The University offers a range of programmes for students over the age of 19 at a number of levels: awareness, certificate, foundation, diploma, first degree and postgraduate. Admission to OUSL courses is open to anyone for awareness and certificate courses. Foundation courses have to be completed successfully before admission onto degree courses. Fees are paid by students, which is exceptional compared with other Universities, even so, OUSL are nowhere near full cost.

There are presently 26,000 students studying courses and a total of 1,120 staff (one third being academic staff).

7.3 Facilities and expertise

OUSL uses a traditional combination of media and techniques for its distance learning programmes - texts, videos, audios, face-to-face teaching and practical sessions.

The facilities and equipment available for the production of video and audio material are superb. Funded by the Government of Japan to a total sum of 1,349 million yen, the Media House at OUSL offers high quality studios and truly state-of-the-art facilities. With 40 staff, well-trained technical support, and a resident expert providing technical training, the Media House is able to produce very high quality promotional and teaching programmes.

Its major problem is the dearth of competent producers in the faculties. Clearly there is a need to use subject experts in the production of audio-visual materials, yet such staff are invariably already heavily committed or sometimes not suited to the role of producer. The Media House runs one month workshops to train academics in this skill. It has also recently established a research unit with two staff, one seconded from each of the faculties of Natural Sciences and Humanities to investigate, in particular, student requirements and student feedback.

On the other hand, the quality of text-based material is poor in comparison with other major distance learning providers. It is outside the scope of this report to comment upon subject content, but in terms of educational technology, learning styles, student interaction, design and presentation, there is significant scope for improvement. It is not surprising, since the majority of OUSL academic and support staff have received no training in the philosophy of distance education or in the techniques of production. There is, therefore, a substantial need and considerable scope to offer training workshops in this area. A project proposal presently in preparation, which involves the British Council in Sri Lanka in collaboration with OUSL, proposes to remedy this

problem as part of a wide-ranging programme. It also seeks to strengthen the research and evaluation capacity of OUSL in order to improve the educational and operational organisation, of OUSL courses. The approval of this project would contribute significantly to the capacity of OUSL to contribute to the human resource development needs in Sri Lanka.

7.4 Practical sessions

The attendance requirement for face-to-face teaching and practical sessions is greater than for comparable open universities, involving students in long journeys and overnight stays. Practical facilities, for example in computing and engineering, are good in the Colombo Centre. However, in Regional Centres they are much more basic with only some computers, a few video machines, but no equipment for engineering. The substantial face-to-face component of OUSL programmes, which is taught by OUSL academics or support staff, places a heavy demand upon both staff and students.

Considering that 70-80% of OUSL students are in employment, the attendance requirements upon them clearly cause them difficulties leading to potential drop-out.

7.5 Drop-out

A major problem for OUSL is that of drop-out. It was difficult to obtain precise figures, although figures of greater than 40%, and greater than 50% for an engineering foundation course of 900 initial students, were mentioned.

Reasons identified by OUSL staff were as follows:

- **Mathematical ability** - there is a huge variation of ability of students in mathematics and an open entry policy does not allow any kind of screening

- **Quality of materials** - it was acknowledged that 'lesson materials' need to be improved

- **Competence in English** - although Levels 1 and 2 are taught in Tamil and Sinhalese as well as English, the prerequisite of English produces problems for students at later stages

Other reasons would doubtless include:

- **Lack of time** - conflicts between time demands from work and home

responsibilities, reducing the time available for study

- **Residential requirement** - the relatively substantial, and compulsory attendance for face-to-face sessions will cause problems for students

- **Lack of trained tutors** - some tutors still employ conventional teaching methods rather than adapting to the needs, and philosophy, of distance learning

- **Inflexibility of provision** - the lack of common systems and approaches between the faculties means that students have difficulty in changing courses and no opportunity to combine elements from different faculties

- **Ambition and motivation of students** - such is the desire for education and the importance placed upon qualifications in Sri Lanka, that students unadvisedly attempt too much.

Clearly, wastage rates at these levels are of major concern to OUSL and indeed they have introduced systems and practices aimed at advising students and thereby counteracting dropout. Engineering students now have access to counselling provided by faculty and tutors. In Science, a system of personal tutors, each responsible for 40 students, is in place. Where necessary, students are discouraged from attempting the maximum number of credits and attend orientation programmes on what being a distance learner is about. OUSL is currently considering creating a post of Dean of Student Affairs.

Finally, however, although drop-out is a major problem, any figures should be treated with caution. Drop-out is notoriously difficult to measure, especially on programmes which allow considerable flexibility. Students can remain 'dormant', apparently (but not formally) dropped-out, but then re-emerge in later years. In particular, the system at OUSL predisposes students to drop-out formally during such a planned dormant period to avoid paying fees before reregistering at a later date. The statistics are unable, at present, to recognise these situations.

8.0 TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

Since the mid-1950s, government funded Technical and Vocational Education and Training (TVET) has been delivered through a plethora of training institutions, created to satisfy a current or immediate national need but with no reference to any kind of coherent or national strategy. Consequently 26 separate Ministries presently control 1,512 different training units often offering similar programmes. As a result there is

substantial duplication, expansion without control and limited resources spread thinly. In addition, links with industry are almost non-existent.

The private sector also established its own training institutes bringing the total in Sri Lanka to over 3,000. The private sector either provided training in fields not available in the state sector or in areas where places in state institutions were already filled. Courses are offered in subjects such as motor mechanics, aviation, marine engineering, computing, office skills, hairdressing and hotel and catering.

8.1 Public sector TVET

The 1,512 institutes collectively service 108,000 students, the largest providers being the:

- Ministry of Education and Higher Education (711 institutes, 31,500 students)
- Ministry of Labour and Vocational Training (349 institutes, 11,600 students)
- Ministry of Youth Affairs and Sports (969 institutes, 23,000 students)
- Ministry of Tourism and Rural Industrial Development (221 institutes, 5,500 students)
- Ministry of Policy Planning and Implementation (7 institutes, 6,418 students)

8.2 Ministry of Education and Higher Education

This ministry also is responsible for:

- twenty-five Technical Colleges (of which thirteen are Grade 1 technical colleges)

- five affiliated & Technical Units

- one National Institute of Technical Education (NITE) (previously the National Technical Teacher Training College (NTTTC)).

9.0 TERTIARY AND VOCATIONAL EDUCATION COMMISSION

The Government has recognised the needs for a fundamental reform of the tertiary education and training system. In particular it is addressing the need for:

- a comprehensive national policy
- co-ordination and avoidance of duplication
- links between education training and employment
- increased efficiency in the use of training resources
- increased practical experience of staff in training institutions
- a system of national recognised certification
- effective career guidance and counselling
- incentives to improve training capability
- labour market information.

As a result the Tertiary and Vocational Education Commission (TVEC) was established in 1990 under the Ministry of Youth Affairs and Sport to 'plan, co-ordinate and develop the training system in keeping with the human resource needs of the economy.' (7)

In addition the Ministry of Industries, Science and Technology has established a Skills Development Fund to 'provide for the establishment of an effective machinery for the financing of training which efficiently meets employment needs, and responding flexibly to priority needs as they emerge.' (7)

9.1 Vocational training reform project

As a result of the Education and Training Sector Strategic Review (7) project, preparation is currently underway on a Technical Assistance Project, funded by the International Development Association, to reform the sector. Under the auspices of TVEC, the project will address the needs listed above, whilst in addition:

- Supporting the full development of the Skills Development Fund

- Assisting the National Apprentice and Industrial Training Authority (NAITA) to improve the efficiency, quality and relevance of apprenticeship training and retraining

- Expanding enterprise training to improve skills and raise productivity

Distance education is expected to play an important role in improving efficiency, relevance, quality, flexibility and consistency of vocational training.

9.2 Distance education in technical training

Using the often-quoted ratio of 1 professional engineer: 4 technicians: 25 craftsmen, the commission (TVEC) are concerned that 29 out of this group of 30 are generally denied

the opportunity for personal up-dating or re-training. Many of these wish to improve their knowledge and upgrade their qualifications but cannot be released from work, and will never go back to the classroom.

In the view of TVEC distance education is:

> *'without doubt the best (and perhaps only) way for future technical updating.'*

Furthermore, a great advantage is that distance education can be work-related and under the Reform Project enterprise-based training will be a priority. TVEC:

> *'cannot imagine enterprise-training without distance learning.'*

It will improve contact with industry, improve work-based learning opportunities and thus satisfy the criticisms of industry that the present training system creates theoretical training institutions instead of skilled people. It would also take advantage of the large numbers of 'trainers' currently working in industry.

9.3 Models for Development

TVEC proposes two alternative, perhaps complementary, models for development of distance education in technical areas, which are presently under consideration:

- In collaboration with the Open University of Sri Lanka, the training of currently around 20,000 engineering-related apprentices managed by NAITA (the National Apprentice and Industrial Training Authority)

- The establishment of a distance learning system for industry at NITE (the National Institute of Technical Education) following its restructuring

9.4 Other Opportunities

The private sector is concerned more and more about human resource development and Chambers of Commerce and Industry require up-grading and refresher courses for their members. Distance education does not require employees to be released from the workplace for training purposes and hence is considered very favourably by the private sector.

9.5 Requirements

Before distance education can take advantage of this opportunity TVEC consider that the distance education must be:

- well designed
- available to the majority of the population
- heavily subsidised

The Skills Development Funds might cover some of the fees since large and medium companies are likely to provide only low-level support of around 500R (circa £7) per person per month.

However, TVEC do not consider that funding will be a problem as there are many available donors.

The concept of distance education will also need to be 'sold' to the population and to industry in order to satisfy people's 'lifelong craving for knowledge'. In particular:

- distance learning must be distinguished from correspondence courses

- the benefits need to be stressed including its employment-orientation and the advantage of not requiring release from work.

10.0 INSTITUTION OF ENGINEERS

The Institution of Engineers of Sri Lanka provides professional up-dating for engineers in all engineering disciplines - civil, structural, mechanical, electrical, marine and agriculture. It has around 5000 members, of whom half are corporate members entitled to use the designation C. Eng. In addition, there are around 1000 Associate members and 1000 Student members (15) Civil Engineering is the largest group.

10.1 Courses

The Institution of Engineers provides an extensive programme of lectures preparing candidates for the Part I and Part II examinations (16) The courses are run outside working time and students attend nearly every weekend and on most public holidays in order to complete the programme. As an example, Part I contains eight subjects each of which consist of 40 x 2 hour lectures. This commitment to study is an indication of the importance of qualifications to Sri Lankans. The majority of the lecturing staff come from the engineering faculties of the Universities. There are around 100 students following Part I and a similar number on Part II courses. There is not a large enough industrial base to contain all the facilities for practical training in one single company,

so staff will move to other companies for essential experience. CPD courses are also run: 'Management Development for Engineers' being the most popular. This is a 12-day Saturday course costing 4000R (circa £50).

10.2 Supply and demand

The University sector will produce around 1000 engineering graduates in 1994, which is excess of the need in all areas except for electronic and electrical where supply and demand are balanced. Recognised engineering qualifications are seen as vitally important. The public sector organisations e.g. government, Departments of Irrigation, Railways etc. insist on them. Private sector organisations prefer to appoint technician engineers (i.e. those qualified with a National Diploma in Technology) because of their more practical orientation.

10.3 Distance education courses

The Institution already recognises the Diploma in Engineering offered by the Open University of Sri Lanka. It is presently looking at accrediting the BTech course, which if recognised will entitle Open University graduates to apply for Corporate membership after a further four years (two years training and two years relevant experience).

10.4 Opportunities for Distance Education

The Institution is concerned that the pass rate for its Part I examinations is only 25%. They identify the problem as the lecturers being different people from the examiners (and hence not teaching an agreed syllabus). They see an advantage in using distance education in that they could be absolutely sure that it covered the correct and full syllabus. There are, however, other ways to achieve that end. Another reason for the low pass rate is likely to be the inflexibility of the Institution lecture series and the consequent severe attendance requirement upon students. Distance education methods, if used flexibly, could alleviate this and improve the completion and pass rate.

Conclusions

Sri Lanka's strategy of becoming a 'newly industrialised country' requires the development of human resources across the board. In particular, and if this strategy is to be achieved, skills are needed in export-oriented industries and in tourism as well as in traditional sectors such as agriculture. Textiles and garment manufacture are already making a significant contribution to export earnings.

The technical and vocational education sector, which conventionally might provide

such training, is large, uncoordinated and impossibly fragmented. This has led to unplanned growth in training institutes resulting in inefficiency, duplication and limited resources being spread too thinly. Links between education, training and industry are few and far between.

The deeply ingrained public attitude of free education as a fundamental right of every citizen politically constrains opportunities to reallocate resources. However, impressively high levels of literacy and participation at schools and the very high value placed upon educational qualifications result in a large number of school leavers severely disappointed at not achieving places in further or higher education. However, even now, lack of employment opportunities and unrealistic expectations result in high levels of unemployment amongst people with qualifications. Political decisions will have to be made whether to educate for its own sake or whether to train towards employment.

These issues are being considered with the utmost seriousness and two National Commissions, one covering education generally, the other technical and vocational education specifically, have had and will continue to have considerable influence.

The general awareness of distance education and its benefits is extremely high, no doubt as a result of the high profile of the Open University of Sri Lanka. However, the ability of individuals and of industry to afford even the low and subsidised fees of the Open University is limited.

There is, however, a tremendous value placed upon education, and cost-effectiveness and flexibility will be very important when government, industry, business and individuals make decisions on their educational and training needs.

Potential demand for distance learning

The opportunities for distance education in Sri Lanka are considerable.

- If the Government wishes to pursue a social policy of providing higher education for qualified school learners, then within its limited resources distance techniques will be the only solution

- The scale of demand, and need, for technical training is so large that distance education will have to play some part in the provision

- The existence of the Open University in Sri Lanka (OUSL) provides an invaluable starting point, so long as some of its internal difficulties can be addressed

- Limited resources, and reasons of pure common sense, insist that distance courses should not be developed *ab initio* where appropriate courses are available elsewhere. However, in-country modification would be essential and it will be necessary to develop people with expertise to do this, either within OUSL or in other organisations

- The size of the technical training need and the actual level of training requires careful thought as to whether OUSL should develop this role. The practical nature of apprentice training and the existence of many institutions satisfying this need makes distance education inappropriate at the apprentice level.

- Subjects where an urgent need exists include textiles, environmental issues, exporting, management and information management

- The problem of competence in English will need to be addressed at the earliest stage

- Translation would be necessary at some levels

- Pricing would need to be appropriate to the cost of living.

Appendix 2.1 - Organisations/institutions consulted

Engineering companies

Walker Sons & Co Ltd	(Civil Engineering)
EMC (Pvt) Ltd	(Electromechanical & Civil Engineering)
IMPACT	(Innovative Management of Projects and Compatible Technology)
Janaco Ltd	(Chemical Engineering)
Samuel, Sons & Company Ltd	(Mechanical, Civil, Electrical Engineering)

Other organisations

Apprentice Training Institute

The British Council

Central Environmental Authority

Department of Irrigation

The Engineers Guild

Federation of Chambers of Commerce & Industry of Sri Lanka

Foreman Training Institute

Institute for Construction Training and Development (ICTAD)

The Institution of Engineers

National Apprentice and Industrial Training Authority (NAITA)

National Education Commission (NEC)

Tertiary & Vocational Education Commission (TVEC)

The Open University of Sri Lanka (OUSL)

The University Grants Commission

University of Moratuwa

Association of Public Service Engineers

Association of France-Ceylonese Technologists

Central Engineering Consultancy Bureau

Colombo Municipal Council

Other Public Sector Engineering

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1.0 BACKGROUND

1.1 Population

Zimbabwe is a landlocked country of 309.8 thousand sq. km. with a population of approximately 10.4 million (1992 estimate) which includes some 90,000 Europeans. (1) The ethnic distribution is about 77% Shona, 18% Ndebele and 5% others. The official languages are English, Shona and Ndebele. (2)

About 70% of the population live in rural communities, the remainder in the urban areas mostly in the vicinity of the two major cities, Harare (over 1 million) and Bulawayo (over 0.5 million). (3) Other major cities are Chitungwiza, Gweru and Mutare. Average population growth is estimated at 2.9-3.6% (since independence in 1980). The population growth in the cities is estimated to be between 5 and 7% per annum, which is putting a severe strain on the amenities and creating social problems. (4)

The Government is attempting to tackle the population growth rate, making more resources available for family planning in both urban and rural areas and is reported to be foremost in Africa in this field. It also plans to control the growth of the urban populations by developing rural areas, decentralising industrial development and by setting up projects which will generate employment in the rural areas. (4) Significantly, nearly half of the population is under 15 years of age.

1.2 Political stability

Following the civil war which ended in 1979 with the demise of white Rhodesia, Robert Mugabe's ZANU (PF) party won overwhelmingly in the 1980 general elections. He formed the first government of Zimbabwe which became independent in April 1980. Mugabe became the first Executive President in 1987 and has retained the post ever since. Multiparty elections are held every five years, with the next one due in 1995.

2.0 ECONOMIC BACKGROUND

Zimbabwe's economy has a broad base. Indeed, outside South Africa, Zimbabwe has the largest industrial base in sub-Saharan Africa. There is a diversified manufacturing base and a strong mineral and agricultural resource base. The infrastructure is comprehensive with substantial networks of road, rail, air and telecommunications. Its work force is one of the best educated on the African Continent.

Zimbabwe's education system benefited significantly from social changes introduced to reflect the new political situation immediately after independence in 1980. Education and also health were given particular attention and are widely acclaimed as successes amongst the population. Primary school enrolments almost tripled between 1980 and 1990, while the secondary schools expanded tenfold. There were also huge increases in tertiary education. (5)

The business community, although proud of these reforms, argue for similar investment into the industrial base.

The goal with regard to health is that no one should have to walk more than 10 km to reach a clinic. Enormous strides have been made in the health sector, going a long way towards meeting this goal.

The economy expanded following independence, but serious economic structural problems emerged during the 1980s. Export commodity prices and inflation both rose and the government found itself burdened with foreign debts and large budget deficits. Imports were limited; there was very little foreign investment and Zimbabwean industrialists found it virtually impossible to obtain foreign exchange (forex). This period culminated in President Mugabe announcing a dramatic policy shift towards a market economy in 1989. (3)

2.1 Economic Structural Adjustment Programme (ESAP)

October 1990 saw the introduction of the IMF-World Bank approved Economic Structural Adjustment Programme (ESAP). This aims to achieve, over a five year period, an average economic growth rate of 5% by means of fiscal and monetary

reform, trade liberalisation, deregulation and control of the economy. (3)

The implementation of the programme was badly affected in 1992 by the country's worst drought this century. The drought, the transitional effects of ESAP and the world recession caused real incomes to fall by about 10% in 1992 (3), and led to extreme dissatisfaction with the reforms amongst large sections of the people. The Government is, however, determined to press ahead with the plan, and the chances of success are rated high due to the strength of the country's industrial base. (5) The foreign exchange restrictions were lifted in January 1994 and business confidence has improved. The emphasis is now on exports and competitiveness, and inflation is falling, albeit slowly. (3)

2.2 South Africa

The de-regulation policy has opened up Zimbabwe as a market for other countries, thus increasing the need for local industry to be competitive. Industrialists recognise this acutely. They also recognise the need for training in order to compete effectively. South Africa is the major immediate competitor with something like a 10:1 competitive advantage in terms of production capability and economy of scale. The view of some industrialists is that they will be increasingly dependent upon the internal market. Although Zimbabwe has opened up its economy, it is still at a disadvantage regarding exports to South Africa, as the latter has retained protective import tariffs. Current negotiations may however change this unequal cross border trade.

2.3 SADC

In the view of President Mugabe, the future of the region lies with SADC (the Southern African Development Community). The priorities of SADC are:

- the establishment of better transport and communications infrastructures
- improving the technical and management skills in its members' public and private sectors
- harmonising cross border customs and tariff formalities and standardising documentation.

The Executive Secretary, Dr Mbuende, believes that the development of the region lies in investment and trade, not aid and assistance. He also sees the private sector, not governments, as the engine for growth in the region. (7)

South Africa has recently become a member of SADC with an enormous role to play,

given its resources and level of economic development. There is already co-operation between the two countries in energy and transport, and President Mugabe envisages adding to this in fields such as tourism and education and,

> *'especially in the area of distance education where South Africa is vested with a wealth of experience.'*[3]

2.4 Economic indicators

- **Inflation**

In May 1994, inflation stood at 25.1 % - as opposed to 49.1 % in August 1992 [1], with the yearly average estimated at 27% [3]. By December 1994 this had fallen to just under 21%.

- **Interest rates**

Interest rates have fallen from a high of 40% to below 30% (May 94) with a further drop anticipated, but the high cost of borrowing remains a constraint [3]

- **Exchange rate**

The Zim. dollar has depreciated by over 70% since 1991. When combined with high interest rates and despite forex now being more easily available, this means that companies often cannot afford to borrow to finance expansion

- **Unemployment**

This is estimated at over 30%, although it is difficult to establish a precise figure. Many more school leavers enter the job market (200,000 per annum) than find jobs: the estimate of new jobs per annum is 30,000-50,000 in the formal sector

- **Medium term outlook**

GDP is projected to grow by 5% p.a. in 1994-96 with inflation declining to 15% in 1994 and to 8% or less in 1995 [3]. However, the medium term outlook is seen to be encouraging

2.5 Gross domestic product

1992 figures give GDP as US$5.15 billion (US$500 per capita) with a real growth rate of 2.0% (1993) following a rate of -0.8% during the 1980s. (3)

GDP by major sectors (June 1994) is as follows:

• Manufacturing	29%
• Agriculture	15%
• Distribution/Hotels	11%
• Education	7%
• Mining	7%
• Transport/Communications	7%

2.6 1993-1995 budgets

The 1993/94 budget included several features relevant to the project:

- Recognition of the role SMEs can play in the economy
- Education was by far the biggest recipient of recurrent budget (33% of expenditure, an increase of 15%)
- Acceptance that the objective of developing infrastructure for the public sector investment programme may not be realised immediately. Water and agriculture were given the highest priority (3).

The 1994/1995 budget focused on enhancing export competitiveness and investment and offered several incentives to the manufacturing industry, but education and culture were again given the largest allocation followed by defence. (7)

2.7 Imports

Zimbabwe's main imports are:

- fuel
- chemicals
- manufactured goods

- machinery and transport equipment.

Imports from the UK include specialised machinery and transport equipment, road vehicles and general industrial machinery. (9)

2.8 Socio-economic aspects

Many people have seen their standard of living drop since 1990. The poor in particular are worse off: in 1993, wage increases averaged less than inflation and average real wages have fallen by one third since 1990 with per capita incomes at a 15 year low. (10) Much of this is blamed upon the ESAP, and donors have recognised the need to protect the poor from transitional hardship or the programme will not be sustainable. (3)

Small businesses in particular are suffering. Although this is the fastest growing sector of the labour market, many first time ventures are failing within a year of starting up. (11)

2.9 The brain drain

According to the Southern African Research and Documentation Centre as many as 15,000 skilled people have left Zimbabwe since 1980. The emigration has increased since the introduction of ESAP and is attributed to the fall in real wages, overwork and the lack of support infrastructure. The exodus is especially noticeable in the sectors of health, education, engineering and technical services, with qualified personnel leaving for South Africa, Botswana and the private sector. As a result, staffing levels in government and municipal engineering departments have often fallen below 50%, and public construction projects have frequently been delayed. There is also an exodus of university lecturers, vocational trainers and government researchers.

An OECD study, *Business Development with New and Emerging Technology in the Resource Industries of Southern Africa*, concluded that more efficient management and better working conditions would be more influential than high salaries alone in cultivating and retaining a skilled workforce. The study indicates that certain sectors in Zimbabwe such as mining and agricultural services might serve as models of indigenous skills and technology developments due to their efficient management, forward looking investment schemes and production know-how. (12)

3.0 MAJOR INDUSTRIAL SECTORS

3.1 Agriculture

In economic terms agriculture is smaller than the manufacturing sector, but in socio-economic terms it is the backbone of the country's economy and provides the basic means of support for around 70% of the population. It accounts for 15% of GDP. It is an efficient sector and generates close to 50% of foreign exchange earnings. (7)

Zimbabwe is one of the few countries in Africa to be self-sufficient in food production producing sufficient surplus in normal (non-drought) years to allow for export of tobacco, cotton, maize, sugar, tea, coffee and beef. Zimbabwe is the world's third largest producer of tobacco and this is the major export earner, with maize the largest cereal crop together with wheat, sorghum, millet and barley.[3]

Agriculture is an area in which Zimbabwe and South Africa are very similar. In opening the 1994 Harare Agricultural Show, President Nelson Mandela said:

> *'Our basic challenge in the field of agriculture is to develop rural communities in order to enhance household incomes, national food security and broadly to improve the quality of life in a sustainable manner.'*

The President also noted that in the field of research,

> *'The advanced technology available needs to be adapted to suit local conditions, meet community needs and make creative use of latent indigenous information and experience.(8)*

Horticulture is a fast growing area with 63% of fruit and vegetables going to the UK, and 70% of cut flowers going to the Netherlands for auction. Indeed, some traditional beef farmers are now creating more profit from horticulture than cattle. The industry has the particular advantage of offering high employment opportunities especially to women. (6)

3.2 Land reforms

Land is an emotional issue and a major source of contention in Zimbabwe. The government is currently trying to redistribute land farmed by white farmers to the black majority. White farmers are challenging the legality of this, and the 1992 Land Acquisition Act is becoming very unpopular, especially in the business sector where there are concerns that compulsory land acquisition will frighten off foreign investors.

There is a belief that much of Africa's underdevelopment is due, at least partially, to the fact that land is not treated as an economic asset, but rather as a social and political resource: the view is that there should be private ownership of land in the peasant

farming sector. Zimbabwean agriculturists feel however that a system of land tenure can only be sustainable if it rests on agricultural growth, employment creation and ensuring food supplies in rural areas. (7)

3.3 Manufacturing

The Zimbabwe manufacturing sector is well-developed and highly integrated with the rest of the economy. It is the largest contributor to GDP and is the most productive sector in terms of output. It is expected to spearhead economic growth under ESAP and is predicted to grow at 5.8% p.a. It accounts for about 17% of formal employment and 39% of total export earnings (13)

Much of the industry is privately owned, but a great deal is dependent on the publicly owned Zimbabwe Iron and Steel Company (ZISCO). At the time of the visit two out of four ZISCO furnaces were out of production awaiting relining. The Government is, however, committed to supporting (a perhaps slimmed down) ZISCO. (3)

The major industrial sectors relevant to the project are:

- car assembly
- construction (including the manufacture of building materials)
- engineering (centred round Bulawayo, Harare, Gweru and Kwekwe)
- metals and metal products (2).

Historically, there is no electronics industry due to the lack of training, although printed circuit boards are manufactured in Harare. Much of the manufacturing is centred upon Bulawayo which has a greater capacity than Harare for heavy engineering. Solar equipment is also manufactured in Zimbabwe - the only country apart from South Africa to do so within SADC.

Industry has been considerably constrained by the lack of foreign exchange to purchase capital goods, spare parts and semi-processed inputs, particularly chemicals, plastics and steel plate. Much of the industrial plant and equipment is therefore out of date. However the Government has targeted manufacturing for priority treatment under the trade liberalisation, policy.

ESAP has forced many companies to streamline and rationalise, thus improving working practices in areas such as cash management, reduction in stock, better packaging and marketing and updated technology, but the non-export sector has been particularly hard-hit. (3)

There is considerable in-country self-sufficiency in components, although because much of manufacturing production is for home use or for export within the SADC, manufactured goods have a distinctly appropriate technology' emphasis: water pumps for boreholes, irrigation machinery, automated gold-panning equipment, fruit washing machinery, solar systems etc. The major items requiring importation include rolling bearings and sheet - steel there is no steel sheet rolling mill in Zimbabwe. Indeed the manufacturing sector is a net importer, especially with regard to capital goods, steel, aluminium and alloy steel sheets, plates, sections, chemical intermediates and petroleum products. (4)

The Government acknowledges that there is a shortage of skilled manpower in the sector and that, while there are plans to train personnel in-country and abroad, expatriate experts will in the meantime be employed in the field of new and high technology industries. (4)

3.4 Future of manufacturing

Several interviewees strongly felt that there was a need to create wealth in the country, and that one way to do that would be to make it easier to start new industries in the manufacturing sector.

Industrialists found it difficult to predict, however, whether the manufacturing base would grow, or whether Zimbabwe would become an agency for another country's products. It was acknowledged that the engineering sector would find it difficult to be competitive and that it was particularly difficult for companies to compete on small commodities which could be easily moved around. Production has to be improved and a huge investment will be required to modernise the manufacturing structures, otherwise industry will find it difficult to export and to sustain internal markets.

There is also pressure to improve the manufacturing industries to provide jobs for the growing population, to provide income to consumers and to improve the standard of living.

In the car industry it was felt that the future would lie in increased local assembly, but that the problem surrounding local components was one of quality and continuity of supply.

3.5 Mining

Zimbabwe is rich in mineral resources including gold, chrome, asbestos, nickel, copper and tin. There are also significant coal reserves used primarily for power generation and mineral processing. (3) Mining is a major contributor to the economy and together with

steel and ferro-chrome production provides about 44% of Zimbabwe's export earnings. Gold generates the most income. Mining produces more than 40 different metals and materials, creating direct employment for 55,000 workers and indirect employment for many more. Anglo-American, RTZ, Lonrho and Cluff Minerals dominate the industry. (3)

In August 1994, approval was granted for the Hartley Platinum project, the largest single mining development ever undertaken in Zimbabwe and expected to require an investment of Zim$1.8 billion (£150 million). The project could make Zimbabwe the second largest platinum producer in the world after South Africa. Production is set to begin in 1996. Training requirements are likely to be significant as there has been no previous platinum industry: over 2,000 expatriates will be required to meet the needs of the project. (11)

3.6 Energy

The main energy source is in the form of firewood (39%) followed by coal, petroleum based fuels and then electricity at about 14%. Virtually all of Zimbabwe's hydroelectric power comes from the Kariba Dam. The other main source of electricity is the thermal power station at Hwangi colliery. (There are three other smaller coal fired power stations at Bulawayo, Munyati and Harare. Upgrading of these has commenced to meet peak winter demand.) The 1992 drought caused the government to reconsider the emphasis on hydroelectricity and to augment thermal generating capacity instead. Currently, 20% of the country's electricity is imported. (4)

While petroleum based fuels are also imported, the consumption of firewood is causing ecological deterioration due to deforestation.

Given the above problems the Government has been seeking alternative forms of energy and more efficient processes, for example:

- the production and use of binges (which use cow dung as fuel)
- solar energy for heat and for conversion into electricity
- fuel efficient stoves designed for both coal and wood (4).

4.0 OTHER SECTORS

4.1 Post office and telecommunications

There is a huge demand for telecommunications in Zimbabwe. The communications services, run by the Posts and Telecommunication Corporation (PTC), have been under

strain to meet the present, fast expanding demand, and in the view of one interviewee, the whole phone system needs to be overhauled. The aim now is to modernise the network, for example, introducing fax services in all major centres. Cellular systems are currently being considered. The PTC operates many of its own training programmes: it established the Belvedere and Gweru Training Centres where personnel take courses in, for example, sales and services, and telecommunications technology. These institutions provide most of the training, but the PTC also buys in training either sending personnel abroad or hiring expatriates specialising in new and specific techniques. Such courses are generally for telecom technicians and mechanics and draughtsmen. Training is also given, both in Harare and abroad, to graduate engineers, pre- and in-service technicians and telecom workers. The intake of trainee technicians doubled in the 1980s. (4)

4.2 Computerisation and electronic media

Computerisation has not really taken place in Zimbabwe as a whole, although efforts are being made to 'kick start' computer literacy. Evidently the population in the urban areas is more computer literate than the rural population. According to the Second National Plan,

> *'the goal to provide formal and informal education...through the electronic media to the majority of the population has not been achieved.'*

It is therefore planned to pursue similar development activities until 1995, including the development of the Zimbabwe Broadcasting Corporation and the replacement of obsolete equipment. (4)

4.3 Tourism

This is a fast growing sector of the economy and is now a large foreign currency earner. In 1993 there were some 750,000 visitors to Zimbabwe. Nearly 50% of these were from South Africa. The industry has the potential to expand and create more jobs in the country, and it is hoped that indigenous entrepreneurs will exploit opportunities in this market. (4)

5.0 ENVIRONMENTAL ISSUES

Among developing nations Zimbabwe is reputedly well ahead in dealing with environmental issues. There is, however, environmental degradation in certain areas of the country due to:

- mismanagement of the environment and rapid population growth
- unplanned and illegal settlements

- unplanned gold panning which has expanded uncontrollably in recent years
- implementation of development projects without environmental impact assessment(15).

There are also distinct environmental problems related to irrigation development: soil erosion, siltation, water pollution and the ecological impacts. Many of the rivers dry up for a few months each year as a result of lack of storage and siltation. (15)

The National Action Programme on Water and Sustainable Agricultural Development has recommended training in the environmental field, particularly for the Water Pollution Section of the Department of Water Development, as well as training on Environmental Impact Assessment techniques. (15)

5.1 Water

Zimbabwe's climate is semi-arid, and the continuity of the water supply is often a major problem. There are no natural lakes and the utilisation of the scarce supplies of surface water is not well developed. Most water supplies are collected in dams. The Kariba Dam on the Zambezi is the largest. (2)

According to the Second Five Year National Development Plan, there will be emphasis on the programme to eradicate poverty in rural areas, in which water development programmes will play a vital role. Distinct organisations are already active in the field: for example, Mvuramanzi Trust, an NGO implementing the upgrading of rural family water wells, other family programmes and building naturally ventilated pit latrines.

Economic growth and the growth of the urban population have overstretched the urban water supply systems so that water supplies have had to be restricted, especially in Bulawayo where investigations are underway to tap water from the Zambezi River and pump it up to Mashonaland dry areas nearly 300 kilometres away. The Plan therefore includes the construction of more dams, irrigation systems, water supply schemes, boreholes and wells. It also proposes to train inhabitants in communal and resettlement areas to repair and maintain the water supply equipment and to involve them in the operation of water supply schemes. (4)

Crops in Zimbabwe are generally produced under rain-fed conditions. Given the recurrence of droughts, however, irrigation will play a more important role in the future. It is estimated that there is the potential for irrigated agriculture in the country, but that the development of irrigation will need to be well planned and viable from a technical, social, economic and environmental point of view. (15)

Water application technology and water management practices need improving in Zimbabwe. There is also a need for intensive technical training of the Agricultural Extension Workers in irrigation. Within the key institutions involved in water resources development, irrigation and environmental protection, the National Action Programme has identified a need for training at all levels, from technical staff to administrators, extension workers and farmers. (15)

The National Action Programme recommended amongst its objectives:

- the strengthening of post-graduate training in-country, particularly at MSc level, in irrigation engineering and water management

- the enhancing of the technical capacity of professionals especially in the field of irrigation, water resources development and environmental protection. (15)

The cost for the above training was estimated in the Action Programme at US$480,000.

6.0 WOMEN IN ZIMBABWE

According to Ruth Meena (Sapem, July 1992), most of the development plans and policies of African states have been 'gender blind'. (16)

While many African states acknowledge the need for human resources development, this is usually biased towards men: women generally retain their traditional roles, providing the bulk of agricultural labour, assuring food security and taking on the normal social reproductive tasks. Polygamy still exists in many parts of the continent, including Zimbabwe. On the face of it, women are better off in Zimbabwe than in many other parts of Africa: in the 1980s there were only 5% fewer girls than boys in primary education (5), and there has been a strong commitment from the Government to equal rights. (15) When it comes to tertiary education however, women make up only 25% of the university population and there are correspondingly few women managers, intellectuals and politicians. (16) The University of Zimbabwe has recently initiated a policy in the 'affirmative action' by adding two points to women's 'A' level results to help them be accepted as undergraduates.

This lack of education is reflected in the positions which women hold at work. They constitute about 28% of the workforce in the formal sector although they make up over 50% of the population. The positions they hold are generally in service occupations. Only 1.3% of women workers are in the administrative and managerial field. (5)

'Black Zimbabwean women... feel that though the environment is changing for the better, a lot still needs to be done.[14]

The Canadian International Development Agency (CIDA) report specifically indicated that funding was needed,

'to enable more women to be employed and to create a greater gender equity in employment... Serious attention needs to be given to the low employment rate of women in all sectors of the economy, but particularly the formal sector. Donor agencies should consider setting gender quotas in all their funding of education and training but particularly if they decide to support credit facilities and training for the development of SSE (Small Scale Enterprises) and expansion of the informal sector.[5]

In the Ministry of Political Affairs, there is the Department of Women's Affairs which focuses on training needs in both the urban and rural communities through two training Centres: the Roger Howman Training Centre in Masvingo and the National Training Centre for Rural Women in Melfort. In the NGO Ranche House College, there is the Women's Leadership Development Training course. There is also a Community and Womens' Education training programme run by the Ministry of Community and Cooperative Development. This particular programme has received help from the Swedish International Development Agency (SIDA). [5]

Other donor organisations which have been active in Zimbabwe include UNESCO, HIVOS (the Humanistic Institution for Co-operation with Developing Countries), UNICEF, CUSO (Canadian Universities Services Overseas) and DANIDA (the Danish Volunteer Service). [5]

While there is evidently training on offer, it is difficult to ascertain how many women it is reaching and how effective it is in improving living conditions for them. In many cases, rural women have retained their traditional roles despite indications that they work well in certain areas such as agriculture and horticulture.

There is therefore a strong case for furthering the training and education of women.

7.0 AIDS

AIDS is endemic in Africa: there are more than 1.5 million AIDS cases on the continent and it is estimated that some 10 million Africans are HIV positive out of a world total of 14 million. [7]

In spite of extensive anti-AIDS information in the media, the disease appears to be

growing rapidly within the country to the increasing concern to industry and Government. President Mugabe draws attention to it in the Second National Development Plan, intimating that it is 'spreading at an alarming rate':

> *'The effects of this plague could eliminate all gains, actual and potential, in socio-economic development unless we take the necessary steps to control or eliminate the epidemic.'*[4]

Despite the media coverage, there seems to be little public discussion of the disease and, according to one of those interviewed when explaining the public attitude,

> *'People either die of a 'short disease' or a 'long disease'. They don't die of AIDS.'*

Yet the figures are frightening: in one company three workers (out of a total of some 500) died in one month alone, in another 200 out of the workforce of 3,000 died of AIDS last year. Those affected are generally at middle management level, up and coming executives aged 20-35. An alarming number of degrees are awarded, by the universities, posthumously. There are unconfirmed reports that the Army and Police are 80% HIV positive.

The AIDS epidemic will obviously have serious repercussions for the Zimbabwean economy. Companies acknowledge that people will be lost, that there will be a shortage of manpower and that there will be a need to retrain. One company believes this to such an extent that it is considering introducing automated manufacturing in the next few years simply to deal with the projected lack of manpower.

8.0 THE EDUCATION SYSTEM

8.1 Responsibility

The Ministry of Education is responsible for education at primary and secondary levels, while the Ministry of Higher Education is responsible for Harare Polytechnic, Bulawayo Polytechnic and the Technical Colleges. It shares the responsibility for the University of Zimbabwe (Harare) and the National University of Science and Technology (Bulawayo).

8.2 Background information

Government spending on education remains very high - the country spends 10% of its GDP on education, the highest ratio in the world, and huge strides have been made since 1980 (potentially at the expense of industry and infrastructure which have not

benefited from similar investment).

Since 1980, Zimbabwe has achieved nearly universal primary education and extremely high numbers in secondary school. There are approximately 700,000 secondary school students in some 1,500 schools throughout the country. (4)

According to the CIDA Report however, two problems have arisen from the rapid expansion.

- The quality of education has declined.

- There is not enough employment for the graduates of the educational system as the investments in education have not been accompanied by equal investments in the economy. The report suggests: 'education per se will not further economic development' (5).

In an attempt to deal with the rising unemployment, the Government introduced technical subjects into the secondary school curriculum in addition to the post school vocational and technical training. There was, however, a severe lack of qualified and experienced teachers to offer such subjects in the schools. (4) This in turn led to a need for increased teacher training, especially in subjects necessary for industrial development: mathematics, physics, chemistry and biology.

8.3 Teacher training

Between 1980 and 1986, the number of trained teachers in Zimbabwe increased by over 50%. However, due to the increase of teachers recruited to provide increased educational opportunities, the proportion of trained teachers in the system dropped from 72% to 54%. In some parts of the country it was common to find untrained teachers dealing with classes of more than 40 students.

It was also found that teachers who had been through the Zimbabwe Integrated Teacher Education Course (ZINTEC) were getting better examination results from their pupils than other teachers. The ZINTEC course comprised a 16 week residential period following which the trainee teachers taught in schools whilst undertaking supervised distance education courses. This programme lasts for more than three years. (5)

The shortage of good lecturers and teachers in schools, colleges and universities also occurs because of the poor conditions of service and remuneration: one interviewee said that lecturers were so badly paid they could earn more as a plumber.

The National Plan also acknowledges that accommodation for teaching and learning, especially in the rural areas, was poor and inadequate. (4)

In an attempt to rectify this situation, the Government has reintroduced school fees for both primary and secondary school education, an extremely unpopular move, especially as the 'O' level examination fees alone are allegedly equal to two months average salary.

8.4 Technical and vocational education

There are three training centres in the country: Masasa in Harare, Westgate in Bulawayo and the Institute of Technology (formerly the Belvedere National Vocational Training Centre). The main fields covered are: automotive electrics, motor mechanics, fitting, turning, fabrication, carpentry and technical drawing.

Between 1980 and 1990 enrolment in the colleges increased by 172% as the government sought to address the shortage of technicians. However, this was not reflected in the numbers enrolling for engineering disciplines:

	1986	**1989**	**% Increase**
Automotive	632	720	14%
Civil Engineering	471	474	1%
Electrical Engineering	698	718	3%
Mechanical Engineering	822	886	8%

The major leaps came in areas such as Business Education (58% increase) and Computer Studies (1,462% increase). (4)

8.5 Tertiary level technical training

The Polytechnics came in for severe criticism from many of those who participated in the research. The most common complaints were that there were few competent staff and that the equipment and library materials were more or less obsolete. Industry did not see the Polytechnics as matching their needs, and the resources were not there to improve them.

There are *circa* 7,500 students enrolled in Harare Polytechnic, which has faculties of Mechanical and Electrical Engineering and Surveying. There are 5,200 students in Bulawayo Polytechnic, 2,000 of them apprentices in engineering. The all inclusive cost per annum of keeping a student in a Polytechnic is Zim$6,000 (about £483).

There are further technical colleges in Bulawayo, Gweru, Kwekwe, Kushinga, Phikela, Masvingo and Mutare.

Virtually every person interviewed felt that there was a need for training at the technician level, especially as there are not many institutions that offer higher national programmes. It is perceived that there will be a need for more mechanical technicians and that the focus should be on manufacturing engineering.

8.6 Apprentice training

The average annual intake of apprentices in 1989 and 1990 was 1100. The intake in industries relevant to the project were as follows:

	1986	**1990**	**% Increase**
Automotive	216	339	57%
Construction	73	113	55%
Electrical	302	365	21%
Mechanical	456	555	22%

The apprenticeship scheme, like the draughtsman scheme, is formalised and takes four years at artisan level. In the view of several of the informants there is no need for training at this level as it is already well covered. There is a problem, however, as the form of apprenticeship training has been recently changed, offering more theory than practical training: a system which is not welcomed by industrialists.

Indeed, it was pointed out that the skilled artisan has been lost across the sectors. NRZ (National Railways of Zimbabwe) conducted a survey amongst their workers in 1993 which indicated 70% of the workers have only three years post training experience and that many trained people have left the company. It is calculated that it will take a generation to replace those skills.

9.0 UNIVERSITY EDUCATION

The university sector is underfunded due to the emphasis of funds for the primary and secondary school sector to deal with the growing youth population. Given the lack of resources, universities are unable to deal with the bottleneck created in the education system among 18 year olds. Every year there are 3,000 'A' level students who are very well qualified for university but who cannot get places.

There are currently three universities in Zimbabwe:

- **University of Zimbabwe in Harare**

There are approximately 8,000 students on campus studying a variety of subjects including engineering (civil, mechanical and electrical, mining and metallurgy). In 1990, 693 students were enrolled for engineering. Even though this represents an increase of 78% over the 1987 figures these numbers are very small compared with arts and social studies graduates.

The University is also responsible for the training of laboratory technicians. (4) It was pointed out, however, that the practical facilities in the University in terms of laboratories are poor, since although the equipment is quite reasonable it is not maintained adequately. In addition, there are apparently few links between the University and industry who feel that the University is not interested in satisfying their requirements.

- **The National University for Science and Technology (NUST) in Bulawayo**

Offering BSc programmes in sciences and technical subjects, NUST opened in 1991. There are currently 1,100 students studying four year courses which include an industrial placement year. The Engineering Faculty includes civil and water, mechanical and electrical. It is intended to introduce chemical engineering in the future. The intention of NUST is that all its students should have a more practical orientation in addition to being educated to a high academic standard. Engineering courses therefore last five years allowing for the practical element to be included. Whilst NUST could be an appropriate partner in a distance learning venture, provision would have to be made for extensive practical laboratory work.

- **Africa University in Mutare** (private)

Built with funds from the United Methodist Church, this opened in 1992, and currently has approximately 80 students. It is expected to reach full capacity of 2,500 by 1999. It will not have a Faculty of Engineering, but will have a Faculty of Science and Technology. (17) A high priority for the leaders of the University is the recruitment of more women as students and as faculty members (8)

A fourth university, the Catholic University, is to be built. Neither the money nor the land has yet been found for the project, but interested parties are already manoeuvring for the tenders. (11)

The Government plan is to address the higher level manpower needs of the country at university level, focusing specifically on scientific and technical fields. This will include a Faculty of Environment and Design in the University of Zimbabwe. (4) However, very few postgraduate degrees exist or are planned and this provides an opportunity for distance learning provision.

9.1 Engineering students

University engineering students in Zimbabwe were described as excellent academically but generally weak in terms of their practical skills due to the lack of practical facilities. Although one interviewee did indicate that they had good 'hands-on' mechanical skills, the biggest problem which Zimbabweans seem to encounter relates to the application of the theory: they can be very numerate and very literate but have great difficulty translating these into applied skills.

Moreover their ambitions after they have graduated also provide problems for companies: they want to be put in charge as managers rather than to work as engineers.

The problem of employment also applies to engineering graduates, with a substantial number of them currently out of work. It was pointed out that, at present, private companies do not need engineers, but they do need technicians and artisans.

In addition there is no need for more civil engineering in the country, but according to several interviewees, it is the only area which generally receives attention.

10.0 PROFESSIONAL BODIES

The Zimbabwe Institute of Engineers (ZIE) is the country's professional engineering body. Accreditation of degree programmes is currently given to individual university departments; candidates are then accepted as graduates of that department. No-one can use the title 'engineer' unless (s)he is a member of the ZIE. There are future plans to accredit courses offered by the Polytechnics: there is currently no accreditation at the technician level.

There is no licensing system for engineers. However, ZIE represents the profession, covering 30 different disciplines. A breakdown of its membership gives an indication of the composition of levels of engineering in the country:

Fellows	183	8%
Members	680	30%
Assoc. Members	75	3%
Technicians	374	17%
Graduates	340	15%
Students	621	27%
Total	2273	100%

38% of the members are civil engineers. [19]

The above figures are not definitive as regards the whole country in that not everyone belongs to the ZIE, but the figures do indicate the poor ratio of technicians to the level of chartered engineers i.e. 374:938 or 1:2.5, whereas it is considered that a ratio of four technicians to every graduate engineer would be more balanced. There should also be four to ten artisans for every technician depending on the discipline and type of work.

11.0 CONTINUING EDUCATION

11.1 Professional updating

It was pointed out that there is a low degree of professionalism in the country, particularly as many people in top positions are not university educated. This evidently has an effect with regard to the perception of training. One resondent put in the form:

'Industry has to wake up and get up to date.'

The ZIE collaborates with colleges in running a limited number of courses covering most disciplines common in Zimbabwe, but very little Continuing Professional Development (CPD) is conducted within companies, although generally the country is now beginning to recognise its value. Indeed, job-related training was identified as a weakness in the system. There is, for example, no mechanism for upgrading engineers or technicians and there are no postgraduate students. Moreover, most posts in agricultural engineering are not held by engineers with a recognised qualification: in this sector, like several others, engineers learn 'on the job'. The mining industry also has a need for CPD, for example, among mining surveyors.

A fundamental problem is that companies do not offer training because of concern over subsequent poaching by other organisations - a common difficulty in Zimbabwe.

Even if the need for CPD is acknowledged, the major question would be how to get industry to invest in it: most students are supported by government loans and limited grants, few are privately funded - a pattern that it likely to remain. There is a need for the employer to take a greater role, but there remains a question mark over who will pay for it.

11.2 Technological awareness

The performance of secondary schools in science is poor, and universities are accordingly obliged to accept students with 'A'-level scores much lower than those gained in the humanities.

According to the Second Five year National Development Plan,

> *'Development of Science and Technology is Zimbabwe's long term and most important strategy for economic and social development.'*(4)

To that aim, the Research Council of Zimbabwe (RCZ) was established in the 1980s. The RCZ accordingly set up the Scientific and Industrial Research and Development Centre (SIRDC) in 1993. The mandate of the SIRDC is:

> *'to facilitate industrial development in the country and to help restructure industrial strategy through modernisation and upgrading.'*(20)

It also aims to provide technical advice and support to small scale farmers, resource-poor individuals, cottage industry operators, informal sector and emerging industrial entrepreneurs wishing to launch productive enterprises. (21)

Six institutes are to be established to carry out the generation and adaptation of technology in the following areas:

- Biotechnology
- Building Technology
- Energy Technology
- Environment and Remote Sensing Technology
- Mechanical Engineering
- Microelectronics and Electronics.

There is also to be a Department of Industrial Management.

Working together with the Standards Association of Zimbabwe (SAZ), the goal of

SIRDC is to enable Zimbabwean industries to produce products to international standards and world class quality. (21) Its mission is to (advance) Zimbabwe's capability of exploiting global technology for industrial competitiveness'

The Confederation of Zimbabwe Industries (CZI), the manufacturing associations and the Indigenous Development Centre will also have significant inputs into the project. (4)

12.0 DISTANCE LEARNING IN ZIMBABWE

The Government has acknowledged the role that distance learning can play in meeting demand and there is a well established section of Adult and Distance Education in the Ministry of Education and Culture. This deals primarily with adults and school leavers who have dropped out of formal secondary education, and works closely with the private distance education institutions. It also works through such organisations the Zimbabwe Institute of Distance Education which focuses on popularising distance education and the study group system. (5)

12.1 Existing courses

- Teacher training by distance learning is well known. The Ministry of Higher Education's distance education programme grew out of the ZINTEC course mentioned earlier. This method of teacher training proved to be more cost-effective than conventional teacher training programmes, and the Government initiated the national Distance Education Centre where distance education modules are designed for all teacher training colleges. (5)

- A distance education unit was set up in the University of Zimbabwe in 1993 and almost immediately recruited 3,500 students onto the BA (Ed) programme. This large influx of numbers in such a short space of time caused huge administrative problems, and the University has appointed a Pro-Vice Chancellor to take charge of distance education. The numbers do however give an indication of the demand in the country.

- In addition to the local courses, Wye College, of the University of London, offers a Distance Learning MSc in Agricultural Development in conjunction with the Faculty of Agriculture and Economics in the University of Zimbabwe (a course which makes use of a local tutor and which is very successful, with 100% pass rate to date).

- The School of Mines, a private distance learning institution, sponsored

by the mining industry, also offers a certificate of competence for mine managers by distance learning. Previously part of the Bulawayo Polytechnic, the School of Mines was re-established by mining companies frustrated by the state of public sector training. The same companies are reluctant to release employees from work for training and thus favour distance education. The system functions with a mentoring scheme within companies, with help from those who have already done the course. There is a residential element but it is not compulsory. The School of Mines is also planning to adapt material being planned by the Association of Mine Engineers, modifying it for Zimbabwean needs. The School is very much in favour of distance learning and believes it encourages entrepreneurship.

The British Council is considering running some distance learning in management subjects. It could also potentially provide administrative support in the local management of distance learning programmes.

12.2 Distance learning providers

Twelve institutions are identified on the ICDL database as offering distance learning in one form or another in Zimbabwe:

- Zimbabwe Agricultural Technical and Extension Services
- Central African Correspondence College
- International College of Bookkeeping and Accountancy
- International Correspondence Schools
- Ministry of Health
- Organisational Training and Development (pvt) Ltd
- Rapid Results College
- University of Zimbabwe
- Zimbabwe Chapter of the Federation of African Media Women
- Zimbabwe Distance Education College
- Zimbabwe Institute of Distance Education
- Zimbabwe Institute of Systemic Therapy

The Zimbabwe Distance Education College includes Correspondence in its full title and it may well be that there is a fine line between 'distance' and 'correspondence ' in the output of some of the above organisations This particular college offers correspondence texts, audio cassettes, video tapes and weekend courses and its science courses require the use of a laboratory for practical work.

It is obvious from the above list that distance learning is known in Zimbabwe. Moreover, the President is reputed to have several degrees by distance learning himself and to be in favour of this mode of learning.

12.3 UNISA

The South African Distance Learning University (UNISA) has a major market in Zimbabwe. Whereas the University of Zimbabwe can afford to buy in UNISA programmes, it cannot afford to buy UK Open University programmes, without aid. UNISA material relies heavily on texts and there is little student support at present. Consequently, drop-out from UNISA courses in Zimbabwe is high.

Nevertheless, UNISA is evidently strong competition for any UK programmes, which might be introduced in Zimbabwe although at present their courses are entirely focused in the arts and management fields; there is no engineering or technology. One interviewee did feel, however, that a UK degree would be more valued than a degree from South Africa, although the Minister of Education is reputedly not keen on Zimbabweans taking external examinations.

12.4 Cultural adaptability

There was general agreement that the Zimbabweans are well adapted to distance learning because:

- they are highly motivated, indeed more so, generally, than their European counterparts. This is especially true for those in their late teens/early twenties.

- high value is placed upon education and many know that distance education provides their only opportunity for progress

- the population is highly literate and many speak English, even though it is their second language

- many are already accustomed to the concept of distance learning

Other cultural factors were identified which are relevant to the project:

- Africans grasp three dimensional concepts later than Europeans, typically at about 16-17 years of age compared to 12. Interestingly, Chinese and Japanese are able to appreciate spatial 3-D around the age of

8. This has implications for the approach to training for several engineering disciplines

- Black Zimbabweans apparently adapt very well to Japanese working practices and work well in conditions of fairly rigid discipline

- Africans are very good at remembering the theory, but find it very difficult to put that theory into practice

12.5 Identified needs for courses

The need for distance learning is indicated by the numbers leaving the school system each year: there are in excess of 65,000 successful 'O' level students annually; of these approximately 10,000 go on to study at 'A' level, 12,000 to teacher training college, 3,000 into nursing, 3,000 into the Forces, 2,000 into forestry, mining and local government and 12,000 enter technical institutions and polytechnics. Thus around 25,000 still remain unable to gain a place in training and continue to apply for courses. Distance learning courses could help satisfy this large and unmet demand.

An indication of the potential demand in one subject area is also shown in the figures of Bulawayo Polytechnic: every year there are 10,000 applicants (all with at least 5 'O' levels) for only 200 places in hotel and catering studies. Given the level of demand, applicants are simply selected at random.

Needs were identified in the following areas:

- **Management skills** - black Zimbabweans are not well trained in business methods. As a result many projects are not being managed properly in Zimbabwe. Consultant engineers are taking the role of project managers. Many companies would like their own project managers, but simply do not have them. It is indicative of this that 90% of companies have whites at senior management level.

- **Entrepreneurship/product enterprise** - training would considerably help small scale enterprises which have the potential to expand rapidly and could absorb quite a few of the new graduates from the education system. Many of the informants felt economic success would come from the development of small businesses. Africans, in this case Zimbabweans, often find it difficult to plan ahead, and need training to help them in this area. Distance learning courses would therefore need to focus on the acquisition of entrepreneurial skills. The concept of entrepreneurship is relatively new to Africans, however, and they need

both training and encouragement in this area. It will take some time, perhaps a generation, to produce results.

• **Industrial engineering** - a broad, general engineering approach is required with significant industrial involvement.

• **Postgraduate degree** - there exists a definite need for courses at postgraduate level. Postgraduate degrees are generally achieved now by students gaining qualifications abroad. Many of those who qualify abroad do not return to the country.

• **Professional engineers** - there appears to be a lack of skills in the areas of design, production and quality assurance.

• **Water engineering** - distance learning could play a crucial role in providing necessary training in the area at postgraduate levels and in updating.

• **Electrical engineering** - there is a need in this field for courses which could act as an adjunct to the programmes, already offered in the University of Zimbabwe.

• **Advanced courses for the telecommunications industry** - there is a need for the industry to expand into advanced courses, for example into software engineering. There is also a demand for an MSc programme in telecommunications, a course which is not offered by the University of Zimbabwe. Nor does UNISA offer any telecommunication-specific courses. There is a view within the industry that as the industry develops, distance learning programmes, will also be developed to deal with the training demands.

• **Other telecommunications programmes**, - the telecommunications industry does require more engineers and wants to be able to promote technicians to the level of engineer. The BEng course (as offered by English polytechnics) in distance learning format would be an appropriate way to achieve this.

• **Training of technical teachers at the polytechnics** - there is a definite need for well-trained and experienced lecturers.

• **Courses for estimators** - this is seen as a particularly hard area in

which to find qualified people.

12.6 Current moves in distance learning

The Government is taking distance education extremely seriously. The President has set up a commission due to a report in November 1994. Apparently it is not a question of whether there should be a Distance Education University in Zimbabwe but rather when and how. There was a suggestion that the intention might be to emulate UNISA. The Commission is to determine the manpower needs of most use to Zimbabwe and then to propose how training would be organised.

The Commission has to decide whether it should be set up as a college in the University of Zimbabwe or whether it should be a separate university. It is already planned to enrol the first students by March 1995.

There is however, some scepticism. Such a distance education university is not seen by all as a serious prospect - given that the Government is committed to keeping spending down but more as a cosmetic move in view of the forthcoming elections.

Conclusions

Zimbabwe is going through a period of fundamental change, and this will be reflected in its education. It is not yet clear, however, how much the Government will simply focus on educating per se or whether it will concentrate on educating with a view to employment. If it is the latter, training and vocational subjects will assume a much higher importance. The current reforms in South Africa are bound to have an influence on the thinking and policy in Zimbabwe: if it wishes to compete with its neighbour, it is going to have to change many of its practices and focus strongly on becoming more competitive. This evidently will affect the perception of education and the role for training and updating.

In view of the population growth, the strains on the education system and the demand for education, it would seem that Zimbabwe is ripe for the development of distance education. It is difficult to estimate, as yet, the extent to which it will turn to South Africa for help or guidance in this field. Nationalism may prevail, and Zimbabwe may "do its own thing". It seems more likely, however, that it will not set about reinventing the wheel and will cooperate with South Africa, either buying in and modifying UNISA's distance learning courses or buying in from abroad other courses which UNISA cannot provide. Either way there will be financial difficulties for Zimbabwe in view of the depreciation and weak position of the Zim.dollar. There may however be no choice, as the country does not yet appear to be in a position to develop its own distance

learning courses either physically or financially.

The Government is very aware of the use and potential usefulness of distance education and would seem to be moving towards its national implementation as a form of education. The question is how much political will and subsequent resources will back up this vision.

There are major pressures upon the economic and social systems in Zimbabwe and distance education has a significant role to play. Consequently there should be substantial investment in this field for the following reasons:

- Traditional education cannot cope with the demand.

- Zimbabwe is investing in new technologies and training will be required for the workforce.

- AIDS will play havoc with the social structures of the country, including the teaching profession, and training will be necessary to fill the gaps.

- Small and Medium-sized Enterprises (SMEs) will no doubt play a vital role in the development of the economy However, these employers are reluctant to release staff for conventional training.

- The apparent demand would justify the investment.

- Distance education might help as regards the brain drain both from the teaching profession and among other sectors.

- As distance education is a portable form of education, it may well help to bring about more parity between the rural and urban areas.

- It may be the only accessible - and hopefully affordable - form of education from which women in rural areas might benefit. Their only way of advancement will be through qualifications.

In order for distance learning to work properly as a system, especially at the tertiary level, it would need the support of business and industry. There would therefore need to be an effective awareness-raising programme on the benefits of distance learning, and measures would have to be taken to inhibit poaching. Hiring expatriates is a simple but expensive solution to an immediate problem: industrialists need to be encouraged to

take a longer term view and to train their own people. Industrial support would also help to regenerate interest in traditional engineering subjects.

There also needs to be governmental support for educational reform, ensuring that there is:

- investment in the trainers and educators to raise the quality of education
- investment in industry to raise the employment chances of those being trained or educated.

Given the potential numbers of students, distance learning should be a cost-effective form of education. The cost of any course imported from the UK would need to be heavily funded or subsidised in order to be affordable for Zimbabweans. The cost must not be perceived as prohibitive, particularly as Zimbabwe may well turn to UNISA first with regard to distance learning provision.

Any training would also have to be modified and adapted to suit Zimbabwe's needs. The Scientific and Industrial Research Development Centre could play a useful role in the development and/or delivery of a distance learning programme in engineering.

The most pressing need in the field of engineering is at the technician and postgraduate levels.

- More postgraduates working in industry, especially in responsible positions, would have a long term beneficial effect on training as they would perhaps be more likely to recognise the need for training at lower levels. An increased number of MBAs working in business and industry would also help to redress some of the management issues and put in place more modern managerial practices. This would ultimately be of benefit to the whole industry.

- In the management area there is evidently a need for encouraging entrepreneurship among Zimbabweans. This would probably require a short-term but tailor-made course with intensive follow up. It would also need backing from Government.

- The academic institutions need to work more closely with industry, and it would seem that a degree in industrial engineering could help to bring this about, creating a course which would be directly relevant to the work situation. Such a course, tailor-made for industry, would also help to raise awareness, and boost the credibility, of distance learning among industrialists.

- There needs to be a strong focus on training at the technician level, both pre- and in-service. Operational maintenance would appear to be key and of vital importance across the industries, especially in the manufacturing field.

- There is also a need to encourage more people to become technicians; there is a shortage of these skills in industry. The lack of interest in the engineering field may well be attributable to poor teaching of the subject at both the secondary and tertiary levels (in the Polytechnics). Improved teacher training, perhaps by distance learning, and upgraded conditions for teachers could go a long way towards rectifying this situation.

- The Zimbabwean electronic and electrical engineering industries seem to be very weak and would benefit from education and training. Otherwise, the country will remain very dependent on imports and on imported knowledge.

- The same situation applies to the telecommunications industry. Here, there is both a need and the demand, although it is not certain whether there would be sufficient demand to merit a tailor-made distance learning course. Further research would also have to be done to ascertain the market.

- More research on the immediate needs for updating within the engineering profession needs to be instigated and this area of training needs to take on a higher profile within the country.

- Any course in engineering in Zimbabwe must lay heavy emphasis on the application of practical skills. The use of facilities, and where applicable, laboratories, must therefore be central to any course by distance learning. Student support would also be crucial to the success of any programme and might help to provide a certain form of discipline to the learning process. Further study should be carried out as to the feasibility and cost-effectiveness of using existing networks and/or central points such as polytechnics, or setting up new regional centres. The current research would indicate that the former was more cost-effective, particularly if facilities were used during the vacation period.

Appendix 3.1 - Organisations/institutions

consulted

Engineering companies

More Wear Industries (2 sites)	(Heavy engineering, railway wagons, wheelbarrows, pressure vessels)
Willowvale Motors	(Car assembly)
Cochrane Engineering (Pvt) Ltd	(Boilers, pumps, pressure vessels)
Treger Holdings (Pvt) Ltd	(Steel, travel goods, plastics, grain, security, transport, engineering)
Zimbabwe Tobacco Floor Ltd	
PTC, Technical Training College	(Telecommunications)
National Railways of Zimbabwe	
African Associated Mines	
United Refineries Ltd	
Radiator & Tinning (Pvt) Ltd	

Other organisations

School of Mines, Bulawayo

British Council, Harare

British High Commission, Harare

University of Zimbabwe, Harare

National University of Science and Technology, Bulawayo

Bulawayo Polytechnic

Institute of Water and Sanitation Development

Zimbabwe Public Service Commission

Northern College of Applied Arts and Technology, Ontario, Canada

Zimbabwe Institute of Engineers

Harare Polytechnic

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Bath City College

Brunel University

Cleveland Open Learning Unit (COLU)

College of Estate Management

College of Petroleum & Energy Studies

Construction Industry Training Board

Ellis School of Building

Engineering Council

Heriot-Watt University

Institution of Chemical Engineers

Institution of Civil Engineers

Institution of Electrical Engineers

Institution of Mechanical Engineers

International Extension College, London

Manchester Open Learning

Napier University

National Computing Centre

National Extension College

Oddbins

Open College, Manchester

Open University

Pergamon Press

Petroleum Open Learning

Plymouth College of Further Education

Rank Xerox

Rover Learning Business

Skillchange

Surrey University

Telford College

University of Bath

Wolsey Hall, Oxford

Wye College, University of London

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ODA
Overseas Development Administration
94 Victoria Street
London SW 1E 5JL

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