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Restructuring the National Polytechnic Institute, Lao PDR*

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This paper presents various mechanisms that have been adopted for restructuring the National Polytechnic Institute in the Lao PDR, from an institution operating under the umbrella of a closed, market-based education system to one that has to prepare graduates for a competitive open-market economy. Newly developed curricula, training of academic staff and steps taken for consolidating the institution building process are examined.

INTRODUCTION

THE NATIONAL Polytechnic Institute (NPI) was founded in 1984 under a five-year UNESCO-sponsored project. Three engineering departments—Civil, Electrical and Mechanical, and Basic Science—were instituted. Management and language units were created at the same time, and together with the Department of Basic Science they service the engineering departments. Engineering curricula based on a Soviet model and leading to five-year degree programs in the above-mentioned engineering disciplines were developed and implemented. To help run the Polytechnic as well as provide it with the necessary academic staff, young graduates trained in the former Eastern Bloc countries were recruited. Until recently, almost all of the lecturing staff had received their tertiary education in such countries as the former Czechoslovakia, the former East Germany, Russia, Ukraine, Uzbekistan, Vietnam and others, where most of them gained qualifications of a diploma or a M.Sc. in a particular field of study. The first graduates in civil, electrical and mechanical engineering were produced by the NPI in 1989.

Following studies conducted by several international agencies, together with new impetus provided by the proposed liberalization of the economy, the Government of the Lao PDR entered into a contractual agreement with the International Development Association of the World Bank in 1989 to restructure the NPI. Under this agreement, several objectives were formulated, the main ones being:

1. To review the current curricula and design new ones so that the NPI would be able to produce engineering graduates who could meet the forthcoming challenges in engineering in a new free-market-oriented economy.
2. To arrange the training of the lecturing staff so that they can handle the new curricula efficiently and effectively.
3. To establish new infrastructure to facilitate the implementation of the new curricula.
4. To facilitate and participate in the institutional building process of the NPI.

Technical assistance for the project, since known as the National Polytechnic Institute Project, is supplied by the Swiss Development Cooperation and channelled through the Swiss Federal Institute of Technology, Lausanne.

This paper concentrates on some of the measures taken to achieve the above-mentioned objectives and improve the academic standing of the NPI. In particular it examines the adequacy of the existing curricula, provides arguments for their replacement and defines the outline of new relevant ones in civil, electrical and mechanical engineering. Strategies for upgrading and training the lecturing staff so that they are able to cope with the new curricula are discussed. Finally, other measures concerning the institutional building process of the Polytechnic are briefly reviewed.

PROJECT FUNDING

In 1989, the International Development Association of the World Bank signed a project agreement with the Lao government for funding the project. The funds were to be provided over a project period from April 1989 to June 1995 under two categories:

1. Grant of approximately US$15 million through the Swiss Development Cooperation, for the following provisions:
   development and implementation of new engineering curricula;

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training of academic, managerial, administrative and other staff;
establishment of a Technical Services Unit for maintenance and production and a Printing Unit;
technical assistance;
procurement of office equipment and consumables.

2. Credit of US$3.5 million for the following activities:
construction of new laboratories, auditoria and other facilities;
procurement of laboratory equipment.

DEVELOPMENT OF NEW CURRICULA

The existing engineering curricula were developed in the early 1980s, when the country was still a closed economy, and economic and industrial activities were sponsored and controlled by the state [1]. They are based on a five-year study program leading to a diploma in civil/electrical/mechanical engineering. The diploma is viewed in the Lao PDR as equivalent to a bachelor's degree. Students enter the Polytechnic after 11 years of pre-university schooling and spend an average of 32 contact hours per week each semester for nine 16-week semesters. The 10th semester is dedicated to project work, which, in most cases, involves a theoretical study of some kind.

These engineering curricula carry an average of 5,030 contact hours. Details of the component areas of study as a percentage of the total number of hours can be seen from an examination of the chart in Fig. 1; it would appear that the contents of Basic Science in the existing curricula are very low. Furthermore, these curricula produce graduates in narrow, specialized fields, based on short-term socio-economic development. For example, in Electrical Engineering, students are taught a narrow range of subjects, which limits their opportunity to seeking employment in the hydroelectric supply industry.

A few years ago, the Government of the Lao PDR introduced the 'New Economic Mechanism', leading to a process of liberalization of the economy. As a result, rapid development has been experienced in such sectors as construction, mining, transportation, telecommunications, agro-based industries, tourism, electrical energy and others. This development is likely to continue well into the 21st century. It is expected that the demand for qualified engineering personnel will not only increase, but because of the new opportunities that will become available, engineering graduates with different profiles will be required.

The existing curricula are limited in scope. They are not suitable for producing graduates who will have to operate in a competitive environment. The reasons for their unsuitability are as follows:

1. They prepare engineering graduates for narrow specializations that ill-equip them to engage productively in the variety of engineering opportunities made possible by the liberalization of industrial activity.
2. They involve an average of over 32 contact hours per week. This leaves the students with little time to pursue independent studies and partake in extra-curricular activities.
3. They are too heavily biased toward theoretical work (lectures and tutorials), with little practical work built into the programs.
4. They do not encourage students to be independent enquirers and critical thinkers, and hence they do not assist in the student's ability to solve engineering problems. This is most evident in the conduct of project work which, generally, is an exercise in the collection of data and in draughtmanship.

The inadequacies of the existing curricula, as laid out above, led to a decision to develop new ones which would better prepare graduates to meet the new challenges ahead. The main objectives were flexibility of the study plan, polyvalence of the graduate's background, and comparability and compatibility of the curricula with recognized programs of study from abroad. The main features of the new curricula are elaborated below.

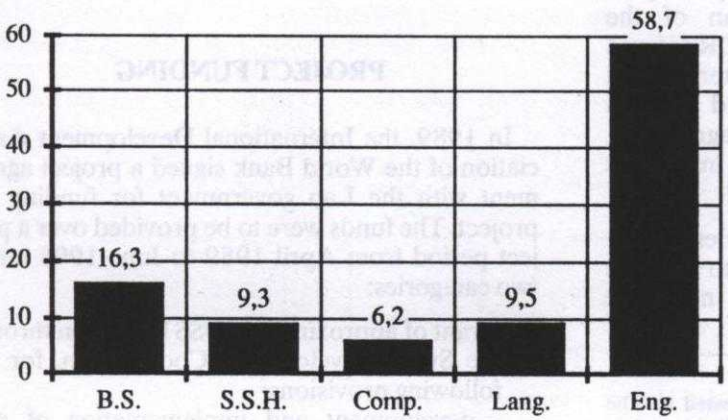

Fig. 1. Percentage distribution of contact hours in existing curricula.

- They are essentially four-year programs leading to a bachelor's degree of engineering in civil/electrical/mechanical engineering.
- The first year of study is almost common to all engineering students.
- At present, Lao students undertake 11 years of pre-university studies before joining a tertiary institution, so they are not academically prepared for a four-year engineering program. To overcome this deficiency in the students' background, an additional bridging year of study, referred to as a pre-engineering year, is provided in the new curricula. Furthermore, the new curricula are organized such that when the secondary school system is eventually upgraded to produce the equivalent of grade 12 students, these curricula will not have to be drastically modified to accommodate these new students. Students would then join the program at the first-year level.
- Students are given a strong background in the basic sciences and in the principles of engineering and their applications. The curricula are broad-based and specialization via a choice of elective subjects is afforded in the final year of study.
- The weekly average number of contact hours over the four-year program is about 27 hr, leaving the students with enough free time to undertake independent studies and to pursue extra-curricular activities.
- A substantial final-year project associated with solving an engineering problem is prescribed in the final year. Students are expected to spend a minimum of 6 hr weekly for the two semesters of the year on the project. The latter could involve the design, and/or construction of experimental apparatus and considerable testing. In many instances, students might have to develop associated computer software.

A summary of the contents of the new curricula is depicted in the bar chart of Fig. 2. For a meaningful comparison with the existing curricula, the figures represented in the chart include the contact hours of the pre-engineering year of study. The average total number of contact hours in the new curricula, including the pre-engineering year of study, is 4,550. In the new curricula, there is a substantial increase in the contents of the Basic Science subjects at the expense of those of the Social Science, Humanities and Management subjects. The apparent reduction in the percentage of computer study is explained by the fact that some of this study is built into various engineering subjects and cannot be shown explicitly. Similarly, some of the management subjects during the later years of study have been taken away from the social science and humanities block into the engineering one.

Implementation of the new curricula in the pre-engineering year of study began in September 1994, while that of the four-year engineering programme is due to start in September 1995. To avoid undue disruption in the student's learning process, the existing curricula will co-exist with the new ones for the next four years, gradually being phased out, so that only the new curricula will be left running from 1999 onwards.

When formulating the new curricula, the perceptions of prospective employers of our future graduates were considered. A recently conducted tracer study on the graduates produced by the NPI since 1989 and their employers, the results of which are nearing completion, has vindicated the rationale for the proposed curricula and shows that the choice of subjects of study for specialization purposes in the curricula was judicious.

New regulations regarding examinations and student assessment have been formulated. These are contained in separate documents.

TRAINING OF ACADEMIC STAFF

The successful implementation of a curriculum rests on factors such as a well-structured organization, a good infrastructure and, above all, a well-groomed body of academic staff. At the inception of this project, all academic staff had been trained

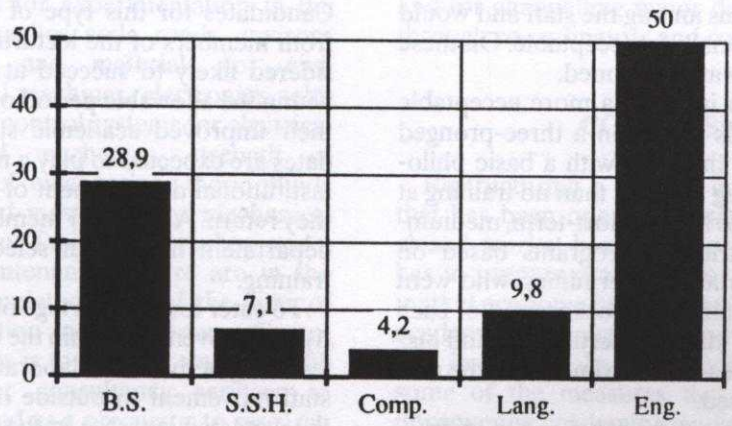

Fig. 2. Percentage distribution of contact hours in new curricula

in the former Eastern Bloc countries. There are about 110 academic members of staff, most of them with M.Sc. degrees from various institutions from these countries. Upon their return from studies, they moved directly into lecturing activities. The qualifications gained by the staff were generally in a narrow, specialized area, thereby restricting them to be productive only in their area of specialization. As an example, three members of staff of the Electrical Engineering Department specialized in the electrification of farms, two members of staff of the Mechanical Engineering Department in hoists and cranes and a member of staff of the Civil Engineering Department in railway engineering. This type of qualification may well be suited for a country with a large population and whose engineering activities are centrally controlled, thus allowing for a fine division of labour to be drawn and thereby guaranteeing employment for graduates with such specializations. However, in a small country like the Lao PDR with a population of about 4 million, it is virtually impossible to expect graduates with such narrow specializations to be productive on a sustained basis. In addition, observations have indicated that many of these staff members have a rather marginal theoretical background. Consequently, the lecturing staff are useful only within or close to their areas of specialization. With the new curricula involving a wider platform of subjects, it was unrealistic to expect the lecturing staff to cope fully with these. To remedy this situation, two different options were examined.

The first option entailed selecting the best candidates from within and outside the Polytechnic and sending them abroad for long-term (18–24 months) academic training, basically acquiring a master's degree from a reputable university. About 15% of the staff within the Polytechnic would have qualified for such training. The remainder would have had to be recruited from outside of the NPI. This option would have posed two major problems upon the return of the newly trained staff, namely (i) the extremely high costs involved in funding the training, and (ii) the plight of the staff who were not sent for training. Parting gracefully with them or downgrading them to the assistant level would have caused serious tensions among the staff and would have been deemed socially unacceptable. On these grounds, this option was abandoned.

The second option involves a more acceptable outcome socially. It is based on a three-pronged approach to training the staff, with a basic philosophy that any training is better than no training at all. Staff are selected to follow short-term, medium-term or long-term training programs based on some pertinent criteria. In determining who went for what form of training, the background of each academic member of staff was scrutinized and his/her potential for increased contribution in the new curricula was appraised.

It should be noted that the language of instruction at the Polytechnic is Lao and that, at the start of the project, virtually no one at the Polytechnic spoke English. The great majority of the academic staff speak Russian in addition to their native Lao. Some speak German and others Czech or Vietnamese. The Project encouraged members of staff to learn English, providing them with special tuition classes. This activity has been extended to cover all students. Indeed, English or French, depending on the student's preference, is compulsory in the new curricula.

The lack of proficiency in the English language by many lecturers meant that the choice of institutions to which they may be sent would be limited. However, the Thai language is close enough to Lao for good communication to be established between Thais and Laotians, and hence Thai universities such as Khon Kaen, Kasetsart and Chiang Mai have been contracted to provide short-term training. This training lasts between 4 and 6 weeks and consists of refresher courses based on the academic subjects that the lecturer is likely to teach in the new curricula. In addition, for those lecturers who are able to comprehend some English, lectures in subjects of interest are given to them by the resident expatriate advisers to the heads of department.

Medium-term training refers to practical laboratory training lasting six months. Lecturers who seem to be more useful at supervising and conducting students' laboratory experiments than at conducting lectures are selected as candidates for this type of training. At present, there are no technical staff engaged in the manning of the departmental laboratories. The main purpose of this type of training is to provide the candidate with hands-on experience of the many devices and equipment that are used for laboratory experiments in existing and future engineering laboratories of the Polytechnic. Those selected for practical training, about three from each department, are expected to manage the laboratories after they return from training. The training is conducted at well-established institutions in England. Candidates are given an intensive course in the English language prior to their departure.

Long-term training is based on the acquisition of a master's degree from a good tertiary institution. Candidates for this type of training are selected from members of the lecturing staff who are considered likely to succeed at their studies abroad within the allowable period of study. In addition to their improved academic standing, these candidates are expected to play a more active role in the institutional development of the Polytechnic after they return. About four members of staff from each department have been selected for this type of training.

To cater for the shortage of lecturing staff due to (i) staff movement within the departments, i.e. from lecturing activities to laboratory management, (ii) staff movement to outside organizations and (iii) the expected increase in the student population, a new training plan has been proposed. It is spread

over a period of 10 years and is based on recruiting prospective lecturers from among young, bright NPI undergraduate students and sending them abroad for completion of their tertiary studies and training. This would essentially consist of gaining a good undergraduate honours degree, followed by either professional training if obtainable, or a master's degree in a relevant area.

INSTITUTIONAL BUILDING PROCESS

Institution building is a long process which involves many aspects of academic, administrative and managerial activities. In this section, some of the other measures taken toward the institutional building process of the NPI are briefly reviewed.

To have a well-groomed body of academic staff, as discussed earlier, is a necessary condition for the successful restructuring of an educational institution. However, without the support of other staff, particularly those in administrative and managerial positions, the task of the academic staff would be immensely difficult, not to say impossible. In line with the general philosophy of upgrading the staff, short-term and medium-term training have also been prescribed in the following areas:

- Deanship and management at the faculty level
- Educational management
- Applied management
- Personnel management
- Accounting
- Secretarial duties
- Librarian activities

The training is formal and usually takes place at tertiary institutions abroad. Where possible, as in the case of the deanship and educational management, professional attachment through a short understudy programme at an established tertiary institution is undertaken.

Under the Project plan, the existing facilities are to be expanded. The construction of new auditoria, engineering laboratories, student dormitory, training workshop, maintenance workshop and new library is already underway. The new laboratories will include facilities for experimentation in the following areas: hydraulics, soils, roads, environmental engineering and materials for civil engineering; electrical machines, electronics, telecommunications and control systems for electrical engineering; applied mechanics, strength of materials and control engineering, thermofluids and refrigeration, and metrology for mechanical engineering. A Student Training Workshop and a Production and Maintenance Centre are in the process of being completed. One of the aims of setting up the Production and Maintenance Centre and some laboratories is to provide staff with the opportunity to offer consultancy services to industry. This is viewed as a precursor to research activity in due course.

Equipment for use in the laboratories and workshops is being acquired by international competitive bidding through World Bank procedures.

The language of instruction is Lao. However, there are virtually no technical books available in the Lao language. The library holds some old technical books in Russian, a few textbooks in French and English, and a few more in Thai. It is hoped that, through the younger generation's enthusiasm and willingness to learn English, students at the Polytechnic will eventually be able to make good use of engineering textbooks in the English language. A major effort has therefore been made to stock up the library with the latest engineering textbooks of interest. Close to 2,000 volumes have been purchased.

In addition, lecture manuscripts covering the subjects that are to be taught in the new curricula are being developed. These documents are basically the notes that experienced lecturers would make after teaching a subject a number of times. Their purpose is to provide specific engineering literature in Lao (after translation from English) for use as teaching materials by the lecturers and also as course notes for students. Some of these manuscripts are produced by the resident expatriate advisers to the heads of departments, but the bulk is being acquired from experienced lecturers from abroad.

Other measures being taken to relaunch the Polytechnic as a modern tertiary engineering institution involve the redefinition of the departmental structure. At present, each department is headed by a senior member of staff who is assisted by two deputies. All members of staff have basically equal status without a clearly defined chain of command. This poses difficulties of delegation of duties in the department, resulting in a disproportionately high work load for the head. Since his/her position is not clearly defined, his/her relationship with superiors also remains unclear. In separate documents, a clearly defined structure for each engineering department has been proposed. These documents outline a new structure for each department and define the scope of activities for each element in the new hierarchy. Guidelines have been laid down for conducting departmental business and for channelling major departmental activities through co-ordinators and committees.

CONCLUSIONS

Restructuring a tertiary engineering institution that has been operating under the umbrella of a closed, market-based education system to one that has to prepare graduates for a competitive open-market economy involves major adjustments in the academic, administrative and managerial set-up of that institution. In this paper, we have examined some of the measures that are being taken to improve the academic standing of such an institution. In particular, we have discussed the develop-

ment of new engineering curricula and strategies for upgrading and training the academic staff. Finally, we have briefly reviewed some of the steps taken to introduce an academic culture, in line with the institutional building process of that institution. It is hoped that the restructuring mechanisms presented in this paper may be useful to other institutions facing similar challenges to those of the NPI.

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