PRIORITY RESEARCH TREE
UNIVERSITY OF INDONESIA
In accordance with the Decree of the Board of Trustees of Universitas Indonesia (SK MWA 005/SK/MWA-UI/2007), which sets the target of becoming a world-class research university as a vision that has to be realized by the year 2012, Nano Technology, Genome Science, Information and Communication Technology, Policy Studies, and Indigenous Studies have been designated as the five priority fields of research.

However, as these five fields represent the cutting edge of sciences, achieving significant results in the fields is obviously a daunting task for any university, but especially for the universities in developing countries such as UI. A clear strategy is therefore in order if UI truly wishes to attain any significant results in the fields.

Based upon such a consideration, the road map for the implementation of intensive research in the five fields was put together in 2007, and the very first step in the map was defined as the identification of UI’s actual competence in the five fields in the form of tree diagrams or the so-called “research trees.” Further, five small teams consisting of top-notch researchers from various disciplinary backgrounds were founded specifically to design the research trees in each one of the five fields.

The teams had convened numerous times ever since, and finally they were able to put together five research trees contained in this booklet. Based on these research trees, public lectures and seminars will be organized, international joint research projects will be initiated, and world-renowned scholars will be invited to the university.

It is our sincere hope that these strategic measures will be effective in enabling the university to achieve significant results in the five fields, and thereby growing into a world-class research university.

Bachtiar Alam, Ph.D
INTRODUCTION

UNIVERSITY OF INDONESIA

VISION AND MISSION

University of Indonesia to be acknowledged as a research university the center for excellence in science, technology and culture.

The university aims to become a core center (center of excellence) and be at the forefront of research by conducting leading/key-cutting edge research. Through its research activities, in the next five years UI envisages itself as an Asia world class university and will be regarded as a trendsetter in scientific community.

OBJECTIVES

To reach the goals of its vision and mission, UI needs to:
(1) build and improve its infrastructure and research facilities
(2) develop a solid intellectual infrastructure by improving its research-core competence
(3) conduct and improve its multidisciplinary and integrated research

**RESEARCH ASPECTS AND RESEARCH CORE COMPETENCE**

Since the past six years, UI has started to spend more of its budget to build and improve its infrastructure and research facilities. In an effort to give priorities of research, The Board of Trustee of UI in 2006 put forward the core-competence of research, which comprise in the five priority research i.e. Information and Communication Technology Studies (ICT), Nano-Science and Technology Studies (NST), Genome Studies, Indigenous Studies, and Public Policy studies. All of these studies carry out interdisciplinary/multidisciplinary approach.

**ROAD MAP 2007-2012**

To guide science and research activities in UI and achieve its target as Asia world class university by year 2012, a road map is needed. The roadmap is set by the five core-competence in UI which are the ICT, NST, Genome, Indigenous and Public Policy Studies, and there are benchmarks which mark the achievement and targets to be met.

**STATEMENT**

In order to be Asia world class university, UI will conduct key-cutting edge research through research program based on the five core-competence. The research programs will have impacts on the global sciences in Indonesia and regional Asia. By carrying out such high-level activities, research in UI will not be considered as mediocre, and in turn, UI will gain admiration and respect from national and international scientific community.

**RESEARCH TREE**

The existence of research tree is important since it gives overview of existing and ongoing research, priorities of research, and future research. Also, it gives information on the physical infrastructure, intellectual infrastructure, research coordination, and management. It is hoped that through such information it can facilitate future research, expertise and capacity to be made. The research tree can also give direction and guideline for the future research which will improve the quality of research. There are five research trees from five core-competence in UI which give overviews of cluster research and noble research from each core competence. The core research put forward is designed to be unique, smart, has competitive edge, applicable and can be implemented. The research activities of each core competence can mobilize academic staff which are doing research and support and promote research fields in UI.
STRATEGIC PLAN

The grand strategy of UI, which is stated UI Strategic Plan 2007-2012, is to strengthen noble research to increase UI’s level in international standard. This can be achieved by:

- Human resource database based on professionalism
- Creating comfortable environment for doing research
- Giving directional research program
- Giving grant to develop cluster and noble/leading research
- Providing infrastructure and research facilities
- Collaboration with industries
- Commercialization of research outputs
- Increasing publications in national and international journals
- Increasing patent
- Increasing awareness of intellectual property rights
INTRODUCTION

The field of genomic is advancing rapidly. It can be said that without the capacity to perform advanced genomic researches, significant achievements in the field of biological and health sciences will be almost impossible to obtain. The current industrial health and biological products are currently dominated by countries who possess the knowledge, skill and technology to perform genomic based research and development. It is therefore highly important for the University of Indonesia (UI) as an incubator for the development of science and technology to develop its capacity in the genomic science that is difficult to separate from proteomic science. In order to establish continuing improvements in both genomic and proteomic technologies, the existing genomic research activities within UI were identified and selected for the development of UI “Research Tree for Genome Studies”. The genomic research activities has been determined to aim at discovering solutions to urban health problems, that is focused on degenerative and infectious diseases.

The Urban Community of Indonesia is still facing the challenges of infectious diseases that are typical to those of tropical countries in Southeast Asia. Dengue, HIV, Tuberculosis are still considered as major problems in the Indonesian community, including in the urban populations. Despite the past and current efforts to control infectious diseases in Indonesia, problems related to infections do not seem to decrease. Emerging infectious diseases, such as the H5N1 Influenza A of which Indonesia currently ranks highest in the number of confirmed cases as well as the mortality rate, also requires special attention. In addition to the ongoing battle against emerging and reemerging infectious diseases, the Urban communities of Indonesia have yet to face the consequences of inappropriate implementation of modern technology and the changes in lifestyle that affect health, such as the development of degenerative and cancerous diseases.

An important issue that requires special attention in the construction of topics for genome research is the exploration of the potentials of unique sequence variations of the Indonesian people and also of the Indonesian plants and microbial pathogens. The University of Indonesia realizes the necessity to protect the invaluable potentials of the information hidden in the unique genomic sequences of Indonesia by active exploration of these potentials through well planned research activities. Such a concern has been proven to be true in the case of H5N1 Influenza A, where a vaccine that is based on an Indonesian strain of the H5N1 Influenza A has been shown to induce the strongest cross protection towards other strains of H5N1 influenza A. In order to maintain the proprietary right of products derived from indigenous genomic sequences to remain within Indonesia, UI seeks to lead the scientific community of Indonesia to the realization of the urgency of active involvement
in research activities that is aimed at elaboration of the potentials of indigenous sequences for the purpose of health promotion.

Several facilities have been established within the University of Indonesia premises to accommodate research in infectious diseases. Studies on Tuberculosis, Dengue, HIV, Malaria, and Avian Influenza have been well established at the University of Indonesia. Intensive clinical researches as well as basic and applied research in these five infectious diseases are currently conducted to meet the increasing demands for solutions to the transmission of these diseases. Cancer research is also an area that is important to develop in order to establish the role of the University in providing solutions to urban health problems. Scientists of the University of Indonesia have initiated researches to study the pathogenesis, diagnosis and treatment of cancerous diseases. The development of capacity in stem cell research has also been initiated by UI scientists, which in the future can be used for treatment of degenerative diseases.

The existing activities related to genomic and proteomic researches performed by enthusiastic scientists and academicians, the desire and willingness of core scientists and academicians to perform interdisciplinary collaborative research in genomic and proteomic science, and the national demand and support for the development of research in infectious and degenerative diseases are factors that will significantly contribute to the development of research activities in genomic and proteomic research in UI.

### OBJECTIVES

- In order to achieve integrated activities in Genomic and Proteomic Research, it is important that the following objectives be met:
  - The establishment of an organization structure that accommodates and facilitates the existence of integrated researches between various fields that deals with Genomic and Proteomic science in UI.
  - The establishment of a solid and well planned infrastructure for integrated research activities in Genomic and Proteomic science.
  - The formulation of policies that promote the development of genomic and proteomic research products that address the needs of national urban communities through UI research activities
  - The formulation of policies for provision and support of indigenous human resources for research and development in genomic and proteomic science in UI (for example: human resources that are exclusively dedicated for research development at every level of competencies, not excluding human resources from the lower level of competency)
  - UI should support the implementation of government policies for national proprietary rights of indigenous biological diversities that also involves the proprietary right for indigenous genome
Research tree of Genomic Studies in UI is focused on Genomic and Proteomic Studies for Urban Health. There are 3 main branches in the Genome Tree, namely “Infectious diseases”, “Indigenous genomes and proteomes sequences” and “Degenerative Studies”. The 3 branches of research activities will address urban health problems that are related to infectious and degenerative diseases and are aimed at finding solutions for national urban health problems in infectious and degenerative diseases, which may be in the form of any of the following categories:

- Recommendations for health promotion
- Recommendations and Strategies for control and prevention of diseases
- Provision of prototypes of diagnostic system
- Provision of prototypes of vaccines
- Discoveries of therapeutic agents (including stem cell therapy and gene therapy)

The details of the three branches of the Genome Tree are as follows:

**Infectious Diseases**
The branch of Infectious diseases is focused on infectious diseases that are considered as major health problems as well as emerging and emerging infectious diseases in the urban community as well as in hospital setting. Examples of such infections are HIV, Dengue, Tuberculosis, Malaria, H5N1 influenza A, Polio and Methicillin Resistant Staphylococcus aureus (MRSA). The branch of infectious diseases is expected to explore the possibilities of finding solutions to the increasing resistance towards antimicrobial therapy and preventing the progression of severe infectious diseases, and to produce prevention strategies through the following research activities:

- **Antimicrobials and resistance genes**
- **Microbial pathogenesis**
- **Host-microbial interaction**
- **Host genetics**
- **Molecular epidemiology of infectious diseases**

**Indigenous genomic sequences**
Research topics include structure and function studies and indigenous sequence. The highlight on “structure and function studies” is deemed as important so that research capacity in this area is continuously increased by exploration of valuable information concerning the structure and function of nucleotide and amino acid sequences, which in turn will provide directions towards future research activities, especially in antimicrobial, pharmacogenomic, host-pathogen interaction and vaccine researches. In order to address proprietary issues and to bring forward the uniqueness of Indonesian genomic sequences, it is important that genome studies at the University of Indonesia is also directed towards exploration of unique indigenous sequence variations either for the purpose of product developments or for elaboration of pathogenesis of diseases. Molecular epidemiology that is based on indigenous genomic sequences constitutes another branch of genomic studies. The ability to link findings in sequence variation with
other epidemiological studies is expected to result in the acquisition of information that will lead to other avenues of genome studies that will also activate other branches of the genome research tree. The studies under the indigenous genomic sequences branch are:

- **Structure and function studies**
  - Antimicrobials
  - Pharmacogenomics
  - Protein structure (Xray etc.)
  - Regulation of expression
  - Host-Pathogen interaction
  - Vaccine development
  - Computational studies

- **Epidemiology**
  - Microbials
  - Degenerative Diseases

- **Antimicrobial Discoveries**
  - Plants extracts
  - Microbial products

**Degenerative Studies**

The research activities in degenerative studies are focused on degenerative diseases, cancer, stem cell and transgenic studies. Problems in degenerative diseases such as heart disease, osteoporosis, diabetes and hypertension will be addressed through this branch. Research topics include degenerative diseases, stem cell research, cancer research and transgenic studies. The capacity to perform research in degenerative studies requires not only basic knowledge concerning the
development of degenerative diseases, but also the skill to plan the required experiments and the skill to choose the appropriate genome and proteome technology for the experiments. Interactions between clinical scientists who are exposed to the problems of the affected individuals and scientists working in the basic molecular and cellular level as well as those who possess the skill in computational analysis should be encouraged and facilitated for the development and expansion of this research branch. The studies under the degenerative studies branch are:

- **Degenerative diseases:**
  - Autoimmune disorders
  - Cardiovascular diseases
  - Neurologic diseases

- **Cancer:**
  - Cervical cancer
  - Nasopharyngeal carcinoma
  - Lung cancers

- **Stem Cell:**
  - Autologous stem cell
  - Tissue regeneration

- **Transgenic studies:**
  - Human antibody based drugs
  - Human peptides and proteins
  - Pharmacogenomic studies
  - Cancer studies
  - Degenerative studies
- **Drug development and delivery:**
  - Microbial based delivery system
  - Anti cancer drugs
  - Peptide based delivery system
The roadmap for Genome Studies in UI is provided for future directions of currently existing research activities that involve genomic and genome related proteomic science. The roadmap describe the steps for the development of genome studies as an integral part of the development of UI to become a World Class Research University.

The directions in roadmap for genome studies include the requirements and strategy for development of world class genome research activities that is based on urban health problems that is specific to firstly Depok and Jakarta, and to Indonesia in a wider scale.

The roadmap to achieve world class achievements in Genome Studies is as follows:

- Strengthening of capacity in performance of research that include the development of strategies for development of human resources in every level of competencies.

- Promotion of collaborative research activities between UI scientists from diverse fields of sciences, while strengthening and expanding each of the established research groups working in the area of genomics. An example of the interactions between disciplines that are required in genome based drug development, is shown in figure 1.
Urban communities, and the problems they face, are at the forefront of civilization’s issues at the beginning of the 21st century. Alan S. Berger, in his book *The City: Urban Communities and Their Problems*, states that the urban crisis can be understood as the difficulties cities have encountered in performing their communal functions. These functions include, among others, normative integration, social solidarity, providing goods & services (i.e. education, health care, transportation, cultural and recreational activity, employment), socializing community members to community norms, controlling behaviour, and community interaction and mutual support. Big cities in Indonesia, Jakarta in particular, face problems of huge scope, such as traffic congestion, provision of adequate public services, and facilitating social communication, to name but a few.

**OBJECTIVE**

The University of Indonesia recognizes that *Information and Communication Technology (ICT)* has a huge role to play in addressing these issues. Going forward, UI is committed to conducting research on how ICT can solve these problems, by
promoting scientific research into the key cutting-edge technology pillars, and by conducting applied research into building tools and systems that directly impact Indonesian urban life, such as e-Learning systems, hospital management software, and effective information retrieval applications for Indonesian language and culture.

Thus, the main objective of this research roadmap is twofold: to further strengthen UI’s capacity in conducting foundational research, and to apply this expertise in helping to solve the various problems faced by Indonesia’s large urban cities.
**Multimedia Information Retrieval**

This field concerns the development of systems that effectively and efficiently retrieve information in various forms, such as text, audio, image, and video. The most obvious example of such an application would be web search engines, although cutting-edge research currently explores more intelligent content-based retrieval, such as music, image and video retrieval, and novel ways of interacting with and presenting information, i.e. speech recognition, document summarization, etc. Moreover, there is an urgent need to develop resources and methods for Indonesian-specific retrieval applications, e.g. Indonesian language and Indonesian cultural artefacts.

**Recent publications:**
- Mirna Adriani, Jelita Asian, Bobby Nazief, S.M.M Tahaghogi and Hugh E. Williams, Stemming Indonesian: A confix-stripping approach, ACM Transactions on Asian Language Information Processing, December 2007

**Cognition and Computational Intelligence**

This field encompasses the study and development of procedures that help humans process and analyse large quantities of data, revealing useful patterns and knowledge hitherto implicit in the data. At its core are the fields of *soft computing* and *data mining*. These research areas are concerned with the automatic extraction and learning of patterns in large quantities of data, whether through unsupervised or semi-supervised techniques. Typically they employ probabilistic and statistical methods to extract trends of interest, although this can be coupled with the use of *symbolic* (i.e. *logical*) reasoning with domain knowledge, e.g. in the form of rules originating from domain experts. Applications vary widely, ranging from automated facial recognition to intelligent e-Learning systems.

**Recent publications:**
Secure & Dependable Grid Platforms

Due to the massive interconnectedness of resources on the Web, traditional models of computing have rapidly evolved into one of distributed processes and loosely-coupled modules, which are easily composed to create sophisticated applications. This research field addresses the challenges and opportunities raised by Grid computing. On one hand, this enables unprecedented levels of computing power, exploiting levels of parallelism previously unthinkable. On the other hand, the nature of the grid, where data and computing resources can be physically and logically dispersed, raises issues of security and dependability. Sophisticated software engineering approaches are required to verify that web services function correctly.

Recent publications:

Simulation, Visualization and Interaction

This pillar concerns the development of tools for modelling, simulation, visualisation, and interaction, whether virtual, augmented or mixed reality and their integration in end-to-end environments. Key challenges in this area include how to facilitate innovative design and creativity in products, digital audio-visual media and services, and the creation of more natural, intuitive and easy-to-use interfaces, particularly new ways to interact with technology, machines, devices and other artefacts.

Recent publications:

Ubiquitous & Unlimited Capacity Networks

With the increasingly widespread use of networked applications and services, there is a critical need for cost-effective mobile and broadband network technologies and systems including terrestrial and satellite networks. The convergence of different networking technologies, i.e. fixed, mobile, wireless and broadcasting networks spanning from the personal area to the regional and global area raises challenges such as the
interoperability of wired and wireless communications services and applications, management of networked resources, service reconfigurability, the complex networking of ad-hoc intelligent multimedia devices, sensors and microchips.

**Recent publications:**


**Embedded Systems, Computing & Control**

More powerful, secure, distributed, reliable and efficient hardware/software systems that can perceive, control and adapt to their environment while optimising the use of resources; Methods and tools for system modelling, design and engineering to master complexity; Open composable architectures and scale-free platforms, middleware and distributed operating systems to enable truly seamless collaborative and ambient intelligent environments for sensing, actuation, computing, communication, storage, and service delivery; Computing architectures incorporating heterogeneous, networked and reconfigurable components including compilation, programming and run-time support; Control of large-scale, distributed, uncertain systems.

**Recent publications:**


**Nano-electronics**

Process, device and design technologies to improve size, density, performance, energy efficiency, manufacturing and cost-effectiveness for components, systems-on-a-chip, systems-in-a-package and integrated systems; Basic photonic components for wide range of applications; high-performance/high-density data storage systems; Very large area/highly integrated display solutions; Sensing, actuating, vision and imaging devices; Ultra low power systems, alternative energy sources/storage; Heterogeneous technologies/systems integration; Multi-functional integrated micro-nano-bio-info systems; Large-area electronics; Integration in different materials/objects; Interfacing with living
organisms; Self-assembly of molecules or atoms into stable structures.

**Recent publications:**


**APPLICATION DEVELOPMENT AREAS**

**Meeting Societal Challenges**

This area explores new systems and services in areas of public interest improving quality, efficiency, access and inclusiveness; user friendly applications, and integration of new technologies.

- For health, improving disease prevention, early diagnosis and personalisation; autonomy, safety and mobility of patients; health information space for knowledge discovery.

- To improve inclusion and equal participation and prevent digital divides; assistive technology; design-for-all.

- For mobility; intelligent ICT-based transportation systems and vehicles enabling people and goods to move safely, comfortably and efficiently.

- In support of the environment and sustainable development, to reduce vulnerability and to mitigate the consequences of natural disasters and industrial accidents.

- For governments; efficiency, openness and accountability, for a world-class public administration and links to citizens and businesses, supporting democracy.

**Creativity and Personal Development**

- New media paradigms and new forms of content; creation of interactive digital content; enriched user experiences; cost-effective content delivery.

- Technology-enhanced learning; adaptive and contextualised learning solutions; active learning.

- ICT-based systems to support accessibility and use over time of digital cultural resources and assets, in a multilingual environment.
Supporting Business and Industry

- New forms of dynamic networked co-operative business processes, digital eco-systems; optimised work organisation and collaborative work environments.
- Manufacturing: rapid and adaptive design, production and delivery of highly customised goods; digital and virtual production; modelling, simulation and presentation tools; miniature and integrated ICT products.

Trust and Confidence

Identity management; authentication and authorization; privacy enhancing technologies; rights and asset management; protection against cyber threats.

Road Map

The above research tree and its component branches form the scope of theoretical research and application areas to be researched. Moreover, in more specific terms there will be several key areas that will be focused on in the first instance, namely:

1. Application Research related to Teaching Hospital at UI
As part of the University of Indonesia’s development plan, a Teaching Hospital will be constructed at the Depok campus to facilitate teaching and research conducted at the medical and health science Faculties. This is a very strategic opportunity to develop various ICT technologies, among others:

- Hospital information systems, e.g. medical records, inventory support, CRM
- Hospital telecommunications infrastructure
- Medical electronics & support system
- e-Medicine/e-Health & Telemedicine
- e-Learning

2. Intelligent Multimedia Information Processing
Intelligent Multimedia Information Processing (IMIP) can be defined as follows: the study and development of procedures that help humans process and analyse large quantities of multimedia data, i.e. text, audio, image, and video, revealing useful patterns and knowledge hitherto implicit in the data. At its core are the fields of soft computing and data mining. These research areas are concerned with the automatic extraction and learning of patterns in large quantities of data, whether through unsupervised or semi-supervised techniques. Typically they employ probabilistic and statistical methods to extract trends of interest, although this can be coupled with the use of symbolic (i.e. logical) reasoning with domain knowledge, e.g. in the form of rules originating from domain experts.
Indonesia has been recognized as a mega diversity country which harbors a huge numbers of indigenous resources, also known as bioresources (biological resources), and local wisdoms and traditional knowledge. It is a fact that indigenous bioresources are one of life essential elements and Indonesian people are reaping the benefits from bioresources, whilst local wisdoms and traditional knowledge are still being practiced and have great social impact on the local communities.

To highlight the importance of indigenous bioresources and local wisdoms, University of Indonesia (UI) has established Indigenous Studies in 2006 to promote unique and high quality of indigenous research and activities. Through such activities, Indigenous Studies in UI aspires to become the finest core of Indonesian indigenous studies and meets UI's target as a World Class Research University.

Indigenous Studies in UI has been engaging in collecting, preserving and studying the impact of local wisdoms and traditional knowledge from different parts of Indonesia. Exploration and characterization of indigenous biological resources have also been carried out. In addition, researches
have been carried out in finding important indigenous bioresources for applications in food, health, pharmaceuticals, agriculture, and environment.

The establishment of Indigenous Studies in UI was based on UI having several major features favorable for indigenous studies: mega diversity of (social and living) cultures for studies, highly motivated and talented academicians/scientists, indigenous studies research groups with strong research activity track records, significant experiences in taking part as researchers in UI and internationally prominent research institution, infrastructure, research funding, and research management.

**OBJECTIVES**

To promote Indigenous Studies in UI, five main objectives are presented:

- To establish a solid infrastructure to develop, preserve and distribute its own indigenous resources for promotion of life science and bio-industry in Indonesia and also for contribution to the global (life and social) sciences.
- To assist in supporting research and conservation of natural biodiversity and national heritage (including local wisdom and indigenous knowledge).
- To support and promote sustainable use of indigenous resources for social and industrial/commercial applications.
- To assist and support collaboration between UI’s scientists and other Indonesian scientists and between UI’s scientists and foreign scientists by supporting exchange of scientists and to facilitate their training in specialized fields of indigenous studies in Indonesia and abroad.
- Indigenous studies should be developed and well managed to improve the health and well being of Indonesian people.
- and to facilitate their training in specialized fields of indigenous studies in Indonesia and abroad.

**RESEARCH TREE**

To develop the research tree of Indigenous Studies in UI, the indigenous research team has been working closely with DRPM UI in recognizing existed research being carried out in twelve faculties and to project future research in indigenous studies.

The team has recognized that the major trend in social and life science research in UI has been aimed at recognizing and utilizing our indigenous bioresources and traditional/local
knowledge for their sustainability. It is a fact that Indonesia has always depend on bioresources developed in other countries, and it always loses their traditional/local knowledge and treasures due to ignorance in our parts.

Thus, the research tree of Indigenous Studies in UI is focused on **Conservation, and Sustainability of Indigenous Bioresources and Local Wisdom Studies**. There are five main research topics in Indigenous Studies as follows:

**Diversity**
Research topics include exploring biodiversity of animals, plants and microorganisms; and exploring and uncovering local wisdoms, traditional knowledge, traditional law, traditional architecture, and indigenous psychology.

**Adaptation**
Research topics include cultural and genetic evolution, cultural dynamics, effects of climate change, disaster and its impact.

**Informatic**
Research topics include phenotype and genome databases, traditional/indigenous knowledge database, local practice database, modelling.

**Genome Analysis**
Research topics include indigenous sequences, genetic population, gene-related social behavior, social functions.

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**Prospecting**
Research topics include the utilization of indigenous bioresources of natural products, application of bioresources for bioremediation, biofertilizer, biocontrol, application of traditional knowledge for improving health, traditional/local culture for tourism, urban living heritage.
Roadmap for Indigenous Studies in UI is designed to guide science and research activities in University of Indonesia. The roadmap contains types of strategies and providing broad context and level directions on the areas of indigenous studies.

The roadmap represents Indigenous Studies position in UI and how indigenous studies science and activities should be developed to meet UI’s target as a World Class Research University.

The directions in roadmap for indigenous studies highlight the areas of science and research we need to build, and also the future skills and connections we need to make. Indigenous Studies in UI foster areas of research and activities as follows:

- Research activities are not limited to high technology, but also focus on medium and basic level technology, i.e. study on local and environmentally-friendly local technologies; development of novel technologies based on local/traditional technology, etc.

- Research and studies in indigenous studies, i.e. ongoing and “strong” bio-based research activities and biomedical research; exploration of biodiversity; study of normal practice on the utilization of bioresources; systematic collection of local wisdom/knowledge and traditional culture; study in the sustainability of local/traditional culture through ecotourism, etc.

- Strengthen capabilities in research activities already exist but there is a distinct need for more researchers, expertise and know-how improvement of infrastructure. Such areas include: phylogeny, taxonomy, genome technology and bioinformatics etc. for studying Indonesian biodiversity, curators for preserving existing local knowledge and heritage, etc.

Initiate novel research which are important and have a direct impact on Indigenous Studies in UI, i.e. indigenous new species discovery, complete genome analysis of microorganism originated from Indonesia, identification of newly biological functions from indigenous organisms, designing new methods to obtain new and unique unculturable biological resources, local-based drug discovery (ethno medicine), application of environmentally-friendly local practice, etc.
INTRODUCTION

The University of Indonesia (UI) recognizes the importance of nano science and technology (NST) and acknowledges that this area will play an important role in the future. The global trend in technological advances indicates that NST has been growing rapidly, entering and influencing significantly almost every aspect of life. Through various research activities initiated by the top management and lecturers, it is realized that UI should actively take part in developing this emerging science and technology.

Therefore, it is necessary to provide a map of the existing resources and activities, related to NST. This is aimed at directing a research agenda towards the general and specific goals that meet the national research priorities. To create “a room” that will be “a home” for the UI researchers involved in the field of NST, it is natural to establish a “NST Center of Excellent” within the university. The Center is dedicated to unify and synergize all of the NST research activities in UI,
accommodating and integrating all the efforts in promoting and implementing various aspects of NST development that meet the nation needs.

**OBJECTIVES**

The main objectives of the establishment of NST Center of Excellent are:

- To develop the capabilities of University of Indonesia in the strategic field of NST in terms of its human and financial resources, infrastructures and long-term research agenda
- To coordinate and synergize the multidisciplinary NST research activities across departments, faculties, and other research centers.
- To assist setting-up research priorities directions of NST for the benefits of the nation

**DEVELOPMENT AREAS OF RESEARCH**

The center focuses on various aspects of nano materials in the field of Physics, Chemistry, Life Science and Engineering. In this group, an alliance of research programs, including nanoparticles, nanostructure and functional materials from the Faculty of Medicine, Science, Engineering, and Public Health, involves an interdisciplinary approach in a highly stimulating environment for both students and learned staffs. At present, various research topics in the aspects of environment and technology, material and life sciences – related to manufacture, health and food - are being pursued or being proposed by an individual lecturer or a group of lecturers within the UI (see Figure 1 and 2).

**PROSPECTIVE AND PROJECT TREND OF NST ACTIVITIES IN UI**

The talent and expertise of researchers, joining the group, are prerequisite for the success in a number of fields of science and technology. This is true particularly for condensed matter and materials science, which are the focus of NST activities. The group consolidates its research activities that deal with physics and chemistry at the nanometer scale, explores and applies its unique properties to solve various problems in the real life. At present, the research topics in this NST areas are: nanoparticle materials, bio- and chemical sensors (for food, health and environment), molecular pattern recognition, nanophotocatalytics (environmental protection, renewable energy, and functional materials), and risk assessment on the occurrence of nano particles and its consequences.

**RESEARCH TREE**

The research topics in this NST areas are: nanoparticle materials, bio- and chemical sensors (for food, health and environment), molecular pattern recognition, nanophotocatalytics (environmental protection, renewable energy, and functional materials), and risk assessment on the occurrence of nano particles and its consequences.

Nanoparticles
The focus of this research topic is the theory and modeling of the magnetic and optical properties, synthesis of nanoparticles and their application in life- and material sciences. In particular the work on material with both magnetic and fluorescent properties in order to have three types of application such as separation & purification of biological molecules and cells, drug delivery and immunosensor.

**Bio - and Chemical Sensor**
Research in the area of bio- and chemical sensor is focused on the development of portable bio- and chemical sensor prototypes at macro, micro and nanoscale for total analysis system implementation. It commits to promoting the imaginative combination of chemical and biological sciences with electronics and materials science for the development of novel sensors and diagnostics. By combining the unique features of recognizing molecules with appropriate physico-chemical transducers, an electrical signal can be read. These bio- and chemical sensors will be used for medical and environmental purposes.

**Molecular Pattern recognition**
Research in this area will concentrate on the application of Artificial Neural Networks (ANNs) in bio- and chemical sensor analysis to recognize molecular pattern on liquid and vapor. The ultimate goal is to develop portable, inexpensive systems capable of real-time identification of molecular chemicals in the field. The initial portion of this effort involves the development of prototype systems, where each prototype combines a sensor array with a neural network.
RELEVANCE AND NATIONAL DEMANDS

The outcome of the research area in nanostructure materials may find its applications in a wide range of fields such as medicine and diagnostic, industrial and building materials, energy resource, health and environmental protection.

OPPORTUNITY TO EXPLORE AND ENGAGE IN CUTTING-EDGE RESEARCH ISSUES

The research questions discussed in the NST agenda are the problems that are currently at the frontiers of research in materials, sensors, energy, communication and medicine. With the latest development of advanced technology, matter transformation to nano size offers some advantages. The advantages of unique properties of nanoscale materials can prompt a new era of advance science and technology such as nanodivices, nanomedicines as well as molecular pattern recognition (artificial nose and tongue).

THE DEVELOPMENT OF NETWORKING WITH OVERSEAS INSTITUTION

It would be rather difficult for the Center to achieve its goals in each research area without the assistance of other institutions, particularly those with world-class reputation. At present the researchers in NST groups maintain various network of collaboration with other national and international research institutions and universities in Asia, Australia and Europe. The collaborations are in the form of joint experiments, share
experimental resources and knowledge, exchange people on the regular basis or on postdoctoral programs, and lecturer short visits.

**THE DEVELOPMENT OF HUMAN RESOURCES**

To truly establish a center of excellence in Nano Science and Technology, UI must first achieve critical mass within the above areas, i.e. build up an adequately sized group of academics to conduct research. The NST-UI has identified a need for an additional number of PhD holders, specifically within the following areas: Nanoparticle materials, Bio- and Chemical Sensor, Molecular Pattern Recognition, Advance Spectroscopist.

**INFRASTRUCTURE AND FACILITIES**

In terms of the infrastructure and facilities, unfortunately, the current state of research facilities are inadequate. To overcome this problem, the researchers have to engage in collaborative works with other research institutions both on the national and international spectrum. Currently, the research activities are conducted in the respective department’s laboratories in various spreading locations and unfortunately have no commonly acceptable access each other. The laboratories including samples or specimens preparation and materials characterization laboratories, are equipped with UV-Vis spectrophotometer, HPLC, GC-FID, Electrochemical Workstation, AAS, NMR, XRD, SEM & EDAX, XRF, FTIR, Thermal Analysis Instruments (DSC, TGA, DTA, TEM, Particle Analyzer, RCL-meter, High Temperature Furnaces and Vacuum system).

In the future, the University should provide proper and adequate infrastructures to foster the NST activities. These including,

- Integrated Laboratory space and equipment for preparation and fabrication
  - Wet chemistry laboratory [special furnitures, water, gas and electricity line systems, open and furnace, acid chamber, vacuum lines, storage room, waste and safety system]
  - Physic and electronic laboratory [special furnitures, water, gas and electricity line systems, open and furnace, storage room, sputtering system, waste and safety system]

- Integrated Laboratory space and equipment for advance characterization
  - Advance Instrumental Analysis Laboratory [Spectroscopy: UV-Vis, FTIR, SEM, TEM, AFM, XPS, XRD, Particle Analyzer; Thermal Analysis: TGA/DSC, TPD; Electrochemistry: Potentio and Galvanostat, Quartz Balance; Others: VSM, Guoy Balance etc]

- Integrated Laboratory space and equipment for application testing and prototyping
  - Fabrication line prototyping
- Reactor system prototyping
- Measuring system prototyping
- Flexible room for field simulation testing

- Integrated space for a workshop
  - Mechanicals
  - Electronics
  - Glass blowing

- Integrated Office space and seminar theater
  - Office space for management and researchers
  - Meeting and seminar room
  - Common room

NST RESEARCH ROAD MAP

- Dense or Tool
- Imaging and Diagnostic
- Separation
- Drug or Tool
- Industrial and building materials
- Nano material for daily life
- Tool and machinery
- Photocatalytic: Energy, Environmental Protection, Self Cleaning Material

- Data collection manager and correlation
- Spectroscopy behaviour
- Electrochemical behaviour
- Incorporation of NP that results proper behaviour for sensing
- Unique properties of NP when interact to some thing
- Unique properties of NP or NP surface
- Synthesis, Fabrication and Characterization of NP
- Nano Particles (NP)
- Illustration of Research Roadmap
INTRODUCTION

Public Policy Studies has been declared as one of the six major research areas at the University of Indonesia, i.e. ICT, Gnome Technology, Nano Science and Technology, Indigenous Studies, Urban Studies and Public Policy Studies.

The Public Policy Studies are composed through multidiscipline studies and research activities. The purpose is to stimulate world-class policy researches which extend to connect between research and its research users. It is conducted through interdisciplinary approach by pooling leading figures with expertises from many disciplines within the University of Indonesia. The purpose is to keenly serve our clients, the research users. In one side, they are decision makers: in the government, public, business and industry sectors who seek policy options, expertise-advice or second opinion; and at the same time they are members of the society who need our advocacy.

The group of research activities in Public Policy Studies at the University of Indonesia has focused itself on the existing urban problems in the following eight areas identified as: environment, public health, urban transportation, legal issues,
poverty & unemployment, and empowerment & community development, ASEAN Regional Cooperation & Economic Integration, and ICT (Information and Communication Technology).

**OBJECTIVES**

The objectives of public policy studies at the University of Indonesia will be outlined as follows:

1. to develop substantive policy options to help improve both policy making and management;

2. to offer policy studies from the eight specified areas mentioned above to promote national development economically, legally, and socially;

3. to provide advisory services and policy options to government bodies and other institutions including international agencies on matters dealing with the performance and optimization in the use of national resources relating to social and economic development;

4. to disseminate information policy studies and issues through the publication of journals, reports, pamphlets and other means of publication such as research papers and textbooks;

5. to stimulate the pooling of experts, scientists, and specialists coming from various academic disciplines within the university, to be able to work together as teams and through joint-collaborative efforts to produce quality products in the forms of various policy studies.

**DEVELOPMENT AREAS OF RESEARCH**

**ENVIRONMENT**

Researches conducted in this topic will cover environmental problems and issues resulting from human activities in urban areas where one problem relates to the others, such as: human settlement, poverty & urbanization, transportation. Admittedly, one universal global problem today has been identified as global warming and its related issues. However, we will start by dealing with one common problem of pollution known as the wastes produced by households and industry. To make it worse, people have contributed much in littering the streets and sewage running into rivers and the seas causing heavy floods during the rainy season. This bad habit has become common realities in everyday life of the city we live. The burning of wastes, the uncontrolled use of fossil fuels by public & private transportation vehicles, the noise and the traffic jams during working hours, the contamination of drinking water, the unhealthy & unregulated sanitation are all kinds of environmental problems which affect public health and the welfare of the people. These environment related problems have been embedded in our everyday life; in mostly big cities in Indonesia.

The ultimate goal of the studies is to contribute to the understanding, appreciation, and preservation of the nature and human environment. This effort is to minimize the impacts...
of environmental problems including global warming. Therefore, the commitment is to continue improving environmental operating performance and procedures, with particular emphasis on: pollution preventive measures, carbon emission reduction, protection and restoring bio-diversity, application of sound science, re-constructing city life, including city re-forestation, socialization, re-enforcement behavior, and the communities empowerment programs. By doing this, hopefully we can save our life from the danger of the environmental hazards. All related researches in environmental problems are conducted through interdisciplinary, collaborative efforts.

**PUBLIC HEALTH**

In this area, we will focus on current issues of public policy and policy analysis in health and politics that affect urban community and the nation. Talking about public health, we will eventually talk about the individual people, the groups and the communities in the public at large, who need affordable medical services and health insurance including the services of doctors to their patients, hospital and clinic management, pharmacists and the pharmaceutical industry, modern Western and indigenous medicines, birth control and family planning, including managing healthy life. Based on the nature of public health itself, the multidiscipline approach of the studies we carry will consist of activities to provide reliable data and to support public policies. The purpose is to develop an affordable, high quality health care system for the public at large and prevent communicable diseases.

In doing the studies, internally, we will work with many academic disciplines within the university, and externally we will collaborate with government bodies, industry, academic and learned society, and public service institutions.

**URBAN TRANSPORTATION**

Transportation is an important means of moving people in the city. Working people need reliable transportation to bring them back and forth from their homes to their work places. School children and university students need transportation as well. Various activities in the city, such as in the field of economic, services industry and business, government and private sectors obviously need the support of public transportation facilities. Almost every one living in the city and active citizen will definitely need transportation, be it privately-owned cars or public transportation.

Being the capital city of Indonesia, and a metropolitan city as well, Jakarta deserves to have a traditional and modern public transportation system that supports the activities of its citizens and the international communities who live and work in Jakarta.

Studies in this topic is dedicated to help policy makers, business leaders and the general public to fully benefit from the available public transportation system including its support systems optimally, conveniently and affordably.

Policy studies include regulatory planning and financing arrangement, supply and demand in public transportation services, highway pricing, car restriction ownership, cost-
effective of road capacity, the zoning area regulations, congestion and road accessibility to road facilities.

**LEGAL ISSUES**
Legal studies will concentrate on broad public policy issues related to governance based on the social and economic conditions with the emphasis on particularly ethical considerations inherent in all legal decision-making, the constitutional parameters of law and its practice and practical assessments of how law influences the culture, the community and the individual.

**POVERTY AND UNEMPLOYMENT**
The focus of the studies is to reduce poverty along with improved labor market condition. The center will undertake policy research and advisory work on the central issues facing public policies for poverty reduction program, particularly in urban areas. With the priority to the improvement of investment climate, the policy has been adopted to promote more flexible employment regulations including the deregulation of protection rules. Poverty reduction has become a global challenge. In this way, empowering the poor by working with poor communities has become necessary. From the democratic point of view, the city poor people, big in number need our helping hands and advocacy. This is to say that reducing poverty means not only reducing poverty in the economic sense, or empowering the poor people, but we must go to the core of the problem of the poverty itself. Studies in poverty reduction are efforts conducted through interdisciplinary approach.

**EMPOWERMENT & COMMUNITY DEVELOPMENT**
Jakarta is a multicultural city. There are many cultural groups living in Jakarta, besides the local, indigenous, cultural group, called as the Betawi ethnic group. Empowering the many, different cultural groups must involve the indigenous Betawi people.

Studies will concentrate on developing approach to understanding the rising social movement, either a social or religious issue, demonstrated by certain groups (ethnic or interest groups). The focus will be on the importance of designing public policies to build civic capacity to achieve harmonious social order that will be carried out through community development.

**ASEAN ECONOMIC INTEGRATION & REGIONAL COOPERATION**
ASEAN, at present, has had a road map for achieving regional economic integration. A free trade area agreement among the six original ASEAN member countries by the year of 2010 has been approved. It will then be followed by the other four ASEAN members by the year of 2015. It means that the two events will culminate into an ASEAN Economic Community by the year 2020. It is also laudable that ASEAN is forging closer ties with the rest of Asia. ASEAN has signed Free Trade Agreements with the People’s Republic of China, Japan, and then India. These regional economic integration initiatives will result in the implementation of free trade fully integrated
ASEAN into a larger regional economic cooperation with the PRC, Japan and India.

Studies in this area is actually a response toward the dynamic change and challenges of this economic integration achieved through free trade agreements. Sooner and later, the impacts will effect Indonesian economy. In short, immediate and long range problems facing Indonesia, economically in particular, due to the free trade agreement, will be the focus of these studies.

**INFORMATION, COMMUNICATION & TECHNOLOGY (ICT)**

ICT is a new area in Indonesia. It is also a new, fast growing economic opportunity in the market place these days. To protect users and the public from the impact of the intensive use of information technology, such as: property rights, cyber laws, internet content, e-commerce, e-business, electronic evidence, privacy and data protection, consumer protection, domain name, e-finance, e-taxation, and e-customs, conflicts of laws, dispute resolution and penalties, internet infrastructure, spam, etc., policy studies on ICT at the University of Indonesia are concerned with these challenges. Relating to the occurring challenges, we respond to the need of the users by developing public policies and regulations in Indonesia.

**ROAD MAP**

Activities in research and studies in public policy studies include being hosts and organizers to seminars and inviting guest lecturers and speakers to express ideas and challenges from all areas of public policy. The center will also invite either a professor (from Indonesia or abroad), or a representative from research institutions, government, and non-government agencies. The job is to supervise the research and studies being done by the scientists and experts working within the University of Indonesia.

Those activities are designed to stimulate world-class policy research extending the connection between the researchers and the research users. The point is to move UI stepping forward into the internationally policy studies institution.

The seminars conducted will be based on interdisciplinary research foundation. The aim is to strengthen capabilities in policy-related research in which we can improve our research skills by which new areas in public policy studies can be introduced. Then, it is highly expected that “the pooling of expertise and quality base” will operate with much more full professionalism and academic integrity.
RESEARCH TREE

The research tree of policy studies shows the development of multidiscipline field of research supporting by experts, scientists, and specialists coming from many different disciplines.

The tree describes how policy studies will be developed at the University of Indonesia. It shows that it grows by “pooling of expertise and quality base” which come from many disciplines already exist in the campus. At present, the tree has branches representing eight main urban problems in Indonesia, identified as:

1. environment;
2. public health;
3. urban transportation;
4. legal issues;
5. poverty & unemployment;
6. empowerment & community development;
7. ASEAN Economic Integration & Regional Cooperation, and,
8. ICT.

All of the urban problems above mentioned deserve public policy studies in the forms of policy options, expertise advice, or second opinion, even advocacy. Analyses will be done using multidiscipline such as: economics, law, and other many disciplines.
WHO WORK ON THOSE RESEARCH AREAS
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8. Doddy Sjahbuddin
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1. Poppy Elvira
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