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**Article** · June 2011

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# A Case Study of Technology Transfer Process in a Government Research Organization in Sri Lanka

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***ABSTRACT***

The purpose of this paper is to identify and discuss the critical elements of a successful technology transfer process of a research organization by exploring the technology transfer process adopted by a leading government research institute in Sri Lanka. A field study based on a structured questionnaire and personal interviews was carried out to collect data. The study identified several factors that hinder a successful technology transfer as well as several facilitating factors. Findings reveal that contract research projects and funded projects have the greatest probability of commercialization success. It exposed that only 37% of the technologies that had received patents have been successful in the commercialization stage raising concerns about the research productivity. It was also found that the personal approach to technology transfer is dominating but dwindling compared with other approaches. Although the overall technology transfer success is about 86%, commercialization success is well below an acceptable level for this organization. Finally, this paper presents recommendations for an effective technology transfer process which can be applied for similar institutes.

Key words – Technology Transfer, Intellectual Property Protection, Technology Commercialization

## 1. INTRODUCTION

There is a belief that government expenditure for Research and Development (R&D) can somehow be captured and redirected if not simply reallocated to improve industrial productivity and to response the multitude of demands facing the society. However it is often criticized that the industry or the society of the developing countries is unable to get the desired return from the government R&D expenditure. Although it is not realized, the reason for this gap greatly lies in the technology transfer process as well as in the technology development process.

Technology innovation and technology transfer represent two aspects of managing technological resources. Technology transfer offers the opportunity to obtain a greater return on past investments in R&D.

Many of the technologies developed by in R&D laboratories remain unexploited in commercial scale either because they are not proven on adequate prototype or pilot scale or due to factors such as patenting and licensing problems, industry ignorance and labs' ignorance of market opportunities. Though in certain cases the reason for inability for commercialization is pronounced, the underlying reasons are obscure and complex in many situations.

### 1.1 Objectives of the study and background of the institute

This case analyzes a premier government R&D organization in Sri Lanka to identify and discuss the critical elements of a successful technology transfer and commercialization process of a research organization.

The study investigates the relationship between the nature of the research project and its commercialization success. It analyzes different approaches used by this organization for technology transfer and reveals trends in the modes of technology transfer and research employees' perception about the existing infrastructure for technology transfer. Finally recommendations are provided for a more effective technology transfer process which can be applied for similar R&D organizations to improve R&D productivity.

The research institute of the study was incepted in 1955 with the recommendations of International Bank for Reconstruction and Development. Until early 1990s the ratio of commercial income to recurrent expenditure was between 30-40% and it was a non-profit organization. The institute was not able to achieve much autonomy with this orientation because the institute still had to depend on the state for all capital expenditure and 2/3 of its operational expenditure. In 1998 it went through structural changes and its income generating activities reached 60% of recurrent expenditure in 2003. The institute is a semi government organization today.

This institute is the only multi disciplinary technical service provider in Sri Lanka. It has three different sections namely R&D, information services and technical services. Technical services laboratories provide the necessary support for R&D activities by sharing resources, providing advice and human resources.

Before 2003, technology transfer activities of the organization were a responsibility of the R&D section which developed the technology. In 2003, a Marketing and Business Development (MBD) department took over the responsibility excluding Intellectual Property (IP) protection.

## 2. METHODS

The case is based on data from several primary and secondary sources. Some comments and suggestions included in the paper are as a result of face to face interviews with officers of the institute.

## 3. RESULTS AND DISCUSSION

### 3.1 Technology transfer process

Technology transfer is a process that permits the flow of technology from a source to a receiver (Khalil, 2000). The following diagram illustrates the stages of technology transfer process (Peiris, 2002). This research paper analyzes the institute with respect to each stage.

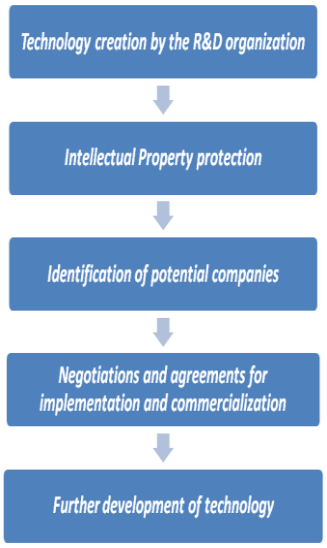


***Figure 1- Stages of Technology Transfer Process***

### 3.2 Technology creation

According to Roberts (1982) market needs rather than technological opportunities provided the main motivation for research project output utilizations and 75% of the innovations judged as most useful by the research institute originated as a response to perceived needs in the market place. Demand pull and technology push played a significant role in development of technology in this institute as well for the period 2002-2008.

According to Ramanathan (2003), technology transfer implies the movement of

technology from one entity to another and if transfer is successful the proper understanding and effective use of technology.

Bozeman and Fellows (1988) presented two distinct models to measure technology transfer effectiveness namely out-the-door model and market impact model. According to the first model, if the technology was transferred to another organization, transfer is called successful. But market impact model assesses effectiveness according to the commercial success of the transferred technology.

For the purpose of this research, technology transfer success of the projects carried out by this institute was measured using a method similar to market impact model but only the application was considered rather than the commercial success. A transfer is categorized as successful if the technology has moved from research to an end user and then has become a product or a part of a product or an important enhancement of a production process,

Technology commercialization is the process of transforming innovative technologies into commercially viable products and services that are in market demand. This process includes deciding a market niche, ensuring supply of raw materials, obtaining IP protection, developing a conversion technology, a manufacturing facility and a suitable business structure.

If the user has been able to convert or move the transferred technology into a profit making position such projects were characterized as commercially successful projects for the purpose of this research. Table 1 shows different forms of research projects carried out by the organization and its commercialization success.

There are no clear and standard methods to measure technology transfer effectiveness or commercial success in this organization. Often the terms "commercialization" and "technology transfer" are treated as if they are inter-changeable by the researchers of this institute. Some researchers consider time, production rate and production capacity as measures for effectiveness. Some commented that effectiveness is in terms of products and how long they remain in the market. Some measured technology transfer effectiveness through feedbacks (e.g. Appreciation letters), quality assurance programs and test samples received by the transferees. There is an inconsistency and absence of a clear method for measuring technology transfer effectiveness.

| Form of the project | 2007 | 2008 | Commercialization Success in 2007,% | Commercialization Success in 2008,% |
|---|---|---|---|---|
| Research projects funded by other organizations | 5 | 7 | 60 | 57 |
| Treasury funded projects | 8 | 9 | 62 | 55 |
| Contract research projects | 10 | 16 | 70 | 62 |
| Projects done as response to a market need | 14 | 22 | 50 | 45 |
| Projects done due to interests of the researchers only | 10 | 4 | 20 | 25 |

**Table 1- Nature of projects carried out and commercialization success**

Sources such as researcher's comments, letters with an invitation for a research and grant of funds were used in categorizing projects.

Some research projects were started by the researches with the sole purpose of obtaining an additional qualification or due to their interests in that area without a foreseeable technology opportunity or market request. Such research was categorized under the projects done due to the interests of the researcher only.

Table 1 indicates that funded and contract projects other than those funded by treasury

have increased at a considerable rate. This is mainly to take advantage of the large resource pool in the institute. The slower rate of increase in treasury funded projects is mainly due to decrease in funds offered by the government to R&D sector. Market oriented research projects have increased at the highest rate. This shows an increase in market responsiveness to the industry especially with the introduction of the MBD unit in 2003. High commercial success of contract research projects may have driven the organization to accept more requests from the industry to initiate research.

Research projects carried out due to interests of the researchers only, is decreasing as only few such projects were able to be commercialized successfully.

These findings reveal that contract research projects and funded projects have the greatest probability of commercialization success.

### 3.3 Research employees' perception about existing technology transfer procedure

Evaluating the commercial potential and locating suitable partners and negotiating contract is mainly a responsibility of MBD unit. Since the first part of the process is mostly an individual effort, there is a resistance from the inventor to share the knowledge with people who were not involved in the developing and patenting stages.

Most of the interviewed officers from the MBD unit (64%) were on a view that technology development staff does not have knowledge and skills to promote the technology to external parties. On the other hand, technology staff (72%) believes that MBD staff is not capable of understanding the use of the technology due to their lack of science/engineering background and because they were not engaged in the project from the beginning.

### 3.4 Scaling up of technologies

Scaling up technologies is another common barrier to transfer technologies of this organization. There is only one pilot plant which is not adequate for the broad scope of research carried out. Inadequate number of chemical and mechanical engineers and inadequate funding and expertise to set up pilot plant facilities are common problems in scaling up technologies. There is a trend to start a partnership with the private sector to set up pilot plants facilities and share resources with the industry.

### 3.5 Technology protection

Identifying and managing IP rights such as ownership, disclosure and distribution of income properly in research findings are important.

The major issue relevant to technology protection in this government research organization is the absence of a dedicated department or a section that facilitates and takes responsibility of the protection of the developed technology.

The practice of this institute is that determination of the patentability and obtaining patent protection are done by R&D section or by the research team. The technology protection stage is a complicated process that can take up substantial time. Without proper guidance and knowledge, the inventor may not be able to protect the innovation properly and timely, which might put his innovation at the risk of counterfeit and misuse. Without such a department, obtaining the protection has become an individual effort, taking up a lot of time of the inventor that could have otherwise used for further development of technology or for other R&D efforts.

As depicted in the Table 2, most of the patents obtained are local patents for the period of 2001-2008. (Patents obtained in a year may not be the result of technologies developed in the same year). However it is important to obtain an international patent if possible, to increase the acceptance and to reduce the misuse of technology in other countries.

Only 35 technologies were patented out of 261 technologies developed during the time period from 2001 to 2008. 30% of the researches interviewed have a low

confidence of the local patent system and they do not practice patenting because they have to reveal data to other parties. This is the major reason for not patenting certain developed technologies. 35% have identified the inability to get an economic benefit so they did not proceed with patenting.

Only 37% of patented technologies proceeded to the stage of commercializing. Lack of coordination between the research sections and MBD unit and inadequate information about the commercial potential of a technology, have given rise to high number of sleeping patents. The sleeping patents are those patented technologies which are unable to reach the stage of commercialization. The disintegration of the process of technology development and commercialization has resulted in a waste of valuable resources of the institute.

| Technologies/Patents | Number/Percentage |
|---|---|
| Technologies developed | 261 |
| Patented technologies | 35 |
| Local patents out of patented technologies | 32 |
| Sleeping patents | 22 |
| Percentage of patents obtained out of developed technologies | 13% |
| Percentage of Patents commercialized | 37% |

**Table 2 - Patents obtained and commercialized 2001-2008**

### 3.6 Approaches to technology transfer

According to Roberts and Frohman (1982) there are three approaches used by research organizations to facilitate research utilization. ***Personal approach*** involves movement of people, joint teams and intensive person to person contacts between the developer and the user of the technology. ***Organizational link-pins*** approach involves specialized transfer groups that include engineering, marketing and financial specialists, use of integrators who act as third party transfer coordinators and new venture groups. ***Procedural approach*** involves joint planning, joint funding and joint appraisal of research projects using research and user groups from manufacturing and marketing. Procedural approach can be used to complement other approaches.

Majority of technologies in this institute were transferred through personal approach. Most of the researches in the institute (62%) considered personal approach to technology transfer as a failure and procedural approach was rated as the best approach for transferring technology.

| Approach | 2002, % | 2003, % | 2004, % | 2005, % | 2006,% | 2007, % |
|---|---|---|---|---|---|---|
| Personal | 90 | 85 | 55 | 50 | 45 | 45 |
| Organizational link - pins | 5 | 10 | 35 | 35 | 40 | 40 |
| Procedural | 5 | 5 | 10 | 15 | 15 | 15 |

**Table 3- Approaches to technology transfer 2002-07**

A remarkable drop in personal approach in 2003-04 is due to the introduction of MBD. Organizational-link-pins approach increased gradually with a remarkable increase in 2003-04 due to the same reason.

### 3.7 Revenue management

When an invention made by an employee of an institution is patented and commercialized, the general principle of this institute is that 100% of the revenue goes to the institution until all expenses associated with protection and exploitation of the patent have been reimbursed. Thereafter the net income is shared and inventor's share decreases with time. Institution defines the stakeholders with whom the institution's income may be shared.

Contemporary licensing arrangements include direct profit sharing, running royalties, lump sum payments and combination of down payment and royalties. Royalty is determined by applying a royalty rate and paid at predetermined periods.

Obtaining a lump sum has been prominent in transferring technology of this institute. The first royalty and lump sum based agreements for the period came in to effect in 2002. The differed royalty has not taken place until 2010. Three royalty agreements have been signed since 2002 up to 2007.

### 3.8 Modes of technology transfer

Upstill and Symington (2002) identified three modes available for transfer of technology from research agencies to the business sector namely non – commercial transfer, commercial transfer and new company generation.

Non commercial transfers take place without any contractual agreement and include seminars, informal contacts, publications, secondmends, staff exchange and training. The more common method is for the lab to educate or train the user. Commercial transfer includes collaborative research, contract research, consulting and licensing and sale of IP.

#### 3.8.1 Non commercial transfers

Non commercial transfers such as publications, seminars and training are mainly used by the institutes. Unlike commercial transfers, the effort for non commercial transfers is difficult to measure due to absence of income indicators. Since absolute numbers will not give an accurate view of the transfer effort the following formula was developed to assess the transfer effort of the section which takes in to consideration the number of employees in the section.

*Effort in non commercial transfer = (Total num of Seminars + Publications + Training)/Num of Employees in the section*

| R&D Technology | Effort in Technology Transfer |
|---|---|
| Food Technology (FTS) | 0.4 |
| Herbal Technology (HTS) | 0.5 |
| Material Technology (MTS) | 0.7 |
| Environment Technology (ETS) | 0.4 |

**Table 4 - Modes of technology transfer of R&D sections**

Table 4 indicates that although Materials Technology Section has conducted fewer number of non commercial transfer programs their effort in technology transfer is high compared to their number of employees. This should be taken into account when assessing and rewarding the effort of non commercial technology transfer.

### Vidatha Programs

Vidatha is a mechanism initiated by Ministry of Science and Technology of Sri Lanka to transfer technologies developed in government research institutes to rural areas and to solve technical problems of those areas. Majority of researches (65%) were of the view that Vidatha program is a good mechanism of technology transfer.

| Year | 2005 | 2006 | 2007 |
|---|---|---|---|
| Num. of Vidatha Programs | 69 | 229 | 82 |

**Table 5 - Number of Vidatha programs participated**

About 40 % of the programs participated in all three years involved Kithul tapping technology showing the limited scope of technologies transferred. Other participated programs include technologies related to agriculture sector (24%) and dairy products sector (15%). 97% of the technologies

transferred were for individuals and small business sector. The reasons for this are that larger firms often have their internal source of technology development and SME sector is more eager to get and try new technology.

During the three years of consideration, 51 used technologies transferred by the institute for their existing business while 77 used the technology to start a new business. This shows the contribution of Vidatha programs to develop entrepreneurs in Sri Lanka.

**Publications of the research staff**

The following table gives a summary of the publications of research staff of the institution.

| Method | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | % of Total |
|---|---|---|---|---|---|---|---|
| Papers in international/regional referred journals | 5 | 5 | 11 | 9 | 10 | 3 | 26 |
| Papers in proceedings of international conferences | 1 | 2 | 1 | 2 | 1 | 2 | 5 |
| Abstracts in proceedings of international conferences | 1 | 2 | 1 | 0 | 0 | 1 | 3 |
| Presentations at international and regional programs | 3 | 4 | 5 | 8 | 16 | 11 | 28 |
| Papers in local journals | 2 | 2 | 1 | 0 | 2 | 3 | 6 |
| Papers in proceedings of local conferences | 2 | 3 | 3 | 0 | 1 | 2 | 6 |
| Abstracts in proceedings of local conferences | 5 | 9 | 13 | - | 8 | 8 | 26 |

**Table 6 - Publications of research of the institution**

Publishing abstracts in proceedings of local conferences was the prominent non commercial transfer method. But presently presentations at international and regional programs and papers in international/regional referred journals have also contributed substantially as a non commercial transfer method. The percentage of publications in international and regional journals and presentations in international and regional conferences in relation to the number of international patents obtained (Table 2) implies that technological know-how developed by the research institute is vulnerable for counterfeit in other countries as most technologies are unprotected but transferred via non commercial methods.

**Training Programs**

Training programs conducted by the institute per year and the revenue from training programs have increased gradually as can be seen from Table 7. In contrary to the literature, training programs are now viewed as a method of generating income for the institute so it is getting more inclined to a commercial transfer method.

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|
| Training Programs | 75 | 90 | 88 | 75 | 84 | 96 |
| Income generated as a % total income | 6 | 3 | 3.7 | 7 | 2.5 | 2.9 |

**Table 7 -Number of training programs and Income generated**

### 3.8.2 Commercial transfers

Use of R&D contracts was the main mechanism of commercial transfers. Income from technical services has grown at a significant rate as can be seen from Table 8.

Direct spin offs are companies involving institute generated intellectual property and former institute staff where as indirect spin off companies are established by former staff drawing on the knowledge acquired during the career. There are no records or evidence of direct spin offs from this institute but there are many companies established by the former staff drawing on the knowledge acquired. During the time period (2002-08) considered, two employees of this institute incepted their own business which can be assumed to have started with the technological knowledge gained.

| Source of Income | 2003, % | 2004, % | 2005, % | 2006,% | 2007, % | 2008, % |
|---|---|---|---|---|---|---|
| Income from commercial transfers as a % of total income | 75 | 76 | 80 | 81 | 92 | 86 |
| Testing services | 54 | 50 | 68 | 62 | 68 | 70 |
| Contract projects | 16 | 23 | 8 | 14 | 19 | 9 |
| Consultancy | 5 | 3 | 4 | 5 | 5 | 7 |

**Table 8 – Income from commercial activities**

### 3.9 Success of technology transfer and technology commercialization (2001-2008)

There were 239 technological innovations, 11 new products and 11 new processes during the period. Only 233 of them were attempted to transfer during 2001-2008. 50% of them were from food section (FTS), 33% from herbal and natural products (HTS) section and 9% from Materials Technology Division (MTD).

| R&D Division | Num of technologies attempted to transfer | Num of technologies transferred | Num of technologies commercialized | Successful technology transfer, % | Degree of success in transfer | Success in technology commercialization, % | Degree of success in commercialization |
|---|---|---|---|---|---|---|---|
| FTS | 116 | 104 | 49 | 89 | Very good | 47 | Poor |
| HTS | 77 | 62 | 31 | 80 | Very good | 50 | Average |
| MTD | 18 | 15 | 6 | 83 | Very good | 40 | Poor |
| ETS | 22 | 20 | 9 | 90 | Very good | 45 | Average |
| Total | 233 | 201 | 95 | 86 | Very good | 47 | Poor |

**Table 9 – Technology transfer success of R&D**

(0 – 49 Poor, 50 – 64 Average, 65 – 79 Good, 80 – 100 Very good)

Table 9 shows that although technology transfer success is at a acceptable level of 86%, the commercialization success is below the satisfactory level. All sections are equally successful in technology transfer but shows great differences in technology commercialization success.

### 3.10 Non transferred technologies

A non transfer refers to research projects that were intended for transfer but were never accepted. There are 60 technologies which are not transferred in the period considered. Most of them were initiated within laboratories expecting future demand. 22 out of 60 non transferred technologies received patents. There were 3 stagnant technologies which could not be transferred to the industry for reasons not associated with the technology. Scaling up issues, lack of pilot plant facilities, lack of motivation from management, favoritism and members of the team leaving the institutes are common reasons for technology stagnation.

There are no special arrangements taken by the institute to investigate the reasons for non transfer and transfer the non transferred technologies.

## 4. CONCLUSION

The primary conclusion to be drawn from the foregoing study of the experience of government research institution in technology development and transfer is that the adopted technology transfer process has many shortcomings which has led to low rate of commercialization and raises a major concern about the R&D productivity of the country.

Furthermore it reveals that explicit policies for technology transfer do not exist in the institute. Attempts to transfer have been a self activated endeavor at different levels. Such self activated behavior often lacks coordination and direction. There is no single unit that caters the full range of process of technology transfer from the identification potential technology to commercialization. In the absence of such unit, work is divided among research sections, MBD group, Corporate Services

Division and individuals. Therefore the scope of each party is often blurred and inconsistent. This inconsistency has resulted in lack of responsibility and a substantial number of unexploited technologies.

Commercialization success indicators explain that contract projects and funded projects achieve the maximum success. The main reason for this is that such projects are funded after a thorough feasibility analysis by the funding organizations and research requests were received after identifying an already existing opportunity in the industry.

The resources available in this institute for scaling up and pilot plant are inadequate. There is a trend to start partnership with the private sector to set up pilot plants facilities and share resources among the industry.

Investigations in the stage of intellectual property protection expose many critical issues. Reluctance of majority of researchers to patent technologies, lack of confidence for the existing patent system of the country, inability to commercialize majority of patented technologies due to ineffectiveness in evaluating the commercial potential, locating suitable partners and negotiating contracts are those issues. Lack of trust and communication between the research sections and MBD unit has delayed the process of obtaining IP protection.

Personal contacts are the dominant approach to technology transfer in this institute. However the trend is towards organizational link pin approach which is considered to be more effective by majority of the staff. Procedural approach is still a small percentage of the three technology approaches.

Small to Medium size companies are often receptive to Institute technologies. 97% of the technologies transferred through Vidatha Programs were for individuals and small business sector.

Lump sum is obtained as the method of payment for technology transfers in most instances. Researches are in the view that a technology is undervalued in this method. Institute is negotiating for lump sum plus royalties starting from 2002.

Rate of success in technology transfer for technologies developed by this institute is 80-90% and technology commercialization success is 40-50%. Degree of success in technology transfer is very good and technology commercialization is poor. There is substantial number of non transferred technologies in the institute.

## 5. RECOMMENDATIONS

### 5.1 Increasing the technology transfer and commercialization success

23% of the technologies developed by this research institute are not transferred to the industry and spin off applications were not considered as a mechanism of technology transfer. Interaction between the industry and institute should be promoted through consultative meetings and collaborative studies to identify market opportunities for existing technologies and to identify new opportunities for technology development.

### 5.2 Developing a technology policy and implementing a technology transfer office

The commercialization success of developed and transferred technologies can be increased through integrating the activities of the technology development and transfer process by setting up of a technology transfer office.

The institute should develop a technology policy that implements policies governing the technology development and transfer process. It would bring consistency and transparency to technology transfer process. Technology policy should develop guidelines for implementation of a technology transfer office.

The proposed technology transfer office should deal with all stages of the technology transfer process. Devising a technology strategy, technology protection activities, evaluating the commercial potential of innovations, revenue management, negotiating agreements with different parties and promoting technological innovations to get the maximum return of investment are

some key responsibilities of the office. Persons with science or engineering background with additional qualifications in management, law or technology management should be appointed to this technology transfer office. The office will also investigate the reasons for non transferred technologies and take measures to gain an economic/social benefit from those. The technology transfer office should take measures to improve relationship with foreign universities and research institutes to gain a broader market opportunity for its technological products and transfer and obtain valuable technological knowledge from other countries through participatory research and training programs.

### 5.3 Changes to revenue management

Lump sum payment method should be discouraged as a revenue generating method. Since the payment is received before the transfer effort, technology transfer process is not followed up by the transferors. It is proposed to use a combination of lump sum and royalties as much as possible so that the employees are continuously in touch the status of the transferred technology.

### 5.4 Support innovation by changing the organization culture and the reward systems

Promote knowledge sharing, communication and technology transfer culture among the employees. Research employees underestimate or confront with technology transfer and technology promotion efforts mainly because they lack knowledge in these areas and they feel that they are being left out from the transfer and commercialization stages. So the management must use training programs to increase the knowledge and skills on these areas and conduct activities to increase the cohesiveness of the employees. Similarly the employees must be encouraged to enter more procedural or organization link pins type of technology transfer activities and more funded, contract and market oriented projects where the commercialization success rate is high.

Existing reward structure should be changed. The present scheme takes in to consideration only the technology development aspect. The new reward structure should also look at the technology transfer success and commercialization success of the department and the individuals. Also the effort in non commercial transfer should be assessed using an equation similar to the proposed equation, instead of absolute values.

### 5.5 Develop research teams with diverse capabilities and educational backgrounds

The institute should encourage communication and sharing of information with the technology transfer office from the time of formation of the research team to avoid last moment misunderstandings. It is advised to include an engineer in the research team to assist scaling up and to developing pilot plant facilities without delays. The institute should form following groups and mechanisms to assist the technology transfer process.

*Engineering Assistance Group (Under Engineering Section)*

This group communicates and coordinates with all research groups in the institutes and the research team will request for assistance in scaling up and pilot plant facilities as the projects are going on. With this way feasibility of pilot scale can be assessed without delay.

*Intellectual Protection Group (Under Technology Transfer Office)*

The activities of related to technology protection should be carried out by this unit including determination of patentability, processing and safeguarding patent and copyright arrangements, obtaining appropriate protection and negotiating and managing licenses.

*Feasibility Study Group (Under Technology Transfer Office)*

This group is formed to continuously monitor the market needs and technological opportunities for research projects. Evaluating the commercial potential of the

invention and locating suitable commercial development partners should come under their purview. This group will monitor the commercialization success after the technology has been transferred to continuously improve research productivity of the institute.

The above groups will help the institute to reduce the technology transfer cycle immensely as some work can be done simultaneously, methodically and minimized delays.

### 5.6 Increasing the scope of non commercial transfers

Details of the Vidatha technology transfers reveal the limited scope of the technologies transferred. It is recommended to expand the scope and to increase the transfers to medium scale companies in which the financial benefit to the institute is high.

The approach and the recommendations of this case study can be made use by any similar research institute to develop a more effective technology transfer process. Further research opportunities are available to investigate whether these research outcomes are common for all research oriented organizations in Sri Lanka irrespective of the organizational differences.

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