



Industry-Academic Collaboration  
via Undergraduate/Postgraduate  
Training and Research Projects



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## **Industry-Academic Collaboration via Undergraduate/Postgraduate Training and Research Projects - Faculty of Science, University of Ruhuna**

The faculty of Science of the University of Ruhuna, Sri Lanka has identified the need for improving the relevance and quality of Science Graduates in order to get their employability expanded. The faculty has launched a number of activities to achieve enhancement and continuity of quality and relevance of undergraduate education. Among these, one of the main and important aspects is to build and to maintain a strong relationship between university and industries (public and private sectors).

More specifically, the faculty is in the process of reforming its educational processes to meet demands from present job market and is also looking forward for contribution from private and public sectors' businesses that have the potential to employ skilled science graduates.

Through the proposed industry collaboration, the faculty investigates more closely means and ways to produce human resources from its study programmes to suite present and future skill-demands. These study programme reforming activities will open-up opportunities for industry participation in development of graduate-skills through the activities such as guest lectures from industrial practitioners, field training and industrial training for undergraduates, undergraduate/postgraduate research projects etc. As one of the initial activities in this direction, we are organizing an informal discussion with industrial practitioners to work out possibilities of such collaborations in this project.

## **What benefits the industry would get from these?**

One of the major problems with regards to university education as well as industrial research in the country is the relevance of the undergraduate/postgraduate programmes offered by the academia to the industry in the country. Indeed, there are only a handful of private and public sector industries in the country that seek assistance from the experts within the country to find solutions to many day-to-day problems arising in their relevant industries. Most of the industries tend to import packaged solutions (hardware, software, chemical modules, expertise and so on) from foreign countries either directly or via the agents of the relevant components. No effort is being made to invent these in the country. This is not only a rather shameful situation but also is a highly expensive way which has no long-term benefit to the industry or the country. The best and closest example we can take is the India, which has now become a fast growing scientific giant in the world. The way the India followed is so simple - find as much as possible technical/scientific solutions from

your own country while trying to establish links with the relevant academic entities.

If we are to find a solution to this, both academia and the industry must realize the importance of the joint collaboration in promoting such programmes. We all know that it is only less than 1% of the school leavers in the country could get a placement in a government university in Sri Lanka. This 1% consists of the best and the talented future workforce in the country. Unfortunately, there has been no mechanism for the majority of this group to contribute to the development of the country using the education they received at the universities. The best possible way to implement this, as we believe seems to be via undergraduate/postgraduate research projects linked to demands and problems in the industry.

To mention a few, the key benefits the industry could receive from such collaboration are as follows:

- Access to the huge knowledge-base and the human resources in the Sri Lankan academic community trained and specialized in many industrial related areas.

- Using undergraduates and postgraduates in problem solution under the supervision of academic members and experts from the industries.
- Providing opportunities for employees in the industries to undergo relevant postgraduate training via joint research projects.
- Requesting the university to offer tailor-made industry-oriented (joint) short/long term courses for employees.
- Possibility of marketing (exporting) successful solutions.
- Avenues for innovations and hence to get joint-patents for solutions/products.

## Our Strength

The Faculty of Science's research potential is strengthened by its well-qualified academic staff consisting of 40 PhDs with specialized training in broad areas of sciences and their applications. Undergraduates of the faculty follow two main general degree streams namely, *BSc General Degree in Physical Sciences* (with hundreds of course units in **Physics, Industrial Mathematics, Mathematics, Chemistry and Computer**

**Science**), *BSc General Degree in Biological Sciences* (with hundreds of course units in **Chemistry, Zoology, Fisheries Biology and Botany**). Students get the opportunity to specialize in each of the above main subjects under the relevant BSc Special Degree Programme (e.g BSc Special Degree in Chemistry and so on). In addition, senior academic staff members conduct several research projects and also supervise many postgraduate degrees leading to MPhils and PhDs in the faculty as well as in other institutes. The faculty is on-line connected to the backbone optical fiber university-wide network which itself is on-line connected to the Internet via Lanka Educational and Research Network (LEARN). The faculty is equipped with scientific laboratories (chemical, biological, computational, physical and mathematical) of the best standards available in the country. For example the Physics laboratories are capable of conducting on-line, computer (or micro-chip based) experiments and measurements. These are ready to cater not only the undergraduate teaching and research but also advanced postgraduate level research work linked to industrial problems. On the other hand, the Computer Science department and the Computer Unit of the

faculty has got the latest state-of-the-art computational resources that are within easy access to be utilized in performing analyses, high performance computer simulations and production of quality graphics etc.

## Undergraduate Research Projects:

At the moment, almost all the departments offer some sort of research project for undergraduates as a component of their degree programme. It is expected to introduce in these programmes joint research projects with various industries in the country by the next academic year (commencing in mid-2005).

### ***Will the undergraduates be capable of providing solutions to industrial problems?***

Our graduates/undergraduates get one of the best undergraduate education which is competitive in the international academia. This has been proven at many occasions for instance in winning internationally competitive awards, scholarships, studentships, getting employment in national/international market. Furthermore,

our academic staff members have also proven their capabilities in winning such awards nationally as well as internationally (E.g. International award for best young scientist, many international fellowships etc). One of another indices that the potential of research is measured is the publications appear in refereed journals. Many of our members have won for example Sri Lankan Presidents Research Award for such (international) publications in every year.

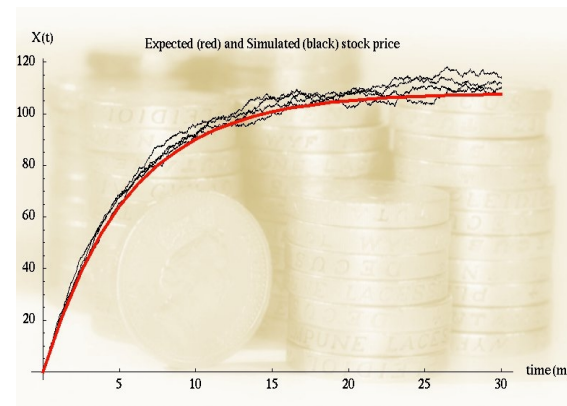
Strengthen by such a solid academic foundation, our graduates have been able to provide best solutions in their workplaces (E.g: Industrial Finance Systems Inc, Royal Ceramics Lanka Ltd., Commercial Bank, National Insurance Corporation to mention a few), according to the informal surveys carried-out recently.

### Can pure scientific results be applied in industrial problems?

Sri Lanka, being treated by the western society as a developing country have had no opportunities for massive industries which can assign their problems as postgraduate/undergraduate research

projects with financial support given for the people involved in these projects. However, the things have now changed. For example, we have proved that we have got talented human resources competitive in any standard in the world to provide solutions in the ICT industry. (This is not just writing/developing software for office work). Although the scale of our industry may not be able to support big research projects, there are possibilities to use the scientific tools to provide solutions to many industrial problems as identified by our members. Here are some examples:

#### A. Forecasting the behavior of the

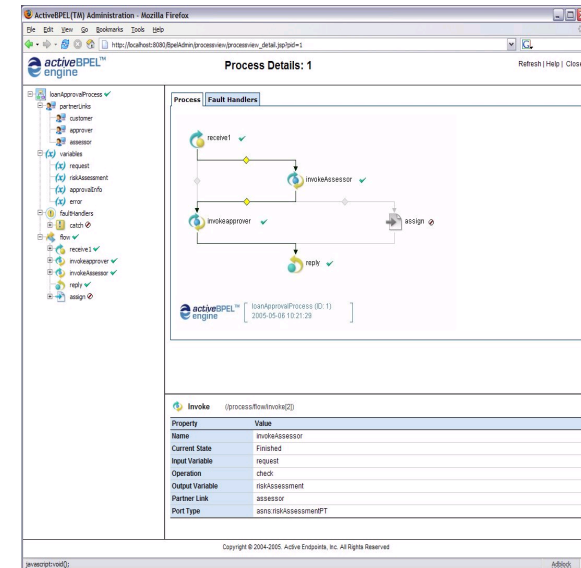


#### stock market/financial analysis:

This is an example where techniques in *Stochastic Processes* and *Differential Equations* are used to build-up a model for

financial market (fluctuations in indices for example). This involves use of deep mathematics and theories from Physics, computer programming as well.

The benefits of using such models for instance in a business organization are immense: one can use these to monitor and obtain forecasts of the future behaviour of the stock-market as many of the socio-economical factors are at ones disposal to change as one wishes on the computer. An obvious question one may ask is that within another 6 months time what is the chance that the average stock price or an option derived on stock prices of some companies

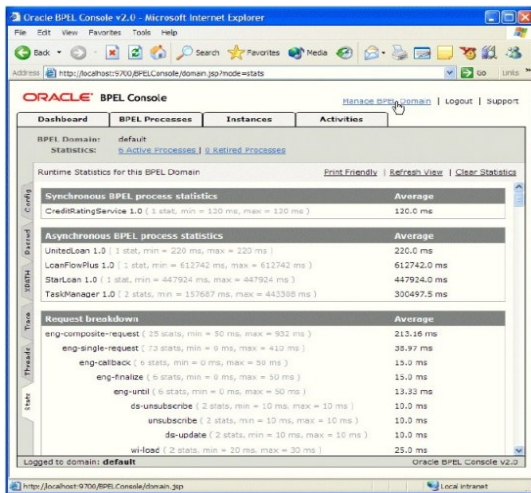


will exceed a certain level? At the moment

no such approaches are in use in the Sri Lankan market. (This is an on-going research project in the faculty).

### **B. Tsunami affected private/public sector:**

Rebuilding Tsunami affected business organizations using latest technology (e.g. ICT, eBusiness solutions) to give substantial



up-lift from their pre-Tsunami state.

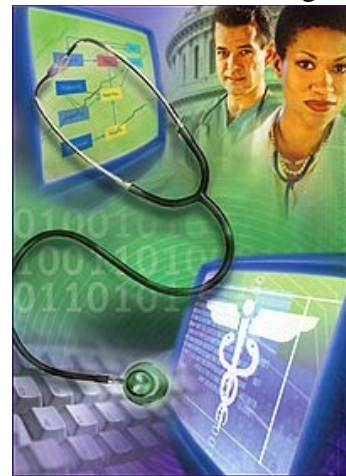
### **C. Use of ICT & eBusiness solutions in industry:**

Use of ICT and eBusiness in industry solutions will automatically expand a company's market despite of regional, national and international boundaries. Improving the productivity and efficiency of

public-sector administrative processes, e.g. applying ICT in communication between various governmental departments. For instance there are open, complete and royalty free xml-based standards that support and enable Business Process Management (BPM) in industry. XML based standards like Business Process Execution Language for Web Services

(BPEL4WS) are widely used and comes with variety of open and proprietary tool supports. D. Using ICT solutions in health-care systems (public and private)

A major problem facing today's health care is the increasing diversity and differentiation.



New medical specialities are constantly created, there exist a large number of roles in patient care, and many organisations – public as well as private – may be involved in the care of a single patient. This differentiation creates a need for the interoperability of organisations

as well as their supporting systems and applications. Our experiences show that the key instruments for achieving interoperability are **Process Oriented Methodologies** and development of **Ontologies** for health care.

### **E. Electronic publishing and archiving**

Electronic archiving of important and confidential documents such as deeds titles, judiciary information, etc. Publishing on the web (designing dynamic websites).

### **F. Designing low-cost and efficient house-hold appliances:**

E.g.: Low Cost Electronics Materials, Solar Cells and Renewable Energy Sources, Designing low-cost and efficient household appliances (e.g. hopper maker, rice-cookers).



### **G. Extraction methods:**

E.g. extraction of plant material from plants e.g. tea, medicines etc.

Perfume industry; extraction of essential oil via distillation methods etc.

***Faculty expertise areas for industrial applications:***

*Information and Communication*

*Technologies:*

- Electronic Business Solutions, (eCommerce, Supply Chain Automation, eProcurement Systems)
- Business Process Modeling, Reengineering
- Office Automation (Hardware Installation, Maintenance, Software Installations/Development)
- Network and Internet Solutions/Administration
- Customized IT System Development
- Web-based Application Development
- Computer Security Solution
- Business Data Warehousing and Mining

*Statistical/Computational and Mathematical Modeling:*

- Industrial Statistics (e.g. applicable in quality control, forecasting)

- Financial Forecasting
- Production Line Modeling
- Modeling of Environmental pollution
- Studying spread of diseases
- Traffic flow control
- Actuarial Analysis
- Modeling and forecasting of earthquakes/tsunamis

*Fisheries:*

- Water quality management
- Ornamental fish breeding
- Cost-benefit analysis, profitability analysis in fisheries and aquaculture
- Management of fish diseases
- Site selection and construction of tanks and ponds for aquaculture
- Formulation of cost effective feeds for fish
- Live fish feed culture
- Fish processing
- Research on Asian eels

*Physics related:*

- Fabricating magnetic thin films for memory, microwave devices and hard magnets

- Low Cost Electronics Materials, Solar Cells and Renewable Energy Sources
- Processing and Analysis of Remotely sensed (satellite) data of ocean waters.
- Designing low-cost and efficient house-hold appliances (e.g. electro-mechanical hopper maker, Rice-cookers)

*Chemical:*

- Manufacture of alcohol and other beverages: Distillation methods etc.
- Production of Sugar: use of sugar and by products in other industries e.g. Toffees, Sweets, etc.
- Synthesis of drugs, paints, Analysis of drugs, Manufacture of soaps, Detergents.
- Quality control of soap and detergents etc., extraction methods e.g. extraction of plant material from plants e.g. tea, medicines etc.
- Perfume Industry; extraction essential oil via distillation methods etc.

- Manufacture and quality control of polymers, rubbers etc.
- Glass productions, cement production etc. Corrosion protection, Iron
- Extraction: quality and material testing etc.

Biological and Ecological:

- Biodiversity
- Management of waste disposal
- Forest conservation
- Forest extension
- Identification and distribution of Medicinal plants
- Introduction of crop development methods
- Pest Control
- Tissue culture
- Hydrodynamics
- Ornamental and Fruit Plants
- Extension of Minor Crops
- Monitoring of quality of water bodies
- Dairy products and pasture management
- Landscaping

- Manufacture of Fruit Drinks, Cordials and Jams etc.

**Present collaboration of the Faculty of Science with Private/Public Sector Organizations**

The faculty of Science has been in collaboration with the following organizations on training undergraduates:

- Loadstar Tyre Industry, Midigama.
- Sampath Bank
- Colombo Stock Exchange
- John Keels Holdings Ltd P.O. box 76, Colombo
- Lankem Ceylon Ltd, 760, Baseline Rd, Col 07
- CIC Ceylon Ltd, 199, Kew Rd, Colombo 2
- Microcelle Ltd, Koskanatte Rd, Mampe, Piliyandala
- Macksons Paint Industry, P.O. Box 4, Keselwatte, Panadura
- Arpico Flexform Pvt Ltd, 310, Highlevel Rd, Nawinne, Maharagama
- Ceylon Agro Industries, 346, Negambo Rd, Seeduwa

- Ceramic Research & Development Division, Thumbowila, Piliyandala
- Maharaja Organization Ltd, 140, Dawson Street, Colombo 2
- Lanka Ceramic Ltd, no 696, Galle Rd, Colombo 3
- Coconut Research Board, Bandirippuwa Estate, Lunuwila
- ITI, P.O. Box 787, 363 Baudhdhaloka Mawatha, Colombo 2
- Hanwelle Rubber Products Ltd, 422, Walawwa Road, Homagama
- Pelawatte Sugar Industries Ltd, Buttala
- Votex Industries, Biyagama Road, Pethiyagoda, Kelaniya
- The Tea Research Institute of Sri Lanka, St. COOMBS, Talawakelle
- HAYCARB LIMITED, 400, Deans Rd, Colombo 10
- Sugar Industries Ltd, Sevanagala
- Link Natural Products Pvt. Ltd, C.I.C. House, 199, Kew Road, Colombo 2
- Unilever Ceylon Ltd. P.O. Box 283, Colombo 14 BOI, 25<sup>th</sup> Floor, World Trade
- Centre Building, West Tower, Bank of Ceylon, Colombo 1

- Industrial Financial Systems, 501 Galle Road, Colombo 06, SRI LANKA, Telephone: +94 11 2364400, Fax: +94 11 2364401
- National Zoological Gardens, Dehiwala, Sri Lanka
- Ecosystems & Livelihoods Unit, IUCN- The World Conservation Union, Sri Lanka Country Office, 53, Horton Place, Colombo 07, Sri Lanka, Tel: 0094-11-2682418, 2694094 EXT: -307, Fax: 0094-11-2682470
- Ministry of Fisheries
- National Aquatic Research Agency
- Swedish International Development Cooperation Agency/Department for Research Co-operation (SAREC)
  
- Asian Development Bank

## **How industries can establish a link/project with the faculty and get benefits of the programme?**

### **1. Via faculty research**

Senior faculty members usually write research project proposals and undergraduate or post-graduate students

conduct research under the supervision of such faculty staff. Expression of interest by the industries with their targets and needs, these project proposals can be tailor-made to meet the demands of the industries.

### **2. Via undergraduate research projects**

Undergraduate students in their final year, work on research projects in selected disciplines. Industries can introduce their interests so that students can design their projects to meet the demands of the industries. For example, an industry may wish to upgrade a product or may wish to analyze the quality of a product so a student can conduct a research study in relation to meet that demand.

### **3. Undergraduate training**

Industries can provide short-term training for undergraduate students. During these training periods, students can identify ways of upgrading the products or any problem related to the manufacture of the product. Even this can be extended to identification of any type of problem within the industry. Students can then design methods of solutions under the supervision of faculty staff to handle/solve these problems.

### **4. Presentation/Conduction of seminars by the industries:**

You may make a presentation or arrange a discussion either at your organization or at the university with the relevant staff of the faculty to discuss about your problems. This will greatly facilitate the initiation of a research project between your industry and the university. These presentations can be organized to directly address students as well as staff. Our past experience suggests that this type of activity will give the industry the best way to find talented graduates to recruit to their organizations. Indeed, the university can organize walk-in interviews for final-year undergraduates if the industries request.

If you are willing to participate in the programme, please contact us via

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Printed at Faculty of Science  
University of Ruhuna

December 2005

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