

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

in collaboration with
UNIVERSITY OF SUSSEX (ENGLAND)

RESEARCH PROGRAMME NO. 55
SCIENCE POLICY STUDIES IN THAILAND

RESEARCH PROJECT NO. 55/5
BILATERAL RESEARCH LINKS : U. K.-THAILAND

REPORT NO. 1
INSTITUTIONAL LINKS IN SCIENCE AND TECHNOLOGY—
THE CASE OF THE UNITED KINGDOM AND THAILAND

BY
HENRY R. GLYDE

ASRCT, BANGKOK 1973
not for publication

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PREFACE AND GUIDE TO THE REPORT

This paper presents the results of a study of recent and continuing Links in Science and Technology between institutions in Thailand and the United Kingdom. The purpose of the study was two-fold: to identify those factors which consistently distinguish the successful from less successful partnerships and to assess the role and special advantages of bilateral links in development. From the results some suggestions for future links are proposed.

In presenting such a study it is impossible to meet the needs of detail and brevity required by all readers. For this reason, the paper is made up of largely self contained sections which may be read separately.

Those readers interested in a brief summary only should begin with the summary of results in section 1. Those interested in these results plus the policy implications drawn from them should then pass on to section 7. (In reading the policy implications it should be kept closely in mind that they are drawn from 16 cases involving two countries only.) Section 5.8 will also be useful in drawing the connection between the results and the proposed implications.

For those with a deeper interest, section 4 describes two link cases in some detail; one most successful and the other much less successful. These two were specifically chosen to illustrate those factors which appear to distinguish successful from less successful links. Section 5, the central work of the study, then discusses these factors explicitly as extracted from all the cases studied in detail. Finally, section 6 presents the assessment of the role and special advantages of institutional links in development.

For those more interested in science and development studies and less in links, the section on the background to the study, the methodology employed and the suggestions for future work (in sections 3, 4 and 8 respectively) will be of most interest.

INSTITUTIONAL LINKS IN SCIENCE AND TECHNOLOGY—

THE CASE OF THE UNITED KINGDOM AND THAILAND

By Henry R. Glyde*

1. SUMMARY OF RESULTS

This report describes a detailed study of 16 bilateral links in science and technology between institutions in the United Kingdom and Thailand. The chief purpose was to identify those factors which distinguish the successful from the less successful links. Link success was judged against the achievement of its stated objectives and the development of a continuing capability in the Thai institution. A secondary aim was to assess the role and special advantages of links in development. The study was carried out over a period of one year, three months in the United Kingdom and nine months in Thailand.

The study of the factors distinguishing the successful from the less successful links found that:

- 1) Links initiated by direct contact between individuals in the respective institutions tended to be more successful than those initiated by a third body. In the direct initiation cases, the initial contact could usually be traced to an AC national working in the DC.
- 2) Links in which the objectives were set within the DC institution tended to be more successful. Particularly, objective setting by short survey of the DC by AC nationals were associated with less successful links. However, survey by the AC institution with the purpose of limiting previously set objectives to areas of AC institution competence were associated with successful links.

*This work was carried out while the author was on the project staff of the International Development Research Centre, Ottawa, Canada. The views expressed are those of the author and do not necessarily represent the views of the Centre. Present Address: Theoretical Physics Branch, Atomic Energy of Canada Limited, Chalk River Nuclear Laboratories, Chalk River, Ontario, Canada.

- 3) There was no apparent relation between the nature and field of link activity and link success.
- 4) Links tended to be more successful if the AC personnel visited repeatedly (mainly for short visits) in small numbers rather than for a continuous long period in a group.
 - individuals or pairs were favoured over a group
 - repeated visits with intervals were favoured over continuous visits
 - short visits by experienced personnel were favoured.
- 5) Links were more successful when the overseas training was integrated with the AC technical assistance visits. This often meant starting the training before the assistance visits.
- 6) Links involving core funded AC institutions tended to be more successful. Core* funded institutions were associated with:
 - a) paired institutions having a large area of common interest prior to the link;
 - b) AC institutions with previous interest in developing countries;
 - c) AC institutions with previously demonstrated competence in DC work.
- 7) The more successful links were associated with DC institutions having a strong and enthusiastic management.
- 8) Small link programmes tended to be more successful than large ones.
- 9) No one single factor predominantly differentiated the successful from the less successful links. Rather the successful links fulfilled many of the above conditions. These conditions were heavily interdependent and mutually self supporting.

*Core funding is defined on page 33.

The observed special advantage of links were that they provided:

- a) a focusing of overseas training to selected subject areas;
- b) an integration of overseas training and technical assistance;
- c) an emphasis on management and post academic training via cooperative programme execution;
- d) flexibility (and experience) in the technical assistance allowing the DC institution to select and manage its aid requirements more effectively;
- e) a number of practical advantages such as
 - access to expensive and sophisticated equipment for the DC centre
 - access to AC markets via the AC centre for the DC centre
 - access to verified and reliable product samples for the AC centre
 - access to information on DC customs and values for the AC centre.

These advantages to links make them potentially most effective in helping to develop an independent capability in the DC institution.

Links, on their own, did not seem effective in turning R and D activity in AC institutions toward DC problems. Funding and a mandate was required in addition to the interest promoted via links.

2. INTRODUCTION

At present there is much questioning of the role and methods of aid to the developing nations of the world^{1,2}.^{*} This questioning and examination has particularly turned attention toward the direct application of science and technology, plus the supporting capability it requires, to economic development^{3,4}.

^{*} Citations and references in this report do not conform to the style adopted by ASRCT, but they have been left in the form chosen by the author, because to request the author, who is now in Canada, to make revisions would considerably delay the reproduction of this report. — Editorial Services ASRCT. 7

One of the most distinctive differences between the developed and developing nations is their respective levels of technological capability. In the presence of advanced nations, this difference leads to a structural relationship between nations^{4,5} in which the technically more advanced nations have enormous advantages in capital and in organizational as well as technical capability⁶. As a result, the type of local or international ventures which look advantageous and are undertaken by developing nations is often set by this structure rather than by a development objective^{3,5}. Whether these ventures and the structural relationship itself restrict development^{6,7} or offer special advantages for development depends critically upon the way in which such ventures are selected and managed^{5,8} and on an understanding of the structural relationship.

For this reason attention has now focussed on

- a) the genuine transfer of technology and technique to the developing countries⁵ and
- b) the development of an indigeneous and independent capability to understand and manage both imported technology and local resources in the developing country^{9,10,11}. This is based on the belief that independence (and security) relies ultimately on the competence and ability to understand, take part in and direct (as well as control) ones own economic affairs¹². This direction now requires a working understanding of technology.

There are many possible ways of importing technique and developing a local capability. One of these is a cooperative link between institutions in a technologically advanced and in a developing country. ACAST¹³, for example, has expressed a specific interest in such links for their special advantages in development. For the AC institution the link provides vital knowledge of and creates interest in developing country issues. This can turn some of the large managerial and R & D capacity in the advanced nations toward the special problems facing the developing regions of the world. For the DC institution, it provides training and cooperative programme execution. This cooperation provides the need and motivation to understand new technology and the methods used by the AC. Particularly, the cooperation can be

specifically oriented toward developing local capability in research and industrial project management. Basically, a link takes advantage of the difference in technical level of the two nations using this difference to accelerate rather than hinder development.

There have been some previous studies of institutional links; mainly involving universities¹⁴. These studies have been reviewed in a recent Unesco report¹⁵ which surveyed bilateral institutional links in science and technology throughout the world. The Unesco report provides an excellent account of the extent of links and the variety of collaborations that existed as well as citing the potential of links for the future. The purpose of the present study is to examine how effective links are in achieving their goals and in fulfilling the needs noted above. Particularly it aims to identify those factors which distinguish the successful from the less successful links in this regard. At the same time the special role and advantages of links in development is examined. In this sense the present purpose is analytic rather than survey and complements the Unesco work.

Since the purpose here is analytic, a detailed study of each link is required. Only a small number of links could then be considered in the time available. In a small sample the impact of variations from link to link which are largely external to the link itself can be important. This problem can be greatly reduced by restricting the links considered to those between institutions in two countries only. In this way variations due to special national characteristics can be removed. The particular case of links between institutions in the United Kingdom and Thailand was chosen for a number of reasons. The magnitude of the technical assistance between the two countries, for example, is of a size that provides a convenient number of links (16). It was also a choice that made visits to the institutions in both countries possible. These questions are discussed further in Section 4.

Finally, bilateral institutional links are but a small component in the manifold of aid possibilities^{1,5,16}. In this small component, we have considered only the case of the United Kingdom and Thailand. For this reason, the present study is largely a pilot study. It will be useful if it can contribute toward a deeper understanding of this

small area. It will be particularly useful if it points directions for and encourages further study both in a wider area of links and in other extensive development issues.

3. THE METHOD AND STRUCTURE OF STUDY

3.1 Definition of links and success

Once the scope and purpose of the study had been set, the basic method was case study of recent and existing links.

A link was defined as any cooperative collaboration, formal or informal, between two institutions. This included collaboration in which sample exchange and cooperative work took place by correspondence as well as by personnel exchange. (Many productive ventures took place at a sample exchange and shared effort level.) This is a broader definition than employed by Unesco which required personnel exchange to constitute a link. The present definition did not include training schemes for personnel from one institution to another unless there was some specific agreement or collaborative work in addition.

Some links had separate branches between quite distinct groups in a given institution pair. These were combined into a single link provided they were not too large or diverse. All the links considered were recent enough to have continued in the late 1960's with many still in existence today.

Since the central purpose of the study was identifying factors which distinguish successful from less successful links, a criterion of success was required. The level of success was judged against two features. The first was the extent to which the link achieved its prescribed objectives. This is basically an impartial criterion since it makes no judgement on what links should achieve. The second was the extent to which the link increased the DC institution capability to continue in the link or associated activity independently. Each link was assigned a level of success rating; low, moderate or high. A high rating was assigned only if the link scored well on the second criterion as well as the first. Since the second criterion involves a value judgement on what links should do, this introduces an important and intentional bias into the study results. Finally, more was expected of a

large or costly link in an effort to obtain a measure of success per unit input.

3.2 Selection and location of links

Given the purpose of the study, the United Kingdom and Thailand case was chosen largely for convenience. This choice made it possible to visit both institutions involved in most cases and in each case someone intimately involved with each institution was interviewed. Thus both points of view were heard. The study was carried out over a period of a year with three months spent in the United Kingdom and nine months in Thailand. During the period in Thailand other activity such as work in government institutions, lecturing in universities and visits to planning bodies provided a contact with Thai institutions wider than the linked institutions. The Thai-United Kingdom restriction also provided a reasonable number of links for detailed study.

While the restriction to institutions in two countries only served to eliminate factors that depended on national characteristics, it also means that the total study results could be very country specific. This point was tested by examining briefly links involving countries other than the United Kingdom. This examination suggested that the United Kingdom was not a special case. There was, however, no test of links not involving Thailand.

The links themselves were located in an ad hoc manner by visits to funding agents and to those directly involved in technical assistance. The visits to those directly involved in technical assistance proved most effective in locating links largely because the links were funded from a wide variety of sources with some funded internally. The complete training scheme to the United Kingdom supported by the Overseas Development Administration (ODA) and the British Council was examined for correlations between United Kingdom and Thai institutions which might suggest links. In this way enquiry in both countries suggested that most links had been located but there is no guarantee that all were found.

3.3 Formulation of questions

There then remained the problem of identifying the important factors and characteristics of links so that suitable questions could be asked. The previous studies cited by Unesco suggested a number of questions but these could not be articulated precisely prior to the study and were often felt to be incomplete. As a result, in the first few links a wide variety of questions were asked and a large number of people were interviewed on an informal basis. This made the study of the first few links time consuming and in many aspects quite wasteful. However, a number of important factors and patterns emerged which could be more specifically tested in the remainder of the cases. A detailed questionnaire was drawn up after the initial few links but in practice this proved less useful than informal discussion around broadly defined issues in the remainder of the cases.

Finally, there was much difficulty in deciding what constituted a convincing demonstration that a given factor was important in fixing the success level. It is not solely statistical since, for example, while repeated assistance visits were associated with successful links, the visits may have been repeated because the link was successful for quite other reasons. In this study, a combination of statistics and "reasonable" explanation is used to identify the important factors. This is not always entirely convincing and the study would be much improved by more extensive statistics.

4. TWO ILLUSTRATIVE LINKS

In this section we review two of the links studied. These two were chosen because they involved similar institutions, similar goals and subject matter with each having approximately equal potential importance for development. One of the links was regarded as immensely successful while the other was regarded as only very marginally successful. Thus comparison of the two serves to bring out, by example, the organizational and operational characteristics which distinguish successful from less successful links.

The presentation of two specific cases should also serve to add a touch of reality to the more 'abstracted' results of section 5.

4.1 CASE 1: The institutional link between

The Departments of Mechanical
& Electrical Engineering
Chulalongkorn University
Bangkok, Thailand

Department of Engineering
Cambridge University
Cambridge
United Kingdom

The initiation of the link

The concept of the link originated with a concern by the National Education Council of Thailand (NEC) about the small number of engineers being educated in Thailand. The NEC then approached the British Embassy in 1963 and the NEC and British Council together visited Chulalongkorn. This visit is the first contact leading to the link as seen by the Chulalongkorn group.

This was then followed by a visit by three people from the United Kingdom to Thailand to assess and advise on what best could be done at Chulalongkorn. Each wrote a report. The third report suggested the need to improve the quality of the engineering teaching before increasing the numerical output. The proposed link was also intended to initiate some research in engineering and to include study abroad (United Kingdom) for some of the faculty and students in an effort to improve quality.

ODA then looked for a linking university in the United Kingdom and contacted Cambridge. The head of the Engineering Department at Cambridge contacted the faculty at Cambridge who ultimately came to Chulalongkorn.

The objectives of the link

The method of setting the objectives used three inputs. Firstly, there were the three assessment surveys of the DC institution by AC nationals (none of whom came from the subsequent AC institution). There was next the original survey by the NEC which proposed the link or aid initially. Thirdly there were the ideas from the DC institution on the needs in engineering and what was compatible with and in DC institution's own interests.

None of the objectives proposed from three sources agreed. The initiating purpose of the NEC to double the engineering student output gave way to the AC survey advice that improvement of the quality of the engineers was more important. The DC institution, Chulalongkorn, then appeared to favour strengthening the undergraduate course work while the AC advisors apparently favoured developing graduate courses. From this discussion, the idea of an optional fifth year diploma course emerged. This fifth year was to be added to the usual four years of undergraduate engineering training. The diploma course would aim to improve the quality of engineering training via project and laboratory experience but it would not constitute a graduate course.

The AC institution did not contribute toward setting the objectives. Rather the AC institution was chosen by ODA after the objectives had been set.

The institutions involved in the link

The AC institution

Engineering at Cambridge University is world renowned for its excellence. This is both in its teaching standards and in the calibre of research which is done in its laboratories. Cambridge has a clearly demonstrated competence in engineering, the subject matter of the link.

On the other hand, those from the engineering department at Cambridge who participated in the link, had not had any previous experience in developing countries. The engineering department is almost entirely oriented toward and has its value and goal structure fixed to AC standards and interest. There is, for example, no section funded to specifically consider engineering problems in developing countries.

The DC institution

Chulalongkorn is the oldest university in Thailand and an obvious choice to establish an improvement in engineering manpower output. At the time the link was started (1964), however, there did not seem to be much effort toward nor desire for a research capacity at Chulalongkorn. Certainly there was little institutional structure to support it and few people motivated in this direction. Generally, the organizational base to direct link activity did not seem strong.

The link activity

The activity of the link consisted firstly of a large group of AC personnel coming to Chulalongkorn to establish the fifth year course and to initiate research. This consisted of a project leader, about six other academics and two Voluntary Service Overseas (V.S.O.) officers. All came out for extended periods rather than short visits. The original project leader remained for 15 months after which time he returned to Cambridge - his leave of absence being expired. A second project leader came out from Cambridge for one year and there after one of the academics who came with the original group was appointed as project leader. There were no repeated visits by a continuing leader throughout the link time.

The fifth year course was established but it was generally poorly attended. Research was begun initially by the AC group working and doing the research themselves. A programme of sending the DC personnel to do graduate research work in the AC was included in the link. Approximately six students were trained in engineering, three to the Ph.D. level. None of these went to Cambridge. Most of these returned late in the link activity and hence were not able to take part in the research with the AC personnel at Chulalongkorn.

Shortly after the link started, it became clear that there was a language communication problem and, to remedy this, additional English language training was started. At Chulalongkorn, there was already an English course in each of the first two years of the undergraduate course. The additional language training consisted of continuing this English course into the third and fourth years. In addition, approximately seven students were sent to the United Kingdom for training in English language to teach this course.

Funding

The funding for the AC contribution was provided by the Overseas Development Administration at an approximate rate of £50,000 per annum for the five years of the link. This was to cover the AC personnel working at the DC centre, the student training abroad and a small equipment allotment. The building space and the bulk of the equipment proposed was supplied by the DC institution.

Assessment of success

By all interviewed the link was not regarded as a success. In terms of imparting an indigenous and independent research and teaching ability the success must be regarded as low. However, some parts were more successful than others and some distinction is required.

Firstly, although the fifth year engineering course was instituted, it was poorly attended. Only a handful of students enrolled for it. The course exists today but has only one or two students per year. Hence this section was not successful.

Secondly, the engineering research section never really materialized and does not exist today. Some research was undertaken while the AC group was at the DC centre and was done by the AC group. There was little participation by the DC institution members and those who trained overseas essentially returned too late to take part or were not able to take part.

On the other hand the English language course, a small part of the total effort, was regarded as a success by all interviewed. It was well attended and found most useful. It exists today and will be continued almost certainly. It appeared to fill a much needed role in the engineering training - that is, improving the English ability of engineers and hence facilitating their contact with engineering information sources. The addition of two courses of English teaching fitted well into the undergraduate programme and English is recognized as a priority need.

The link had some impact in that, in a general way, it pointed up some of the organizational changes required in the DC institution to make research possible. The training abroad also was regarded as generally successful in improving the ability of those trained.

Summary & critical assessment

The idea and concept of the link originated outside the two institutions ultimately involved. There was no evidence that either institution had given any long term thought to the link activity. There was also no evidence of sustained interest in the link activity. The objectives were set by AC personnel making short visits to the DC institu-

tion. It seems that the assessments involved in these visits appeared critical to the DC institution and generated certain sensitivities and apprehension of the subsequent link activity.

There was a general consensus that the addition of a fifth year was inappropriate. The fifth year did not fit into the career or value system of Thailand. It was not a research or M.Sc. degree and hence did not carry the prestige and value of a graduate degree. Yet, it was not part of the undergraduate course which was completed after the usual four years. As a result there was little incentive to take the Diploma course and little reward for having completed it. It did not seem fully supported by Chulalongkorn as the solution to their needs. The objective of establishing research appears to have been well received by the DC institution. However, it is not clear that this was a serious functional possibility at the time the link was proposed.

The inappropriateness of the objectives seems the central reason for the reduced success of the link. A broad, but well defined object of improving the quality (or quantity) of engineering training with the details left to the two institutions may have been more appropriate.

The link began with a large team of AC personnel arriving at the DC institution. Their impact appears to have been too large and to have generated apprehension concerning a possible loss of control in the department on the part of the DC staff. Specifically, the DC members mentioned that a smaller group would have been more appropriate. A small AC group would have had to work more closely with the DC staff and there would have been less tendency for self alignment. This self alignment made communication and working relations difficult.

This was also a genuine language problem which made communication difficult. The English language ability of many students was poor yet none of the AC members knew any Thai.

The DC 'counterparts' for the research effort did not materialize or took little interest in the research. This was firstly due to a financial problem. Many DC nationals in the universities hold additional positions to supplement their income. Participating in research would mean a direct loss of income and, at the time of the link, there was no provision to cover this loss if research was undertaken.

Secondly, there was an apparent reluctance on the part of the faculty to release staff to work with the AC nationals. This reluctance seemed connected with the apprehension, on the part of the senior staff, of loss of control in the department. Also, the timing of the overseas training was such that it did not increase the number of trained DC personnel available for research during the period of the link.

The DC financial contribution was the supply of building space and equipment. While the working space was amply supplied, there were long delays in obtaining much of the equipment. This seemed largely due to the administrative procedure which requires an advanced listing of needed equipment to stand for at least one year before the equipment can be obtained. In an attempt to speed activity, the AC group did not always follow the established procedures and this served to reinforce feelings of apprehension in the DC staff.

Finally, the bond with Cambridge was not strong. The students did not go to Cambridge and there was no continuous leadership of the AC group from Cambridge. Hence there was a general absence of effective and personal contact between the two groups. This is possibly a direct result of the complete orientation of engineering at Cambridge to AC concerns. In addition, the link did not provide any specific benefit for Cambridge or contribute toward its objectives.

By contrast the English language course was well attended and regarded as most successful. Here, the objectives were set over a long term by the DC institution in collaboration with the AC group and in full knowledge of the teaching structure. The language courses fitted directly into the existing administrative and goal structure of the DC institution and country. Only a small AC group was involved and there was no communication problem in language or in separation of activity.

4.2 CASE 2: The institutional link between

The Faculty of Tropical Medicine
Mahidol University
Bangkok, Thailand

The Liverpool School of
Tropical Medicine
Liverpool, United Kingdom

The initiation of the link

Professor Chamlong Harinasuta, the Dean of the Faculty of Tropical Medicine at Mahidol University, completed his M.D. from the University of Medical Sciences (now Mahidol) in 1944, and his diploma in Tropical Medicine in Calcutta in 1948. He then wished to establish a school of Tropical Medicine in Bangkok but felt he first needed further education in the area. At this time the British Council opened an office with a liason officer visiting Thailand announcing the possibility of study in the United Kingdom. The Dean was advised by an Australian doctor passing through Thailand of Professor Maegraith and the Liverpool School of Tropical Medicine. Professor Chamlong wrote to Professor Maegraith and arranged a place. Subsequently both the Dean and Liverpool wrote to the British Council who funded the three year Ph.D. study which took place from 1951-53.

In 1956, Professor Maegraith visited Thailand and asked Professor Chamlong for more Thai graduate students. Then in 1959 the Dean proposed the Mahidol School of Tropical Medicine to the National Education Council. The NEC approved and WHO, at the request of Mahidol, asked the Professor at Liverpool to come for two months to advise on setting up the school. Since then he has come eleven times in twelve years to assess the progress of the school and advise on further work.

The objectives of the link

The objectives of the link were set by the DC institution itself in consultation with the AC institution. These objectives were to develop a school of Tropical Medicine for research into indigenous tropical diseases of Thailand and to establish a Diploma in Tropical Medicine and Health teaching course. With an intimate knowledge of the local situation, this school was designed to fit the local needs and value structure. For example, Professor Chamlong's own interest was primarily in research, but he knew that if the School were to be a properly integrated part of Mahidol University that it must include a strong teaching component. At present the emphasis is approximately 50% teaching, 50% research. In the research effort, approximately 50% of the time is spent in those parts of Thailand where the conditions and diseases themselves exist.

For the AC institution the objectives were a source of medically trained Ph.D. students and access to the real field situation to which the Liverpool School is oriented.

The institutions involved in the link

The AC institution

The Liverpool School of Tropical Medicine was established in 1898 and, initially at least, supported by the Liverpool Steamship Owners Association. The founding purpose was study of tropical diseases contractable by sailors on voyage to Africa. Africa is still the chief area of interest and Thailand is the first interest outside Africa.

The Liverpool School has a long history and a clearly demonstrated expertise in the area of the link activity i.e. in Tropical Medicine. It has had previous experience in managing relations with DC's. Its mandate is oriented directly toward DC issues and had 'core' funding which ensures a stable and continuing career pattern for those directly concerned with DC problems. As a result it is likely to have a large measure of common interest with a DC institution and a genuine expertise to contribute.

The DC institution

The Mahidol Faculty of Tropical Medicine did not strictly exist prior to the link. However, the nucleus of the school contained enthusiastic and highly motivated people eager to develop an institution of excellence.

The link activity

The link included firstly about 8 students going for advanced degrees from Mahidol to Liverpool. In time order, much of this was done before and in the early stages of the Mahidol School. The training, due to the large overlap of interest of the two institutions, and the timing provided faculty who could return to work directly in the areas needed to build up the Mahidol School. Approximately one half of the senior faculty of the school were trained at Liverpool.

Next, the link included repeated short term visits by the same professor from Liverpool to Mahidol. A visit of approximately 4-6 weeks

duration took place each year. The purpose was one of assessment of previous progress, discussion and consultation in the development of the teaching and research programmes of the school. These visits provided continuous and uniform appraisal and advice on direction during the development of the Mahidol School. The intervals between visits provided an opportunity for the Mahidol faculty to proceed on their own, in their own way and hence develop a large measure of independence. There was one additional short, expert consultant visit by a professor again from the Liverpool School.

From May 1968 to October 1971 there was one long term technical assistance visit from the AC institution. The purpose of the visit was to execute research and to help establish the Department of Tropical Nutrition within the Mahidol school with the present department head. The present head and the expert were graduate students together at Liverpool and had established a close relationship over a period of five years prior to the visit. This field experience directly supported the career development of the expert.

In arranging the "expert" visits from Liverpool to Mahidol a clear distinction was made between short term, consultative and advisory visits and long term execution visits.

Funding

The funding was largely provided by the Overseas Development Administration (ODA). This funding included support of expert visits to Mahidol, support of advanced study at Liverpool and some equipment funding (£16,000) to support the long term visit and the establishment of the Department of Tropical Nutrition. WHO contributed to expert visits while IAEA contributed to student training and equipment.

Assessment of success

The link was rated as immensely successful by all persons consulted. Firstly, it played a major role in establishing an excellent school of Tropical Medicine in Thailand. This was done by training people in the appropriate field and supporting this by expert visits to the new school to aid successful installation and development of the local effort. The link thus greatly increased the indigenous ability to continue inde-

pendent work in an area of direct importance to Thailand. This was accomplished by close integration of the training and technical assistance components. The link also produced a great deal of research results during its period of existence. The link continues today.

No single aspect stands out as particularly promoting the success. Rather it seems due to an assembly of a number of supporting and well managed aspects.

Summary & critical assessment

The link was initiated by direct contact between the DC and AC institution with most of the initiative coming from the DC institution. The idea and concept of the link originated within the linked institutions again chiefly within the DC institution. The link directly supported the development activity of the DC institution and was basically an instrument for the DC institution to achieve its goals. The link was a part (a large part) of assistance selected from a number of areas. The knowledge that funding was available played some role in sparking off the initial study and the link itself.

There was also long term interest and thought given to the link activity prior to the link itself in the DC institution. Connected with this thought and the direct initiation was a strong and long term personal contact between the two groups. The objectives were set by the DC institution following this thought with full familiarity and taking account of the needs and criterion set down by the developing country (e.g. the teaching and research balance, the need for extensive field work). The objectives of the link were broadly laid out with the details left to the institutions.

A pronounced feature of the link was a strong and imaginative direction of the link activity by the DC institution. This direction ensured that the link activity was managed to support the DC institution. Since there was a large and genuine overlap of common interest between the two institutions, this activity also supported the goals of the AC institution. The AC group had a long previous experience and demonstrated ability in the area of activity of the link. As a result it had a definite expertise and competence to bring to the collaboration. The AC group also had experience in managing AC-DC relation and received

core funding to consider DC issues which provided a base for a continuing career interest in DC issues.

The training received in the AC institution was immediately appropriate to the DC institution needs. This was supported by repeated, short term visits by senior and highly competent AC centre people to advise and monitor progress of the DC school. These visits provided expert advice with intervals in which the DC personnel developed their own working methods and independent abilities. There was never a large number of AC personnel at the DC centre to inhibit independent development. There was always a clear distinction between the role of long and short term visits.

5. THE FACTORS DISTINGUISHING SUCCESSFUL LINKS

The chief purpose of this study is to identify those factors which distinguish the successful from the less successful links. In this section the results of this identification are presented. In practice the factors which emerged are very interdependent. To discuss them, however, it is convenient to divide the link into sections such as its initiation, the setting of its objectives and its overseas training component, and to treat the factors as independently as possible. These factors are then brought together and their strong interdependence is emphasized in the final subsection 5.8.

5.1 The initiation of links

The relation between the way in which the link was initiated and its subsequent success is indicated statistically in Table 5.1. In the Table, the manner of initiation of each link is classified into one of four different categories. The Table suggests that links initiated by direct contact between individuals in the respective institutions tended to be more successful than those initiated by a third body (e.g. a funding agent) bringing two institutions together.

TABLE 5.1 THE METHOD OF INITIATION OF THE LINK AND THE LINK SUCCESS^{1/}

Mode of initiation	Level of link success		
	L	M	H
DC → AC		6	4
AC → DC		1	
Via third body		1	
By third body	3		

DC → AC Initiation by direct approach from the DC institution to the AC institution

Via third body initiation by one institution through a third body who locates the other institution

By third body initiation by a third independent group which brings the two institutions together

^{1/} All the Tables will consider only 16 links since link No. 12 is too recently formed to judge the success.

On the basis of interview comment, a number of interrelated reasons emerged which support (and partly explain) this characteristic.

Firstly, in the cases of initiation by direct contact the idea and concept of the link originated within one of the institutions. This was usually within the DC institution. As a result, some detailed thought about the link, its purpose and role had occurred before the initiation. Particularly, the concept of the link emerged from the interests of the institution and was generally observed to meet its needs. Also, the direct initiation by the institution itself suggested a degree of interest and motivation that was likely to carry the link through any subsequent set backs.

On the other hand if the initiative came from outside either institution, the concept and idea will also have been developed outside. In these cases, the link was not obviously the best solution to the institutional needs. Also, there was no evidence of commitment to the link and the apparent initial interest may have been largely a response to a funding opportunity rather than a genuine interest in the link itself. This difference in level of motivation for the link seemed the most important feature.

Secondly, for the two centres to be able to select one another, a number of characteristics, which we will subsequently see are associated with successful links, must have been present. For example, for the DC centre to know of the existence and interests of the AC centre, in most cases it meant that the AC centre had done some work previously in DC's. Hence the AC centre selected usually had some previous experience and a direct interest in DC issues. Also, in the directly initiated links there was usually a large overlap of common interest between the two centres. At the same time, the contact usually resulted from direct or indirect personal contact. This personal contact allowed the link to develop slowly and provided detailed information on the appropriateness of the institutions and the most profitable areas for cooperation. It also guaranteed the amiable personal relations which seem so important in link ventures.

Since direct initiation of a link requires a previous knowledge of the opposite institution, it was interesting to trace this knowledge back to the original source. In tracing back the contact, it turned out that in a large number of links, the initial contact which led to the link could be traced back to an AC national working in a DC while only in a few links could the contact be traced to a DC national working or studying in the advanced country. This point is displayed statistically in Table 5.2

TABLE 5.2. THE LINKS AND THE TYPE OF CONTACT BETWEEN THE DC AND AC TO WHICH THEIR ORIGIN CAN BE TRACED

Origin tracable to	Number of links
AC National at DC	9
DC National at AC	2
Previous link contact	2
Neither	4

From interview discussion the role of the AC national is firstly as a provider of information on AC institutions and secondly as a provider of personal contact and introduction. In many cases the subsequent link hinged heavily upon these individuals. Thus, while in

Table 5.1 we see that much of the initiating contact was from the DC to AC, this initiative was often made by or in close collaboration with an AC national in the DC centre.

In the two cases in which the contact could be traced back to a DC national studying in the AC, the link was initiated more than ten years after the study took place. Thus, while Table 5.2 suggests that AC nationals in DC's are more effective than DC nationals in AC's in promoting link contacts, it may be a question of time delay rather than any absolute difference. This is possible since most links are associated with senior people in the DC institutions (see Table 5.12).

From Table 5.1 we also see that most of the observed links were initiated by direct contact between the two centres rather than via or by an independent body acting as a go-between. This is not a useful statistic from a predictive view point since the purpose is to promote successful links rather than to simply promote a large number of links.

Finally, Table 5.2 also suggests that links themselves do not have a large 'multiplier effect' in producing further links. Here again, though, there may be a problem of time delay.

In tracing the initiation of links, it appeared that the knowledge that funding was available for a link acted as a strong stimulus or spark for the direct initiation.

5.2 The objectives of links

The setting of appropriate and realizable objectives seemed the most decisive factor in setting the ultimate level of success of a link. These objectives must be appropriate to the needs and interests of each centre (particularly to those of the DC centre). They must also be realizable given the limits and mandates of the paired institutions.

In Table 5.3, the way in which the objectives were established, which reflects the source of the objectives, is divided into three categories:

- (a) those set following a survey of the developing country by an AC national;
- (b) those set during a long collaboration between AC and DC nationals when an AC national was working in the DC centre

and

(c) those set essentially by the DC institution on its own.

TABLE 5.3. THE METHOD OF SETTING THE LINK OBJECTIVES AND LEVEL OF LINK SUCCESS

Method of establishing the objectives ^{1/}	Level of success of the link		
	L	M	H
Use of DC centre recommendations		3	3
Long term collaboration by DC-AC personnel working in the DC centre		4	2
A survey by the AC	2		

^{1/2} - objectives source unknown.

The relation between these methods and the subsequent level of success of the link suggested first that links in which surveys by AC nationals were used to set objectives tended to be less successful.

In the cases in which an AC survey was used, the purpose of the survey was both to decide whether to support the link and to set the objectives. In each case the survey was associated with a link initiated by a funding agent. This association is almost inevitable since the idea of the link originated outside the two institutions and an idea or concept implies objectives.

During interview, a number of issues emerged which support the above point. Firstly, the short AC survey had little time to develop a feeling for the local situation and hence was unable to gauge or foresee the implications of the suggested course of action. For example, in both cases the objectives suggested by survey did not fit into the DC administrative and value system. This led both to difficulties in execution and to a low level of enthusiasm since accomplishment in the link activity was not fully recognized as accomplishment in the developing country at large. There was also suggestion that some of the AC surveys appeared brisk, critical and lacking in understanding of the DC centre. This generated some sensitivities which set the link on a less than ideal beginning. In addition, the objectives set out were not

able to take full account of the institutions and people who would subsequently be involved. Finally, the objectives appeared imposed from without and hence there was a reduced commitment to them. There is a natural human tendency to be more enthusiastic and committed to one's own ideas and objectives.

In three cases there were AC surveys of the link possibilities with the purpose of limiting objectives and assessing what contribution the AC institution could make. These surveys were distinguished from the objective setting surveys in two most important aspects. Firstly, they were associated with links that were initiated by direct contact between two centres and in which the objectives of the link had been previously proposed by the DC centre. Secondly, the AC survey was carried out by a member of the AC institution with the purpose of assessing the area of common interest and deciding where the AC institution expertise could apply. Effective assessment here requires an intimate knowledge of the AC institution rather than of the DC. These surveys resulted only in limiting the objectives to those areas in which the AC institution could contribute.

The relation between this type of survey and link success indicated that surveys of the DC institution by members of the AC institution with the purpose of limiting previously established DC objectives were associated with more successful links.

Finally, from Table 5.3 we see that links in which the objectives originated within a DC institution were the more successful links. Objectives originating within the DC institution were set either by long term consultation between the DC personnel and AC nationals working in the DC centre or by the DC personnel alone. Although we have distinguished between these two methods in Table 5.3, it was difficult in some cases to establish exactly where the objectives originated and to what extent they had been influenced by or discussed with AC nationals. This distinction does not seem important from a link success point of view. Both were associated with links initiated by direct contact between the two linked institutions.

The objectives originating in the DC institution did not suffer from the problems mentioned above. Also, they took account of the in-

terests of the institutions, the capability of the people and incorporated an intimate knowledge of the local value and administrative structure..

Finally, the cases suggested little definite with regard to the flexibility of the objectives and link success. Generally, in links that were initiated directly, the objectives were broad but well defined. Those set by third parties tended to be more fully defined in detail.

5.3 The nature & field of link activity

There was no clear relation between the nature and field of the link activity and link success.

The activity undertaken in the links is analysed in detail in Appendix A according to both the field (agriculture or engineering) and the nature of the activity (teaching or research and development). In this analysis, no relation between the success of the link and the field or nature of the work being pursued was found. Hence, it appears that operational and managerial factors rather than subject matter factors are responsible for the levels of success.

Considering the sum total of the activity in the links, it is interesting that most of the activity was centred in the fields of engineering and natural sciences with somewhat less activity in agriculture. This weighting of activity appears most appropriate to a largely industrialized nation which is also reasonably dependent on agriculture rather than one which is largely dependent upon its agricultural production. This weighting differed from that found in the UNDP aid (rather than link) projects¹⁷ where the bulk of the activity was in the field of agriculture and engineering with little activity in the natural sciences. This difference between aid and link projects suggests that an aid project is more able to reflect the priority areas of the DC country while a link project must take account of the field of interest and expertise of the AC institution. Also, subjects which vary less from country to country (e.g. the natural sciences) are more likely to be suitable for link activity if the AC institution is not able to orient its programme toward DC problems.

The link effort was largely consumed in teaching and R and D. This emphasis on type of activity again reflects the areas in which the AC institutions have a competence to offer. It again contrasts the UNDP project emphasis which was in teaching and in information services with R and D being only 11% of the total activity. Also, in general the link effort was oriented toward developing indigenous ability via training and co-operative R & D rather than oriented toward direct execution of projects. From the need cited in the introduction and discussed in section 6, this orientation gives links an enormous advantage.

5.4 Technical assistance visits

Most links involved technical assistance visits of the AC institution personnel to the DC institution. These visits are categorized by: (a) the number of personnel involved in a given visit; (b) the length of the visit, and (c) whether the visits were repeated or a one off venture.

TABLE 5.4. THE LINK SUCCESS AND THE TYPE OF VISITS TO THE DC INSTITUTION

Type of visit by AC personnel to DC institution	Level of success in each link		
	L	M	H
Repeated short visits (small group)		2	2
Repeated short and long visits (small group)		2	2
No visits		4	1
Single long term visit	3		

Unfortunately, these aspects were combined and there was simply not enough data to separate each facet of the visit and its relation to link success unambiguously. Hence only a combined statement can be made with any confidence. From Table 5.4 this is that the links tended to be more successful if the AC personnel visited repeatedly (for long or short periods) in small numbers (one or two of one time) rather than for a single long period in a group.

To separate the components of this combined statement we begin by displaying the relation between the size of the technical assistance group and the level of link success in Table 5.5. Table 5.5 suggests a clear relation between group size and link success. It should be em-

phasized, however, that the large group visits were also one off ventures while the smaller group visits were repeated with gaps between them. (In practice, this is often the option.) Hence, this point needs further support. This support came from interview comment which suggested that the size of the group itself was indeed an important factor.

TABLE 5.5. LINK SUCCESS & THE NUMBER OF AC PERSONNEL VISITING THE DC INSTITUTION AT ONE TIME

Number of people	Level of link success		
	L	M	H
One or two		4	4
More than two	3		

5 Links with no visits.

5.4.1 The size of the technical assistance

In the cases involving a large team difficulties in working relations were cited. These difficulties emerged first from an unintentional competition between the visiting group and the DC personnel. The visiting group often took the lead in the technical sphere and this on occasion led into the organizational sphere. The DC personnel naturally represented the established authority. This unintentional competition and existence of a competent additional group in the institution led to a feeling that the established authority was being undermined from within both in terms of competence and leadership. This was especially the case if junior personnel were working with the visiting group and it was cited as a significant reason why the group found difficulty in obtaining counterparts. This problem is particularly important in Thailand where the relations between junior and senior staff depend heavily on personal understanding.

Difficulty also arose through an unconscious by-passing of the established working channels by the visiting group in an effort to 'get the job done'. This again tended to suggest that the established authority was being undermined. Also, when the group was large there tended to be a strong internal alignment within the group and insufficient contact between the group and the developing country institution

personnel. This led to poor transfer of technique and ideas and the establishment of isolated and separate working patterns.

Essentially, the impact of the group on the developing country institution was too large. The group activities could not be effectively managed by the institution or incorporated into the institution working pattern. At the same time the group tended to work in isolation leaving the institution personnel out or behind. As a result, when the group departed the exercise left the institution largely unchanged.

In the cases involving long residence of AC individuals, no working difficulties were cited. This suggests that a single person must work sufficiently closely with the DC personnel that few separation difficulties can arise. Also, in these cases close personal relations developed (or had been developed previously). In one case, however, the counterpart problem was still specifically cited. This experience suggests that when long term technical assistance visits were required they, and the links, were more successful if the number of personnel involved was small (one or two).

Quite independently, an important negative aspect of large technical assistance programmes was repeatedly cited. When one group received large support by way of equipment and overseas personnel a feeling of impotence was instilled in other groups. That is, other groups felt that by comparison and without similar help it was impossible to complete with the aided group. This tended to reduce the incentive for self help in surrounding research groups and oriented much activity toward external aid. Thus while a large aid effort can help a particular group it can also have a pronounced negative impact on other institutions and the overall programme pattern by distorting research portfolios toward those areas which are likely to receive external support. This feature often accounts for much of the duplication of effort and for the poor communication between R & D groups.

5.4.2 Repeated or continuous assistance visits

Table 5.6 shows the relation between the level of link success and whether the DC personnel visits were repeated with gaps (gaps in which there were no AC personnel at all in the DC centre) or whether

the link involved a single continuous visit of AC personnel. The Table suggests that intermittent rather than continuous visits were more effective. (Comparison of Tables 5.5 and 5.6 indicates the difficulty in separating the factors of group size and repeated or not repeated visits.)

TABLE 5.6. THE LEVEL OF LINK SUCCESS AND WHETHER THE ASSISTANCE VISITS WERE REPEATED WITH GAPS OR ONE OFF AND CONTINUOUS

Type of visit	Level of link success		
	L	M	H
Repeated with gaps		4	4
Single and continuous	3		

5 Links with no visits.

Interview comment suggested that repeated visits were more effective because the AC personnel then came to advise, teach and consult with a much smaller emphasis on direct execution of task. In the intervals the DC personnel must largely get on with execution on their own. These intervals provide an opportunity for establishing appropriate working patterns in the new activity. The form of the visit also makes it clear that the DC personnel are in control and must do the work if it is to get done. The AC advisor can return to assess progress, encourage and suggest new direction but the ultimate success depends on the efforts of the DC personnel. In these circumstances, if the link work is accomplished, the collaboration is much more likely to impart a lasting indigenous ability in the DC centre.

Also, the repeated visits seemed correlated with a well organized and competent DC group. Essentially, the DC is able to unpackage the aid possibilities and select these parts which they want and the time they want them. In this sense, the repeated visits reflect a DC group that can make good use of link as well as being a contributing factor toward the success.

5.4.3 The length of technical assistance visits

The impact of the length component of a visit on the link is the least well supported aspect. Interview comment noted that long and

short visits serve different purposes and that both are important.

In a short visit (less than three months), the purpose is to advise, consult, teach and execute previously understood tasks only. There is no time to understand new issues and then begin execution. Such visits generally involved senior and experienced AC people to be worthwhile. Since the visit is short, it is indeed generally possible to get senior AC people.

On the other hand, in a long visit (greater than one year) the object is to get the AC personnel immersed in an understanding and executing capacity. Such people need not be so senior since there is more time to learn on the job and to acquire expertise. The long visit should also provide a valued opportunity for the AC person to develop himself. It is unlikely that senior AC people will want or be able to stay for extended periods. Indeed, given the possible competition problems cited above, more junior people may be the most appropriate for extended visits.

Keeping this distinction in mind, many DC people quite specifically commented that they prefer short visits by highly competent AC people. The task can then be well defined and the momentum kept high during the short visits with no time for interest and enthusiasm to fade. Also, the trainee counterparts can be more readily assembled for short visits. Often the DC centres felt they did not get the best possible people and felt offended at being presented with people who they, at least, did not regard as expert or especially competent. This was particularly felt if the residence was long. These points are made statistically in Tables 5.7 and 5.8. Table 5.7 indicates the relation between link success and the seniority at the AC institution directly involved while 5.8 displays the relation between seniority and the length of visit. The impact of senior people may be as much their ability, simply by virtue of position, to assemble the facility and cooperation needed for success as their competence and experience.

TABLE 5.7. THE LINK SUCCESS AND THE AVERAGE SENIORITY OF THE AC PERSONNEL INVOLVED

Level of seniority of AC personnel involved in the link	Level of link success		
	L	M	H
H		3	3
M		5	1
L	3		

TABLE 5.8. THE SENIORITY OF THE AC PERSONNEL VS. THE LENGTH OF THEIR VISITS

Length of visit	Level of seniority of visiting AC person		
	L	M	H
Short	2	12	13
Long	26	5	1

TABLE 5.9. LINK SUCCESS AND THE AVERAGE SENIORITY OF THE DC PERSONNEL INVOLVED

Level of seniority of DC personnel involved in the link	Level of link success		
	L	M	H
H	2	6	3
M	1	2	2
L			

There was no apparent relation between the seniority of DC personnel and link success level perhaps because most links involved senior DC personnel (see Table 5.9).

To conclude, while short visits seem to be favoured, Table 5.4 shows that both long and short visits occurred in successful links. Some tasks simply made long visits necessary. The important point is to identify the need and select the appropriate visit.

5.5 The overseas training component

Although much effort was devoted to the role of training in the advanced country and link success, little decisive from a statistical point of view emerged. There was, for example, no apparent relation between the existence and amount of training abroad and link success. Some general statements are, however, possible.

Firstly, a degree or training abroad still carries great prestige in Thailand. As a result, the overseas training component of a link is often the chief incentive for the DC institution to enter into a link. If the DC institution can offer overseas training it can attract and retain people and hence build a reputation in the country at large. At the same time there can be an over emphasis on this component to the neglect of other aspects which now seem more decisive.

The overseas training component is almost always useful. Training and experience abroad always widens the horizons of the trainee. In particular it can provide experience in how 'R and D' is done and what methods and management are required to make it successful. The training in management and atmosphere required to develop an active R and D institution is perhaps the most useful result of training abroad - more useful than the knowledge acquired in the subject of study itself. It also provides an opportunity to compare two societies in which technology has flourished to different degrees.

Much of the gain from this training can, however, be nullified if there is little support for the trainee upon his return. Given the large number of students trained abroad, there is still a shortage of people capable of managing and effecting an R and D programme independently. The present structure of many institutions in Thailand does not support and encourage the further development of the trainee. Rather, the incentive structure tends to dampen and contain enthusiasm and effort, making the opportunity costs of remaining in R and D heavy. This aspect seems the most important problem at present. There is thus a danger in emphasizing the overseas training component if it is not equally balanced by effort to develop the local institutions. For this reason it may be more productive to support in house or local rather than overseas training.

The impact of the training is greatly increased if it is timed so that the link activity at the DC institution is still in progress when the trainee returns. This means that the trainee can participate in the link activity at the DC centre. It also eases the return of the trainee and makes it more likely that some of the new activity can be retained in a permanent form. While this is an obvious point it still seems to be missed by many institutions.

At the same time, the training helps to cement the link by developing contact between individuals in the DC institution and the AC institution. This can, however, be done only if the trainees do indeed go to the linked institution rather than some other institution in the DC. In one link, none of the trainees went to the linked institution and as a result essentially no contact or coherent subject training was possible.

5.6 The linked institutions

5.6.1 The advanced country institution

The links tended to be more successful if the AC institution received core funding to specifically consider developing country problems.

By core funding, we mean direct funding to the institution (or section of the institution) on a continuing basis to be managed by the institution. With this funding the AC institution can take a specific interest in DC problems without relying on additional funding for each endeavour. With the funding invariably comes a mandate and a career pattern for some individuals oriented toward developing countries. The relation between core funding and success is displayed statistically in Table 5.10. Interview discussion suggested a number of explanations for the relation.

Firstly, the core funding provided resource and people to initiate links slowly and on an informal basis before specific link funding was required. This made it much easier to initiate a link along the lines which appeared most successful in section 5.1. For example, the period of introduction will provide an opportunity to develop personal relations and to become familiar with the DC institution and its national setting. Objectives taking account of the local characteristics and the people who will be directly involved can then be worked out by the two centres.

TABLE 5.10. LEVEL OF SUCCESS OF THE LINK AND ITS RELATION TO CORE FUNDING OF THE AC INSTITUTION

Type of funding	Level of success		
	L	M	H
Core funding or internal support	1	5	5
No core funding	3	3	

One link falls into both categories.

Secondly, in links involving core funded institutions there was also a high level of genuine common interest prior to the link between the two centres. This follows naturally from the continuing specific interest of the AC institution in DC issues. The correlation between core funding and common interest is shown in Table 5.11. Since there is this direct connection, one could equally state that the links between institutions having a large area of prior common interest were more successful than those in which there was little common interest.

TABLE 5.11. LEVEL OF COMMON INTEREST BETWEEN INSTITUTIONS PRIOR TO THE LINK AND THE RELATION TO CORE FUNDING

Type of funding	Level of common interest		
	L	M	H
Core of funding or internal support	1	2	8
No core funding	4	2	

One link falls into both categories.

This statement has some separate meaning since in two cases, a lack of genuine interest in the link activity on the part of the AC institution was specifically cited as a reason for the reduced success of the link. Since link activity is (or should be) oriented toward DC interests, the demand for common interest inevitably means a demand for DC interest in the AC institution - unless the subject matter is completely invariant from country to country. Core funding is thus a method for promoting common interest.

Following along this line, in links involving core funded AC institutions, the subject matter of the link was treated in a manner specifically suitable to the developing country. For example, if the subject was engineering it was an aspect of engineering particularly appropriate to developing countries. In the non core funded cases it was usually an aspect that was common to both countries or equivalently an aspect which is invariant nation to nation. This separation is shown in Table 5.12.

TABLE 5.12. CORE FUNDING OF THE AC INSTITUTION AND LINK SUBJECT MATTER OF SPECIFIC RELEVANCE TO DEVELOPING COUNTRIES

Funding	Subject not specific to DC	Subject specific to DC
Core funding or internal support	1	10
No core funding	5	1

One link falls into both categories.

Thirdly, a core funded institution is more likely to have had previous experience in developing countries and hence have a genuine expertise in activity of special interest to DC institutions. The core funded institution will then more likely have a genuine contribution to make and experience in dealing with the special situations which arise in international relations. (Experience and ability in this sphere seemed instrumental in link success in two cases.) Again, from the direct relation between core funding and previously demonstrated expertise (Table 5.13), one could equally state that the links involving AC institutions which had a previously demonstrated expertise in developing countries tended to be more successful than those involving institutions which did not. This statement implies an expertise which is particular to developing countries aside from simple expertise in subject matter.

Fourthly, since there will be specific posts in the AC institution to consider DC issues, there will be a greater likelihood of continuity of personnel throughout the link. This will make repeated visits by the same person in a given activity a greater possibility. It will also reduce problems associated with change of emphasis with change of personnel. It will also increase the likelihood of sustained interest in the link at the AC centre.

TABLE 5.13. THE RELATION BETWEEN CORE FUNDING AND AC INSTITUTION EXPERIENCE IN DEVELOPING COUNTRIES PRIOR TO THE LINK

Funding	No previous experience	Previous experience
Core funding or internal support		11
No core funding	3	2

Finally, Table 5.11 shows that a high proportion of the AC institutions involved in links received core funding. Since core funded institutions in the United Kingdom are a small fraction of the total, this large proportion indicates that core funding has indeed been effective in directing interest toward developing countries and in promoting links.

5.6.2 The developing country institution

In comparing the characteristics of the DC institution with the link success, only one issue emerged as significant. That is in successful links, the DC institution had a strong directive capacity capable of selecting and managing the external assistance that it required. This relationship is displayed statistically in Table 5.14.

TABLE 5.14. LINK SUCCESS & MANAGEMENT STRENGTH OF THE DC INSTITUTION

Management strength	Level of link success		
	L	M	H
H		2	5
M		6	
L	3		

The strong and weak management cases of the present study can be closely compared to the 'unpackaged' and 'packaged' models which are now appearing in general discussions of transfer of technology. In an 'unpackaged' importation, the importer defines the needs and selects those components from the many alternates of technology that he requires. The components will often come from different places and will be supplemented from time to time by further importation as new needs arise. The components are then managed and assembled by the importer making use of local capability when possible. Essentially the importer is directing the enterprise.

In the 'packaged' case, the total requirement (and hence often much of the objective) is imported in a lump from a single group at a single time. Much of the management and expertise in reassembling the package and executing the enterprise comes with the package.

In the stronger management cases in the observed links, the DC institution had a well defined objective and plan to execute these objectives. It then selected the technical assistance and promoted the overseas training that it required via the link as part of the overall plan. It very much jointly controlled the link activity with the AC institution and was responsible for executing certain parts independently. As a result of this independent execution and management, the DC institution gained both management experience and experience in executing new activity independently. Thus the link left behind it a much improved institution.

In the weaker management cases, the assistance was often assembled outside the DC institution. The link activity tended to be directed by the assistance group - in the absence of strong direction from the local institution. Since the DC institution participated little in management nor was responsible for independent activity, the link developed little independent capability in the institution. As a result, when the link activity ceased the DC institution had difficulty in taking over the activity and the local capability was often not greatly increased.

TABLE 5.15. THE DIFFERENCE IN LEVEL OF RESEARCH SOPHISTICATION BETWEEN THE TWO INSTITUTES AND THE LEVEL OF LINK SUCCESS

Difference in research sophistication	Level of link success		
	L	M	H
High	2	4	1
Moderate	1	2	2
Low		2	1

This desire and ability to manage the link activity should not be confused with an ability in the subject matter of the link itself. Table 5.15 indicates that the difference, whether high or low in level of sophistication, experience or ability between the two institutions had no apparent relation to the level of success. In fact, in some cases of links well managed by the DC institution the chief purpose was to take advantage of a large difference in sophistication. The desire to manage and direct the activity is probably most closely related to link objectives that support the objectives of the DC institution.

5.7 The funding of links

The impact of funding on link success has largely been discussed in relation to other factors.

The most significant feature was the strong correlation between core funding of the AC institution and link success. This relation suggests that an efficient use of funds for promoting successful links should include at least a portion of the funds for direct support of the AC institution. The reasons for this are discussed in detail in section 5.6.1 on the characteristics of the AC institution and link success.

The next important feature was the relation between the magnitude of the funding and link success. Table 5.16 indicates that the smaller, less costly programmes achieved a higher level of success. The cost is very closely related to the size of the AC technical assistance team in the DC institution. The drawbacks and problems encountered by large teams are discussed in detail in section 6.4.1 and essentially explains why the larger programmes were less successful. Larger programmes can also have an important negative impact. This is discussed in section 6.4.1.

TABLE 5.16. THE RELATION BETWEEN THE MAGNITUDE OF THE FUNDING AND LINK SUCCESS

Funding in (£000's)	Level of link success		
	L	M	H
Less than 10		3	3
10-100		5	2
Greater than 100	3		

The other less specific feature which emerged was a relation between flexibility of funding and link success. This flexibility was associated with core funded institutions. The flexibility allowed the link to be developed slowly and particularly allowed student training to be done first and hence to be more effectively integrated with the technical assistance programme (see section 6.5).

5.8 Summary & interdependence of results

In the preceding subsections a number of factors related to link success have been discussed separately. In practice these factors are strongly interdependent with many appearing together in a successful link. As a summary statement, one could say that successful links were not associated with a single important factor. Rather the successful links met many or most of the conditions associated with successful links and these conditions were mutually self supporting. In the following, the isolated factors are pulled together and their interdependence is emphasized.

For the DC institution a key pre-requisite to the link success is a motivation and drive to develop its own institution. This leads to seeking out the possible ways of building up the institution and a link may play an important role in this development. The link will then be part of a general plan of development and execution in the institution as a whole.

In pursuing the development, the institution is likely to make the contacts, invite AC technical visits and seek out or use its own funds to initiate the link itself or in direct cooperation with an AC institution. This initiation will invariably imply objectives. It then almost naturally follows that the objectives will be set in the DC institution and these will support the needs and aims of the DC institution. As seen from the outside, the initiative will reflect a motivation and internal support for the link which is likely to carry the link through possible difficulties that may arise subsequently. The knowledge that funding and specifically interested AC institutions existed was an important stimulus to direct initiation.

On the other hand, if the initiative comes from outside the institution, there will be no evidence of genuine support or enthusiasm for the link. In fact, the reverse may hold; that if the link must be set up from outside there is probably not sufficient enthusiasm in the respective institutions to fully support a link. Again, initiation implies objectives and, coming from outside, the link objectives may not support those of the institutions leading to further loss of support for the link when it gets underway.

Once the links were initiated a central feature of success was a strong managerial and directive capability in the DC institution. This strength was very much associated with effectively timed and suited overseas training and technical assistance visits. For example, in the strong management cases, the technical assistance was usually kept to a manageable size. The visits were selected when required or when appropriate. These were often interspersed with periods when the institution worked independently to incorporate the activity into its portfolio. Basically, the institution was in control and not overwhelmed by the size of the assistance. Alternatively, one could equally say that the small size of the assistance and periods of independent execution allowed the institution to retain control and manage the link effectively.

Turning to the AC institution, one of the chief difficulties that developing countries have in establishing a link is locating an interested institution in the advanced country. This was often cited and many DC institutions have attempted to form links but could not find interested opposite institutions. Similarly, many AC groups would like to form links but cannot since they have no funding or mandate for this area. One in particular felt it necessary to curtail link contact for fear of criticism in neglecting their own chartered duties.

Much of this problem was removed by core funding or a specific mandate in the AC institution for interest in developing countries. This firstly made links possible. It also allowed these institutions to send liaison officers, to let it be known that links were possible and to establish the conditions in which direct initiation between the institutions was possible. The mandate also allowed the AC institution to specialize in DC problems so that there was a genuine common interest between the two institutions and so that the AC group had a special expertise and contribution to make. Finally, it provided a technical working base for technical experts so that short, repeated visits could be arranged and appropriately timed. This base generally made the link much easier to manage for the DC institution.

6. THE ROLE & SPECIAL ADVANTAGES OF LINKS

We begin by citing problems and needs as obtained from interview comment and then cite the advantages of links in meeting these needs. This discussion of needs is, of necessity, more subjective than the results of section 5. At the same time, some previously cited advantages of links are tested against observations made in the link cases.

The purpose of the science based institutions in the DC's is to apply science and technology to development or to train personnel for this application (or for further training of personnel). Since many institutions are young, many are still developing their own capability to effect this application. A link or aid programme can thus help in either the direct execution of task or in the development of local capability to execute (or both). In interview it was generally agreed that¹⁸, at present, the central need is the development of the institution's independent capability. This can be done by training both locally and overseas, by experience both local and overseas and by programmes involving technical assistance in the DC institution itself. The basic point here is that links have special advantages in aiding this development.

Broadly, assistance activity falls into two parts: overseas training and technical assistance visits to the DC's. We now discuss these two facets and indicate the advantages of links in each and in pulling the two components together.

6.1 Overseas training

Overseas training in any form carries a high prestige in developing countries. Thus an institution which can offer overseas training to its personnel is in a much better position to attract good people and to develop a position of prestige in the nation. The overseas training component of a link or an assistance programme is often the biggest drawing card for a DC institution. In some instances the institutions seemed consumed with this component to the neglect of other supporting aspects which are needed to make this training effective. This component is seemingly straightforward to arrange but if it is not carefully planned

much of the gain is lost upon the subsequent return of the trainee.

Among the problems occurring in overseas training is the existence of a wide range of subjects studied overseas and a subsequent difficulty in building cohesive groups concentrating on certain problems.

This problem was noted in both universities and government laboratories. Its symptoms are many small groups or individual programmes staffed by insufficient numbers to carry out the programme effectively. There is also a subsequent communication problem with too few people working in a given area to form a self supporting community. This is particularly important when there is in total a small number of scientists working in an atmosphere which is generally unacquainted with their subject and needs.

In an advanced country which trains its own people, there are usually a number of key persons who develop certain fields and gather students to these fields. While one can dispute the usefulness of certain fields, this gathering serves to build groups concentrating in particular areas. For a developing country which relies on overseas graduate training from many different countries this natural focusing effect is absent unless there is deliberate planning for it.

As part of the study, we examined the general pattern of training of Thais in the U.K. supported by the Colombo Plan - both inside and outside links. From this it was clear that while the diversity still existed, there had indeed been a great deal of channeling of students to selected institutions in the United Kingdom. This came out in an interesting fashion since one of the purposes in examining this pattern was to look for correlations between institutions which would reveal links. In fact correlations existed, but most of these had been created by the British Council. In spite of these efforts, however, diversity persists as a problem.

There is the important problem of the inappropriateness of much of the training overseas. This is perhaps more in approach than subject matter. The training is often done in a way which creates reliance on equipment and support which will simply not be available in the home country. It is often of high academic standard but includes little training in actually how R & D is done and how an industrial programme

should be executed. For the AC student, this training is gained in the few years following his formal training in established institutions or working with more senior people who have established experience. For the DC student, this phase is missing and he returns directly often to flounder in an institution where much of this experience does not exist and where the atmosphere is not conducive to further personal development. This observation is supported by the fact that usually the most capable are those who have had some working experience in industry abroad after their formal training.

Finally, as well as the major problem of adjustment upon return, there is still the problem of adjustment of the students to the overseas institutions. This problem is reflected in performance in training below capability. It comes from studying in an atmosphere which lacks understanding of the interests and background of the student and his problems of language and social adjustment.

A link, if organized along the lines of the successful links of section 5, can help solve these problems. Firstly, by establishing a few institutions with special interests in developing countries, the training overseas can be channelled to a smaller number of institutions. These institutions, provided they have the mandate and appropriate funding, can then orient part of their training effort toward developing countries. This will both help narrow the fields of subject and allow the training to be more appropriate and specific to DC needs. Particularly, the experience and management aspects can be emphasized which are not normally part of advanced country training. This training, both directly and indirectly, in management of R & D and the atmosphere and incentives necessary to conduct effective R & D is one of the most important aspects of overseas training and needs further emphasis. (In this regard a Ph.D. seems more effective than an M.Sc. - probably due to the increased exposure and acceptance of values needed to gain a Ph.D.)

At the same time, the link with the DC institution who is sending the trainees can provide the information needed to make the training appropriate. It will provide the understanding of the local problems and information on the needs around which oriented R & D programmes can be established in the AC institution. Perhaps most importantly,

through the technical assistance component, it will ideally allow the trainee to carry his work back to the DC institution and hence make his entry home much smoother. The adjustment to the DC institution will be less severe and some of the experience training can be continued on toward independent work.

Finally, an alternative solution to these problems of diversity, of inapplicability, of adjustment both overseas and on the return home, would be to build up graduate training in the universities and application training in the DC institutions. This latter now seems particularly important. In the Thai universities there is a large enrollment at the undergraduate level, but graduate training and research of any kind is still extremely limited²¹. Here too, links between universities could play an important role in building up graduate schools. This would be useful only if the AC university can take a special interest in this activity rather than regarding it as an addition which is tolerable provided it does not interfere with the normal functioning of the university.

6.2 The technical assistance visits

Here we examine the advantages of links in technical assistance work to DC institutions. This is done firstly by listing the advantages that have been cited previously and noting whether these advantages were indeed found in the observed links. We then go on to cite advantages which emerged from the observation of the links.

Most of the R and D capability (98% is an often quoted figure) resides in the advanced countries. One way to speed the application of science and technology to development would be to turn some fraction of this large capability toward the problems facing developing countries. An often cited role of a link is as an instrument for creating interest in AC institutions in development and turning some of their activity to development problems. While the links did indeed create an interest in the cases examined, a link on its own was not able to turn activity. This is essentially because the AC institution required a mandate and funding to undertake work in this area. In some cases, the interest was sufficiently strong that only a mandate would be required. However, for the AC institution to shift activity without it would mean neglecting

their stated function and hence leaving themselves open for criticism. This danger was specifically cited in two cases. The problem of orientation of the AC institution and its direct relation to core funding is discussed in section 5.6.

Links are often said to make the provision of more suitable technical experts possible. Here, again, this advantage was associated with core funded institutions only. Otherwise there was no apparent difference. The experts are also said to be able to arrive more quickly. This appeared to hold but again was more noticeable in the links involving core funded institutions.

Finally, the linked AC institution is said to provide a more stable background for the experts and a technical base that can be consulted when they are in the developing country. This aspect, particularly the provision of a stable background, seems most important. It is closely related to the provision of more suitable experts and experts who get less anxious in difficulty and hence who are more readily able to accept and work in difficult situations. In the study, the stable background was again most closely associated with core funded institutions. At the same time the career base oriented to developing countries provided a motivation and interest in success.

Referring to links involving core funded institutions, the central advantage of a link observed in the study was the flexibility it provided in the technical assistance. It made repeated visits of long or short duration possible with a continuity of contact over a long term. This flexibility made it possible for the DC institution to manage assistance more effectively to suit its own development plans. Particularly, in the most effective links, the overseas training was closely integrated with the technical assistance so as to minimize adjustment problems. At the same time, the link provided a most valuable indirect training in management and the needs of effective R & D institutions.

The technical assistance component, at any time, was also generally smaller in link assisted programmes. As well as management difficulties, large assistance programmes have another distinct negative aspect. This is the feeling of impotence that the large projects instil in other groups. That is, other groups and other institutions feel

that by comparison and without similar help it is impossible to compete with the aided group. This tends to reduce the incentive for self help and independence in surrounding R & D activity. Thus, while a large aid effort can help a particular group it can also have a pronounced negative impact on other institutions. Since aid agencies wish to make distinctive and visible impact with their programmes they often deliberately choose large programmes. Finally, there are a number of technical aspects in which links can play a special role. Of these, the two most important are:

- (a) That the DC institution can supply reliable samples and information on local customs and market needs to the AC institutions. For many projects, reliable samples and market information are imperative to operating a realistic programme in the advanced country.
- (b) The AC institution can act as a screen and tester for DC institution products. In particular, the AC institution can play a crucial role in introducing DC products into the AC market. These markets often require detailed understanding and personal contact making them difficult for the DC institution to penetrate alone and from a distance.

6.3 Summary & areas for improvement

There has been a large number of bright and well trained students emerging from the overseas training programmes. Yet there are still few engaged in R & D and there still remains a great shortage of personnel capable of conducting an effective R & D programme independently. Basically, this is due to the high career opportunity costs of remaining in R & D and the subsequent drain after training to other activity in Thailand - mostly administrative functions. This drain is also due to organizational and management structures in many institutions which can make R & D a frustrating and tiring struggle. While Thai organizational structure are most effective in areas of traditional activity they do not appear to translate well to R & D activity - which is, after all, a new activity in Thailand.

With this in mind there seems an over emphasis, both in and outside links, on the overseas training component and a need for renewed emphasis on improving the local environment for R & D. For links, this means more attention to the technical assistance component so that it may be timed and organized to support the overseas training component in the DC institution. Particularly if the training and activity in the AC institution can be carried over effectively to the DC institution then the methods and atmosphere needed to support R & D can be carried over, almost inadvertently, with it.

Following up this apparent need for management structure to suit R & D in many institutions, a central need now is to have the link activity planned and directed by the DC institution - and here direction should be carefully distinguished from control. Often the technical assistance component seems to catch the DC institution unprepared and overwhelm it and, as a result, the link activity does not properly support the internal programmes. The emphasis should then be on introducing flexibility so that the DC institution can more easily plan the link activity. This direction can also be encouraged by emphasizing experience training overseas and encouraging visits by more senior people to the AC institution. The latter will provide suggestions in management by exposure and information on which to base effective planning. At present the senior visits are largely from the AC to the DC institution.

Finally, the third basic need is to provide the AC institution with a realistic opportunity to get fully involved and committed to link activity. One of the chief difficulties in establishing a link is locating an interested AC institution. There were many more DC institutions desiring links than AC institutions that could accommodate them. Thus the limiting factor on the number of links is apparently the number of receptive AC institutions. This, coupled with the strong correlation between link success and core funding of AC institutions, suggests further core funding is critical if additional successful links are to be promoted.

7. POLICY IMPLICATIONS

The following policy implications are based on the observed advantages and role of links in meeting the needs of DC institutions and on the study of factors contributing to successful links.

7.1 Promoting successful links

The study results suggest that links can be best promoted by creating the conditions in which mutual contact between DC and AC institutions is encouraged rather than by explicitly making the contact. Those institutions which have the genuine motivation for a link will emerge to make the contact. The conditions can be improved by:

- (1) Providing core funding and a mandate for selected AC institutions to become involved in DC problems. In some cases only a mandate would be required.
- (2) Making known to DC institutions that funding for links is available.
- (3) Encouraging visits to developed countries by AC nationals. (The older liaison officer concept seemed quite effective.)
- (4) Supporting visits by more senior DC institution members to AC institutions. (In the cases studied (3) was more effective than (4).)
- (5) Centering conferences around institutions and making institutional visits part of conference programmes.
- (6) Encouraging and supporting management training in how to organize R & D involving more than one institution in developing countries.
- (7) Particularly, an inventory on institutions and their objectives has been proposed for promoting links. The study results quite definitely suggest that this should not be used by an independent agent to match or pair institutions. Rather, it should be used as an information source for the institutions themselves allowing them to make or not to make the contact on the basis of the information.

7.2 Supporting successful links

To support successful links, the study results suggest the following points.

Objectives

Allow the DC institution to set the link objectives, either alone or in collaboration with the AC institution, to meet the overall objectives of the DC institution*. In this regard;

- (1) Short surveys by the AC to assess need and to set objectives do not seem useful.
- (2) However, visits by the AC institution to limit objectives to those realizable by the AC institution are worthwhile. Care should be taken to limit only rather than modify.
- (3) For long term links, broad but well defined objectives were preferred. The requirement of detailed objectives can reduce flexibility and the opportunity to meet changing needs and circumstances.

Funding

- (1) Core funding of AC institutions for development problems should be considered as part of a programme to support links.
- (2) Funding for smaller links should be increased.
- (3) Funding at a lower rate for a longer period should be considered. Particularly, some 'pre-link' funding should be considered to allow links to develop slowly and begin with overseas training.

Overseas training

- (1) Explicit management training and exposure to industrial application should be emphasized.

* This is not abdicating the setting of objectives to meet national need. Rather the objectives of the DC institution should have already been set (and approved by government) to meet this need. The supporting agent, of course, always reserves the right not to fund.

- (2) visits by senior DC people for survey of management techniques and operations (and to promote contact) should be encouraged.
- (3) Training should be timed so that it can be most readily integrated with the technical assistance activity.
- (4) Wherever possible, the trainees should go to the linked institution rather than some other institution in the AC.

Technical assistance

- (1) Small assistance efforts involving individuals or pairs rather than a large group should be favoured. This makes the activity more manageable for the DC institution and reduces the negative aspects of large efforts.
- (2) Integrate technical assistance with training.
- (3) A clear distinction between the role of long and short visits is most important:
 - short visits by senior people should be for teaching, consultation or execution of precisely defined work only (these visits were highly favoured).
 - long visits by more junior people should be for execution and learning on both sides.
- (4) Periods in which there are no visitors is useful.
- (5) Continuity of personnel should be encouraged.
- (6) 'In house' training schemes and training in local universities as a method of building local capability should be encouraged.

8. DIRECTIONS FOR FUTURE WORK

This study considered the small sample of links between institutions in the U.K. and Thailand. It has been essentially a pilot study. Many interesting points have emerged but the convincing substantiation of these points is limited by the small number of links considered. At the same time, some of the findings do not agree with previous findings. For example, a Unesco¹⁴ study of interuniversity cooperation cited the existence of a threshold time (six months) below which effort is not

really useful. The present study suggests that both long and short visits are useful, their value being closely related to purpose and the experience of the people involved. In fact, short, well defined visits by senior people seemed favoured. Clearly, these points need further substantiation. The present results may also be specific to the U.K. and Thailand. The first need in future work thus seems to be a study of links outside the U.K. - Thai cases.

Links and collaborations in the commercial sphere have not been considered at all here. Again, previous study²² suggests that technical assistance in this sphere can be effective - particularly if integrated with government and aid efforts. A study of this sphere and its possible relation to links seems most worthwhile.

Finally, there has been only a most superficial comparison of link activity with aid projects in the present study. This superficial comparison suggests that in many task areas link supported programmes would be found to be more successful than aid programmes. This seems an interesting area for further study.

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APPENDIX A

THE THAI-U.K. LINKS BY FIELD AND NATURE OF ACTIVITY

In this Appendix, the activity in the Thai-U.K. links is displayed. The purpose of the display is firstly to indicate in what areas the activity is concentrated and secondly to demonstrate that there was no apparent relation between activity type and link success.

To describe the spectrum of activity, we distinguish first between the nature of the activity (i.e. research or teaching) and the field (i.e. medicine or engineering) of the activity. To classify the nature of the activity, we use the Frascati manual²³ categories. This breaks the activity into:

- (a) R & D (Research & Experimental Development)
- (b) STS (Scientific & Technical Services)
- (c) STED (Education & Training)
- (d) AST (Application of Science & Technology in the production of Goods & Services).

These categories describe the nature of link activity in a straightforward manner except STS. Here, STS will denote the transfer of information between the two linked groups. Often this transfer was much more than simply an exchange of technical reports or papers. It included specific and personally counselled information on matters which could involve the opposite institution in a specific search or task (e.g. sample categorization and sample testing). When such transfer was frequent and centred on the same subject it was denoted co-operative research and placed under the R & D category. Finally, AST is interpreted as specific pilot project operations or market introduction of developed product as against development of experimental or bench model product - which was denoted as R & D.

To describe the scientific field, we use the Unesco classifications:

- (a) Natural science (including bioscience)
- (b) Engineering
- (c) Medical sciences
- (d) Agriculture

Table A1 shows the level of activity in the links in the above categories. A link is counted more than once if more than one type of activity was involved. For the narrow sample of links between the U.K. and Thailand, there is a heavy weighting of activity in the natural and engineering sciences.

This weighting suggests two points. Firstly, some subjects and fields are essentially invariant to location. Mathematics, for example, will be largely the same everywhere. As we move from physics and chemistry through engineering to medical sciences the field will become increasingly location specific until we reach certain areas of agriculture where the subject may be so location specific that an expert from another region can contribute little on a foreign location. From this point of view a weighting of link activity in those fields which are most invariant is to be expected from a common interest and expertise point of view.

Secondly, the U.K. is basically an industrial nation which relies heavily on an expertise in applied natural science and engineering. Again, from an expertise point of view, it is natural for Thailand to look to the U.K. for links in areas where the U.K. has a decided contribution to make.

On the other hand, one is certainly at liberty to ask whether the subject matter is appropriate to Thailand, a nation for which approximately 90% of the GNP is earned in agriculture.

In Table A2, the level of success achieved in the links is shown as a function of the category of activity involved. Again a link is counted more than once if it involved more than one type of activity. There was some difficulty in assigning a success rating to some of the STS activity since the objectives of some of it was limited. If the objective was simply exchange of paper not involving council or discussion, then the link was assigned only a moderate success rating even if the objective was fully met (since simple paper transfer does not seem to be very successful in developing indigenous ability).

The Table A2 suggests no decided relation between the success of the link and the nature of the link activity. In a given link there was also no apparent variation of success with the field and type of activity.

TABLE A1. THE LEVEL OF ACTIVITY (HIGH, MODERATE, LOW) IN THE THAI - U.K. LINKS BY FIELD AND BY TYPE OF ACTIVITY

Level of activity	Field of activity				Nature of activity			
	Natural sciences	Engineering	Medical sciences	Agriculture	R&D	STS	STEP	AST
High	2	3	1	1	4	1	4	2
Moderate	5	3		2	5	3	3	4
Low	1	1		1	1	1		

TABLE A2. THE LEVEL OF SUCCESS ACHIEVED IN THE THAI - U.K. LINKS IN EACH OF THE FRASCATI TYPES OF ACTIVITY AND THE UNESCO FIELD OF ACTIVITY

Level of success	Field of activity				Nature of activity			
	Natural sciences	Engineering	Medical sciences	Agriculture	R&D	STS	STEP	AST
High	1	2	1	1	4		2	2
Moderate	5	2		1	6	4	3	1
Low		2		1	2		2	1

APPENDIX B

THE LINK CASES

- | | |
|---|---|
| 1. Applied Scientific Research Corporation of Thailand
Bang Khen, Bangkok | Tropical Products Institute
56/62 Gray's Inn Road
London, W.C. 1 |
| 2. Department of Electrical & Mechanical Engineering
Chulalongkorn University
Bangkok | Department of Engineering
Cambridge University
Cambridge |
| 3. Asian Institute of Technology
Henri Dunant Road
Bangkok | Department of Civil Engineering
University of Newcastle
Claremont Road
Newcastle Upon Tyne |
| 4. Department of Organic Chemistry
Mahidol University
Rama VI Road, Bangkok | Tropical Products Institute
(as above) |
| 5. Applied Scientific Research Corporation of Thailand
(as above) | Royal Botanic Gardens
Kew, Richmond
Surrey |
| 6. Asian Institute of Technology
(as above) | Tropical Section
Road Research Laboratory
Crowthorne, Berkshire |
| 7. Asian Institute of Technology
(as above) | Overseas Division
Building Research Section
Garston, Watford |
| 8. Fisheries Technology Laboratory
Department of Fisheries
New Road, Bangkok | Torry Research Station
Ministry of Agriculture
Fisheries & Foods
P.O. Box 31
Aberdeen |
| 9. Faculty of Science
Chiang Mai University
Chiang Mai | Faculty of Science
Aston University in Birmingham
Birmingham |
| 10. Applied Scientific Research Corporation of Thailand
Bang Khen, Bangkok | Scottish Textile Research Assoc.
Kinnoull Road
Dundee |
| 11. Faculty of Tropical Medicine
Mahidol University
Rama VI Road, Bangkok | Liverpool School of Tropical
Medicine
Liverpool |

- | | | |
|-----|--|---|
| 12. | Faculty of Agriculture
Chiang Mai University
Chiang Mai | Wye College
London |
| 13. | Takfa Cotton Development Project
Department of Agriculture
Bangkok | Cotton Research Association
12 Chancery House
Eccleston Street, London, S.W. 1.

Shirley Institute of Technology
Manchester

Wye College
London |
| 14. | Applied Scientific Research
Corporation of Thailand
Bang Khen, Bangkok | Building Research Station
(as above)

Road Research Laboratory
(as above)

Fire Research
Ministry of Technology
Mill Bank Tower |
| 15. | Asian Institute of Technology | Engineering Department
University of Dundee, Dundee |
| 16. | Department of Mineral Resources
Ministry of Industry
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APPENDIX C

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