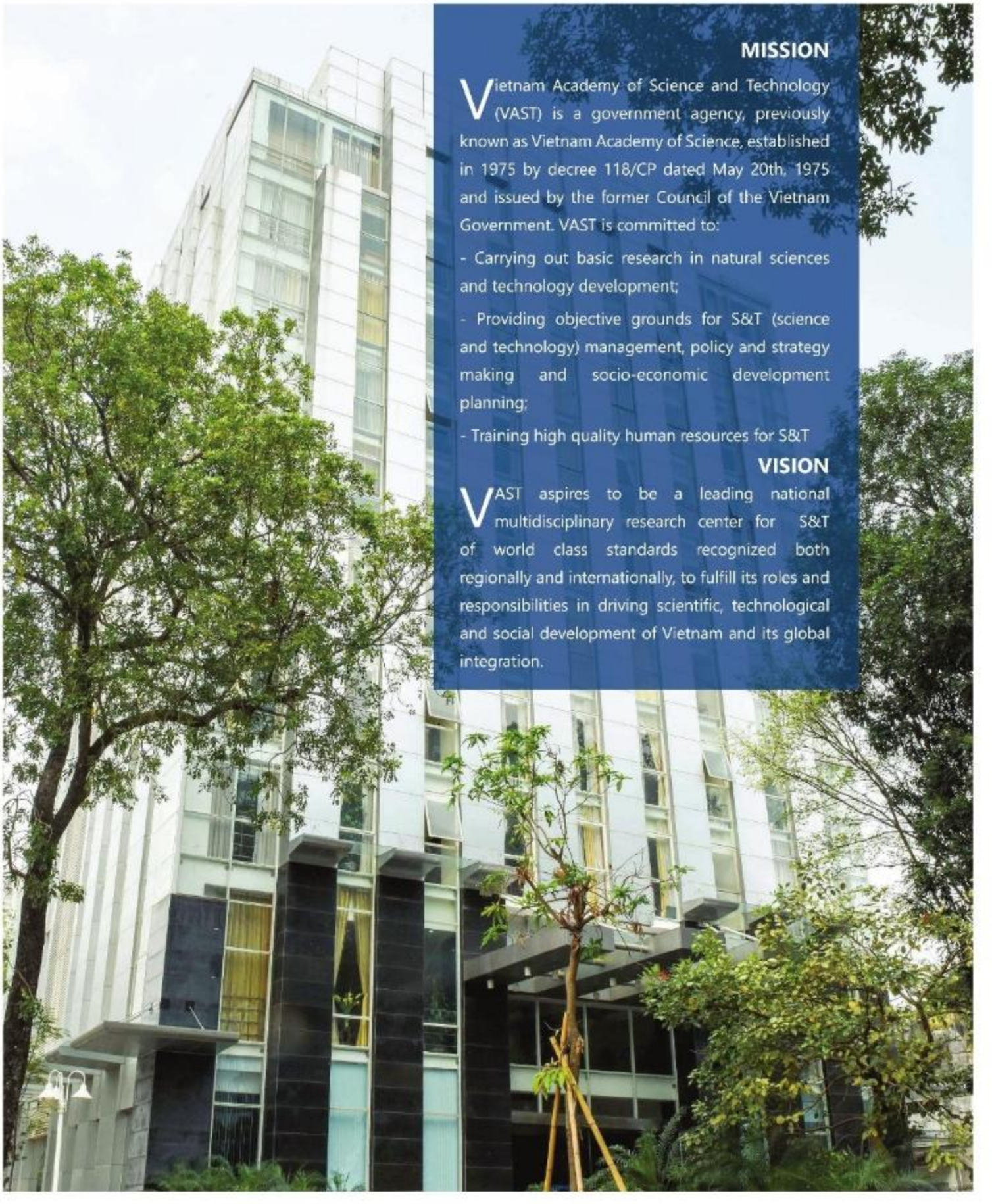
VIETNAM ACADEMY OF SCIENCE AND TECHNOLOGY

ANNUAL REPORT 2017

CONTENTS

ABBREVIATIONS LIST

GUST	Graduate University of Science and Technology
ISI	Institute for Scientific Information
IT	Information Technology
MOST	Ministry of Science and Technology
MoU	Memorandum of Understanding
NAFOSTED	National Foundation for Science and Technology Development
NGO	Non - Governmental Organization
ODA	Official Development Assistance
SCI	Science Citation Index
SCI-E	Science Citation Index Expanded
S&T	Science and Technology
VAST	Vietnam Academy of Science and Technology
VNMN	Vietnam National Museum of Nature
VNSC	Vietnam National Space Center



MISSION

Vietnam Academy of Science and Technology (VAST) is a government agency, previously known as Vietnam Academy of Science, established in 1975 by decree 118/CP dated May 20th, 1975 and issued by the former Council of the Vietnam Government. VAST is committed to:

- Carrying out basic research in natural sciences and technology development;
- Providing objective grounds for S&T (science and technology) management, policy and strategy making and socio-economic development planning;
- Training high quality human resources for S&T

VISION

VAST aspires to be a leading national multidisciplinary research center for S&T of world class standards recognized both regionally and internationally, to fulfill its roles and responsibilities in driving scientific, technological and social development of Vietnam and its global integration.

HUMAN RESOURCES

>4000
Members

2351
Permanent staff members

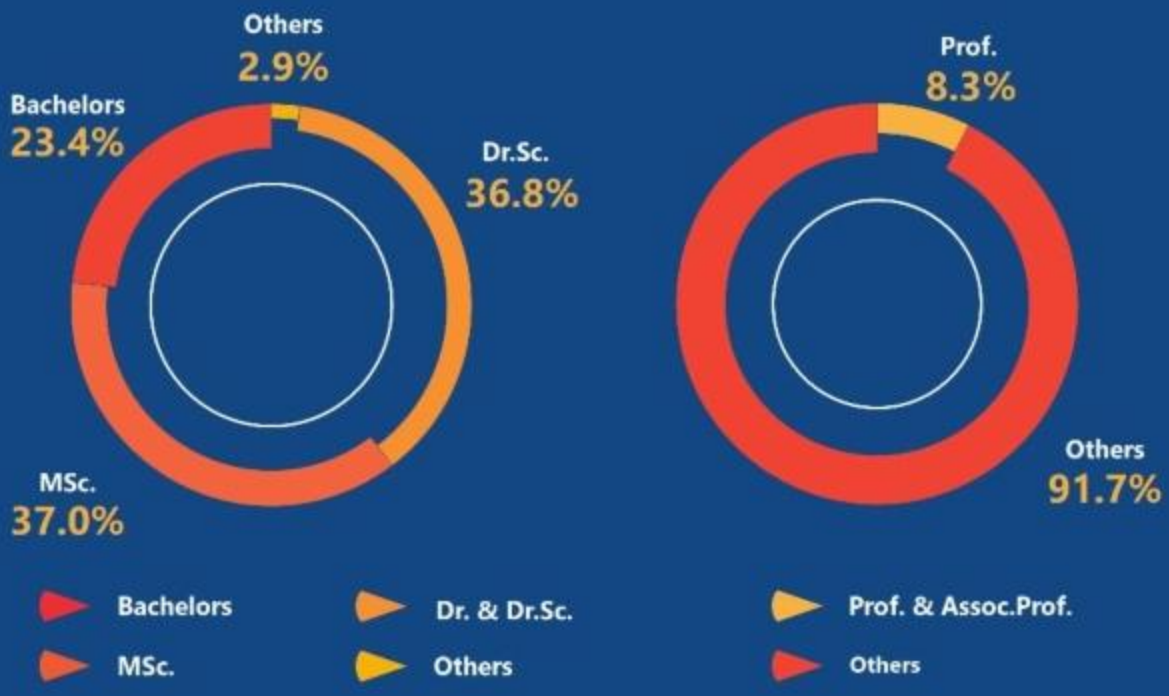
45
Prof.

150
Assoc.Prof.

838
Ph.D.

26
Dr.Sc.

869
MSc.



Distribution of VAST's scientific staff members in 2017

A MESSAGE *from the President*

VAST has had remarkable achievements in 2017, all made possible by the effort and solidarity of its science staff.

VAST accomplished the important science and technology (S&T) tasks assigned by the Prime Minister together with other tasks and programs at all levels. In basic research, the quality of the scientific publications has enhanced increasingly. For many years, VAST has been the first in the top ten list of universities and research institutes in Vietnam ranked by Nature Index for high quality scientific publications outputs.

S&T research, application & deployment of technology are increasingly focused to meet the demands of socio-economic development and national security. In 2017, VAST launched 02 projects: the commercial product development and test production, which have been joined by numerous VAST scientists.

In scientific research and training activities, Graduate University of Science & Technology and University of Science & Technology of Hanoi have successfully performed their tasks. VAST continues to strengthen and expand international relations in S&T research all over the region and globally with more forms and new fields of cooperation such as space research, energy research, investment consulting and high quality training. Following the success of 2017, 2018 is a pivotal year for implementing a five-year plan 2016-2020. This year is of great significance for the development and direction planning until 2020 with visions towards 2030, approved by Vietnam's Prime Minister.

Despite many difficulties and challenges, VAST, with a spirit of sharing and cooperation, will probably turn difficulties into solutions, challenges into opportunities and effectively promote the role of the leading national S&T research agency.

Prof. Acad. Chau Van Minh

President of Vietnam Academy of Science and Technology

2017 VAST IN FIGURES

407 S&T projects and tasks at all levels with the total funding of more than 3.057 billion VN (excluding ODA and NGO funding)

68 New species of plants and animals discovered by VAST experts

55 NAFOSTED Basic Research Projects

53 New monograph books published by Publishing House for Natural Science and Technology

24 ODA Projects (06) and NGO projects (18)

1592 Ph.D. students (748), MSc. (355), students (489)

>1830 Scientific publications, including 888 articles in international journals

112 Observation stations in 15 research institutes

40 Patents and Utility Solutions

1165 S&T contracts with total value of over 2.563 billion in 2017 (increased by 11% compared to 2016)

DIRECTORATES

PRESIDENT

PROF. ACAD. CHAU VAN MINH is responsible for all VAST activities: strategy and development projects, planning financial activities, organizational and administrative activities, international cooperation management and inspection activities.

VICE PRESIDENT

PROF.DR. SC. NGUYEN DINH CONG is responsible for scientific research management, planning and finance, application and deployment of technology

VICE PRESIDENT

ASSOC.PROF. DR. PHAN VAN KIEM is responsible for organization and personnel management, inspection activities.

VICE PRESIDENT

PROF.DR.PHAN NGOC MINH is responsible for higher education and postgraduate training.

ORGANIZATIONAL CHART

DIRECTORATE

SCIENTIFIC COUNCILS

ADMINISTRATIVE UNITS

- Department of Organization and Personnel
- Department of Planning and Finance
- Department of International Cooperation
- Department of Application & Development of Technology
- Department of Inspection
- Administration Office
- *(Representative Office in Ho Chi Minh City)*

OTHER UNITS

- Institute for Scientific Information
- Vietnam National Museum of Nature
- Publishing House for Natural Science and Technology
- Center for High Technology Development
- *Branch: Tay Bac Center for Technology Development*
- *Branch: Center for Environmental Technology Application and Development*
- Center for Informatics and Computing
- Graduate University of Science and Technology
- University of Science and Technology of Hanoi
- Center for Research and Technology Transfer

SELF-FINANCING UNITS

- *Institute of Telecommunication Technology*
- *Center for Technology and Technique Development*
- *Scientific Production Union of Telecommunications – Informatics Hi-Tech*
- *Scientific Production Union of New Technology*

STATE ENTERPRISE

- Newtatco Company Limited

ADMINISTRATIVE UNITS

- Institute of Mathematics
- Institute of Mechanics
- Institute of Information Technology
- Institute of Mechanics and Applied Informatics
- Institute of Physics
- Hochiminh city Institute of Physics
- Institute of Applied Physics and Scientific Instruments
- Institute of Materials Science
- Institute of Applied Materials Science
- Institute for Tropical Technology
- Space Technology Institute
- Vietnam National Space Center
- *Branch: Southern Centre for Space Technology Application*
- Institute of Energy Science
- Institute of Environmental Technology
- *Branch: Ho Chi Minh City Center for Environmental Technology*
- *Branch: Da Nang Center for Environmental Technology*
- Institute of Chemistry
- Institute of Natural Products Chemistry
- Institute of Marine Bio-Chemistry
- Institute of Chemical Technology
- Institute of Biotechnology
- Institute of Ecology and Biological Resources
- Southern Institute of Ecology
- Institute of Tropical Biology
- Institute of Genome Research
- Institute of Geography
- Institute of Geological Sciences
- Institute of Geophysics
- Institute of Marine Geology and Geophysics
- Institute of Oceanography
- Institute of Marine Environment and Resources
- Hochiminh city Institute of Resources Geography
- Nha Trang Institute of Technology Research and Application
- Tay Nguyen Institute of Scientific Research
- Mien Trung Institute for Scientific Research
- *Branch: Quang Tri Center for Scientific Research*

PRESTIGIOUS AWARDS

HO CHI MINH AWARD 2016

Prof. Ngo Viet Trung, Prof. Nguyen Tu Cuong and Prof. Le Tuan Hoa received the Ho Chi Minh Award in science and technology in 2016 for their work: "Some important invariants and structure of local and graded rings" (January 15th, 2017)

KOVALEVSKAIA AWARD

Assoc.Prof. Tran Kim Anh

Assoc.Prof. Vu Thi Bich

Assoc.Prof. Pham Thu Nga

Assoc.Prof. Tran Hong Nhung

Assoc.Prof. Nguyen Phuong Tung received the Kovalevskaia award for their works in fundamental research on nano-technology applied in agricultural production and health care. (March 7th, 2017)

VIET NAM WOMAN AWARD 2017

The Vietnam Women's Union has awarded the Vietnam Women's Prize in 2017 to Dr. Ha Phuong Thu - Head of the Department of Nanomedicine Materials, Institute of Materials Science for her contributions in public health care. *(February 17th, 2017)*

ASEAN SCIENCE AND TECHNOLOGY MERITORIOUS SERVICE AWARD

Prof. Dr. Nguyen Quang Liem received the ASEAN Science and Technology Award and medal (AMSA)

(October 20th, 2017, in Myanmar)

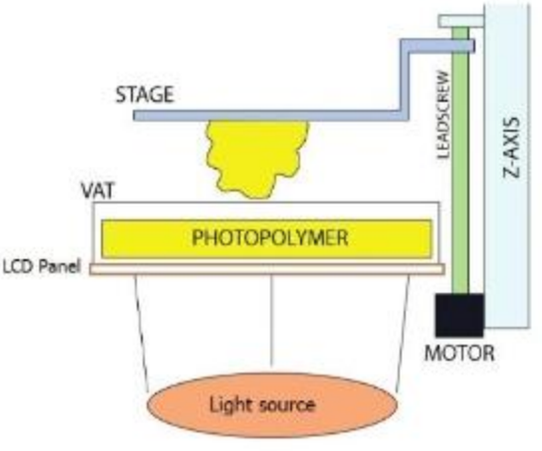
HIGHLIGHTS IN 2017

NHA TRANG OBSERVATORY OFFICIALLY CAME INTO OPERATION

Nha Trang Observatory (in Nha Trang, Khanh Hoa) is one of two observatories built in the framework of the Vietnam Space Center project. At the end of September 2017, the Nha Trang Astronomical Observatory opened its doors to visitors. Nha Trang Observatory's main facilities include a 0.5 meter optical telescope, a 60-seat spacearium, and a 200-square-meter exhibition room. *(Vietnam Space Center)*

3D SLA / LCD PRINTER

3D SLA/LCD printing technology has a resolution of up to 0.01mm per layer, which makes it possible to get printouts of higher quality surface. By using light beams to solidify materials, it is possible to make complicated small size components, which the FDM, LOM technology is not able to do. *(Institute of Mechanics and Applied Informatics)*



Operating principle of 3D SLA / LCD printer

CO TU CURCUMA COTUANA IS A NEW PLANT SPECIES FOR THE WORLD

Local people are very appreciative of this species because they believe that it has the mystical effect, can bring good luck and helps avoid bad things happening to the villagers. It also has an antibacterial effect, Curcuma Cotuana is used by Co Tu women for pain relief and effective recovery after childbirth. This discovery will provide a foundation for the study of the chemical composition and potential of drug development. *(Southern Institute of Ecology)*

Dr. Vu Ngoc Long and Co Tu Curcuma Cotuana.

PRODUCT FROM THE LEAVES OF BLUMEA BALSAMIFERA HAVING FUNCTION OF WHITENING SKIN

Bio DR White and Bio White GEN contain high leaf extract of Blumea Balsamifera.

The product uses the Blumea Balsamifera leaf extract in Bio White GEN and Bio Dr White in order to lighten skin, even skin tone and maintain moisture for skin. The results mark the initial successful stage for a collaborative model of biologists of Department of biologically active substances of the Institute of Tropical Biology with enterprises in the Hi-Tech Park.

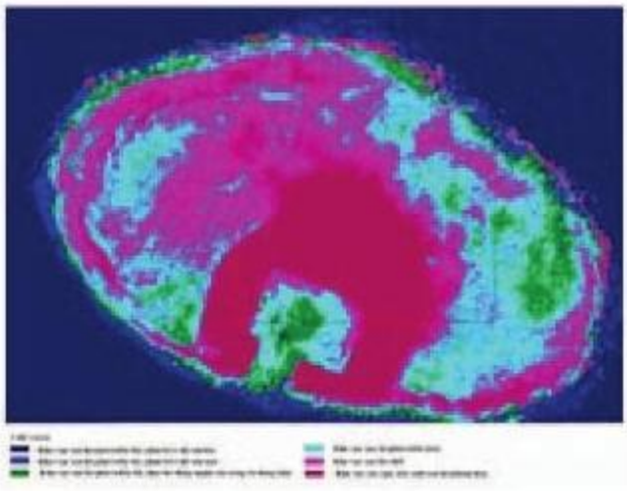
THE SYSTEM OF LINE OF DECREASING HYDROLYSIS, INCREASING THE QUALITY AND VALUE OF PEPPERMINT BEE'S HONEY FROM STONE PLATEAU OF HA GIANG PROVINCE

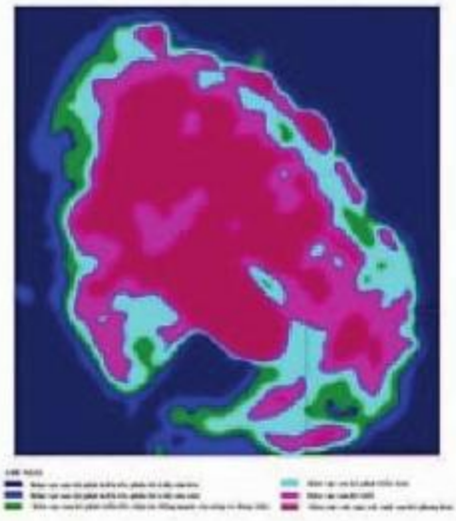
The system of line of decreasing hydrolysis used the low-pressure evaporative evaporator (vacuum pressure) technology with high water removal efficiency while liquid (honey) temperature was low. It also easily adjusts the technology by increasing or decreasing the pressure. *(Institute of Natural Products Chemistry)*

NEW TECHNOLOGY FOR PRESERVING AND IMPROVING LYCHEE QUALITY WITH MODIFIED ATMOSPHERE PACKAGING (MAP).

With the new technology of modified atmosphere packaging, Bac Giang lychee is preserved for up to 30 days, quality is 98% of its original, economic efficiency increased more than 5 times. (Institute of Chemistry)

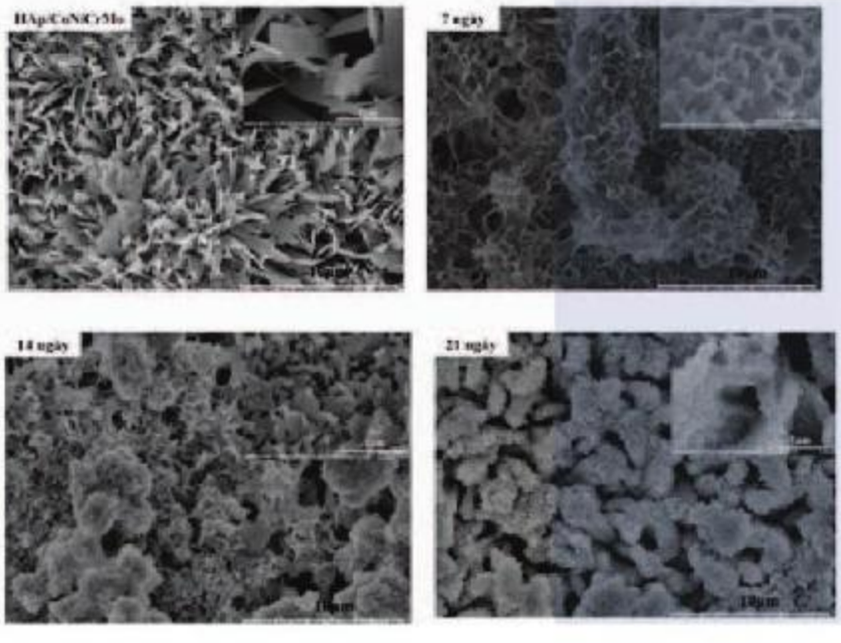
SATELLITE PHOTOS APPLICATION IN THE ASSESSMENT OF SOME NATURAL AND ENVIRONMENTAL CHARACTERISTICS OF SOME BIG ISLANDS AND SURROUNDINGS OF TRUONG SA ARCHIPELAGO FOR ECONOMIC DEVELOPMENT, SECURITY AND DEFENSE", *(Institute of Marine Geology and Geophysics)*





ELECTROCHEMICAL SYNTHESIS AND CHARACTERIZATION OF HYDROXYAPATITE MEMBRANE ON BIOMEDICAL COMPOUND

The objective is to select suitable conditions for the hydroxyapatite (HAp) hydrochloride electrochemical synthesis on biomedical alloys to meet the requirements of bone grafting materials. The results of the project will be tested in animals, followed by clinical trials in humans. Then it will be transferred to medical device manufacturers to bring into production. *(Institute for Tropical Technology)*



GENK STF, GHV KSOL AND GHV BONE - PRODUCTS RECEIVED THE TITLE "HIGH-QUALITY PRODUCT AND BRAND IN 2017"

The title "high-quality product and brand in 2017" by Vietnam Standards and Quality Institute, Vietnam Institute for Businessmen, International Management Institute and the Creative and Intellectual Property Magazine co-organized. (Nha Trang Institute of Technology Research and Application and Institute of Natural Products Chemistry)

The health food supplement GHV KSOL with Extra XFGC Nano-particles as a cancer-fighting

The health food supplement GHV Bone relieves pain and protects joints

The health food supplement GenK prevents and supports cancer treatment

PRIORITY DIRECTIONS IN SCIENTIFIC RESEARCH AND TECHNOLOGY DEVELOPMENT

The Prime Minister Nguyen Xuan Phuc visits Institute of Mathematics (December 14th,2017)

FUNDAMENTAL RESEARCH

Strengthening in fundamental research, VAST has promoted international publications, encouraged intellectual property registration and created legal premises for applied activities. Its achievements in 2017 are as follows:

In 2017, VAST had a total number of 1,830 publications. The total number of international articles was 888, decreased by 10.8% compared to 2016. The number of international ISI articles (SCI and SCI-E) is 688, a slight reduction of 7.3% in comparison with 2016 caused by implementation of S&T projects behind schedule. However, numerous publications in the international journals had a high impact factor. There are 170 articles (accounting for 19.8% of the total number of publications in the ISI journals), coordinated by institutes of VAST, performing an increase in cooperation among institutes of VAST. The total number of intellectual property registrations is 40 with 20 patents and 20 utility solutions, an increase of 43% compared to 2016.

• In 2017, VAST had 55 fundamental research projects out of 190 projects throughout the country funded by the NAFOSTED Foundation. The projects were in eight priority directions: mathematics, information science and computer, physics, chemistry, earth science, agricultural biology, biomedical science and mechanics.

In 2017, VAST has discovered 68 new animal and plant species and published 53 monographs.

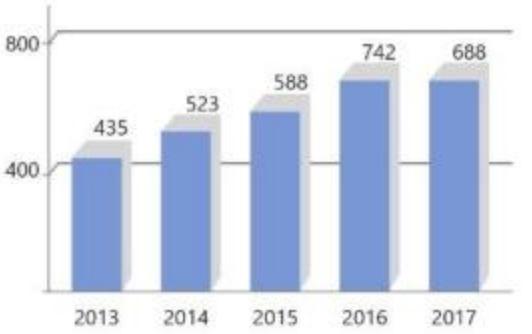
In 2017, after the Agreement between the Government of Vietnam and UNESCO, VAST has launched the establishment of 02 international centers in Mathematics and Physics under the auspices of UNESCO and will be put into operation in 2018.

Based on the contributions and development of Institute of Mathematics, in 2017, the Simons Foundation has announced funding for Institute of Mathematics to carry out scientific activities

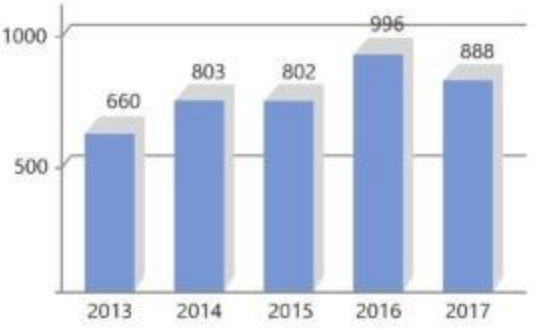
including: scientific exchanges and conferences, short courses, postdoctoral scholarships with a total expense of $600,000 for the 2018-2021 period. The Simons Foundation is a non-profit fund sponsored leading research institute from all around the world, including International Mathematical Union-IMU, Steklov RAS (Russia), Beijing International Center for Mathematical Research (China).

Top 10 institutes of VAST with outstanding achievements in international publication according to the number of articles (SCI, SCI-E) and intellectual property: Institute of Ecology and Biological Resources, Institute of Materials Science, Institute of Mathematics, Institute of Marine Bio-Chemistry, Vietnam National Museum of Nature, Institute of Physics, Institute of Chemistry, Institute of Biotechnology, Institute of Tropical Biology, Institute of Mechanics. If SCI, SCI-E and intellectual property are compared to the number of researchers, top 10 institutes are: Institute of Marine Bio-Chemistry, Vietnam National Museum of Nature, Southern Institute of Ecology, Institute of Ecology and Biological Resources, Institute of Genome Research, Institute of Mathematics, Institute of Physics, Institute of Natural Products Chemistry, Institute of Tropical Biology, Institute of Environmental Technology.

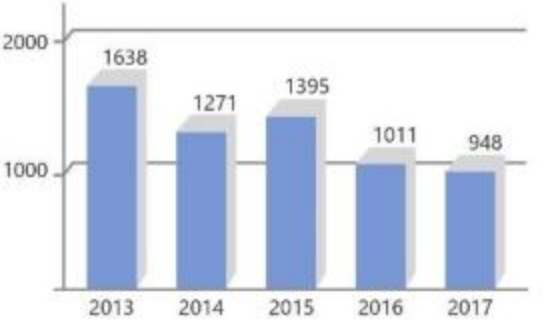
Implementing the Decision No. 2133 / QĐ-TTg dated December 1st, 2011 of the Prime Minister approved the Plan for overall development of VAST up to 2020 with orientation toward 2030 with the following targets: VAST will have 05 international standard journals by 2020 and 10 international standard journals by 2030. VAST has implemented the project "Upgrade Quality of Scientific Journals of VAST according to standard of Scopus" period 2014-2018. Up to present, three international standards journals are Advances in Natural Sciences: NanoSciences and Nanotechnology (ANSN), Vietnam Journal of Mathematics and Acta Mathematica Vietnamica.



The total number of journal articles in ISI list



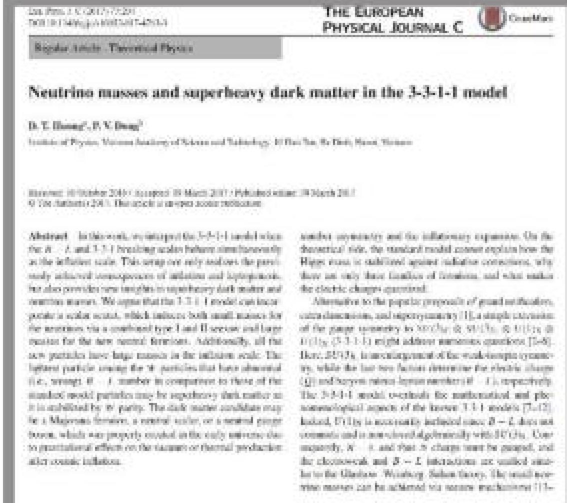
The total number of International journal articles



The total number of domestic journal articles

Distribution chart of publications of VAST in the last five years

SEVERAL HIGH-QUALITY SCIENTIFIC ARTICLES PUBLISHED IN INTERNATIONAL JOURNALS


THE EUROPEAN PHYSICAL JOURNAL C

Regular Article - Theoretical Physics

Neutrino masses and superheavy dark matter in the 3-3-1-1 model


Sensors and Actuators B: Chemical

ELSEVIER

Schottky contacts of (Au, Pt)/nanotube-titanates for fast response to NO_2 gas at room temperature

ARTICLE INFO

ABSTRACT


Taylor & Francis

RESEARCH ARTICLE

OPEN ACCESS

Expression of aryl hydrocarbon receptor, inflammatory cytokines, and incidence of rheumatoid arthritis in Vietnamese dioxin-exposed people


Contents lists available at ScienceDirect

Journal of Algebra

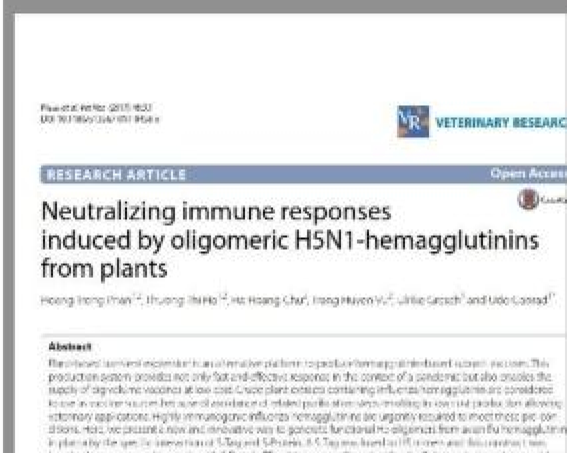
ELSEVIER

On the flatness and the projectivity over Hopf subalgebras of Hopf algebras over Dedekind rings

Nguyên Dai Duong, Phùng Hô Hai, Nguyên Huy Hung

ARTICLE INFO

ABSTRACT

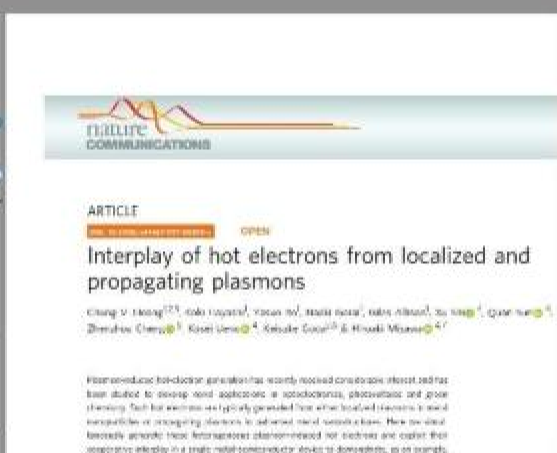

VETERINARY RESEARCH

RESEARCH ARTICLE

Open Access

Neutralizing immune responses induced by oligomeric H5N1-hemagglutinins from plants

Abstract


nature COMMUNICATIONS

ARTICLE

OPEN

Interplay of hot electrons from localized and propagating plasmons

Center for control exploitation of small satellite of VAST in Hoa Lac high technology area by UAV

IT - ELECTRONICS - AUTOMATION SPACE TECHNOLOGY

Prof. Dr. PHAN NGOC MINH

Chairman of Scientific Council

In 2017, in the field of IT, Electronics, Automation and Space Technology (VAST01) 30 projects were carried out with a budget of 17.4 billion VND, including 20 transferred projects (2015-2016, 2016-2017) and 10 new research projects (2017-2018).

Among 10 projects in the period of 2015 – 2016, 04 projects were completed and successfully evaluated (Results: 03 exellent, 01 good) and 06 projects are expected to be completed in early 2018. 10 projects in the period of 2016 – 2017 are also expected to be completed on schedule. 10 new projects in the period of 2017 – 2018 are being implemented on time with the approved schedule of annual funding of the budget.

Some outstanding results of specific research results in the field of Information – Electronics – Automation – Space Technology related to state-level projects are summarized in the different articles as follows:

ELECTRONICS AND AUTOMATION

Project, *"VAST01.10/16-17. Study and fabrication of an electrical generator model using sea wave energy"*, has studied and successfully fabricated an electrical generator model using sea wave energy. The electrical generator model can generate 100W - 1000W power and output voltage of 12VDC and 220VAC, with a frequency of 50 Hz pure sine wave. The generator is fixed at the bottom of the sea. The fabricated generator has appropriate design, structure and material to ensure the long-term stability operation in different conditions of the sea.

The idea of the electrical generator model utilising sea wave energy has received the acceptance of

Experimental preparation of the electrical generator utilising sea wave energy on HQ1788 Ship

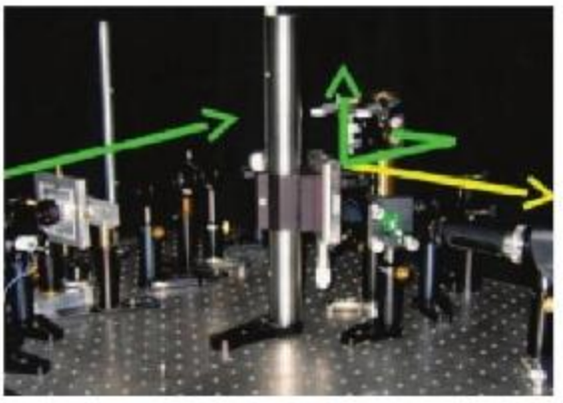
invention from the National Office of Intellectual Property of Vietnam and published in the official Gazette of the National Office of Intellectual Property of Vietnam. The scientific results of the project were published in 04 articles, including 01 article in an international journal, 02 articles on VAST journals and 01 article published for the national scientific conference. The project has set a precedent for utilising sea wave energy to supply electric power.

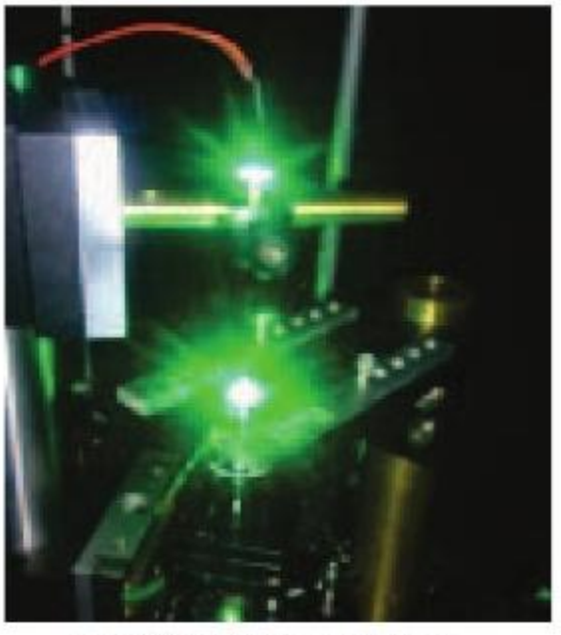
Project: *"VAST01.05/17-18. Studying and prototyping of active vibration isolation to construct high resolution optical tweezers"* has studied, designed and prototyped successfully an active vibration isolation and high resolution optical tweezer. This system is practically useful for optical systems requiring high precision control. The project's results have been perfected to submit to ISI-journals.

SPACE TECHNOLOGY

Project: *"VAST01.03/15-16. Research on the possibility of combining optical satellite images with radar satellite images for estimation of biomass, carbon storage and CO2 sequestration by forest vegetation in Yok Don National Park, Dak Lak province".*

The main results of the project are as follows:





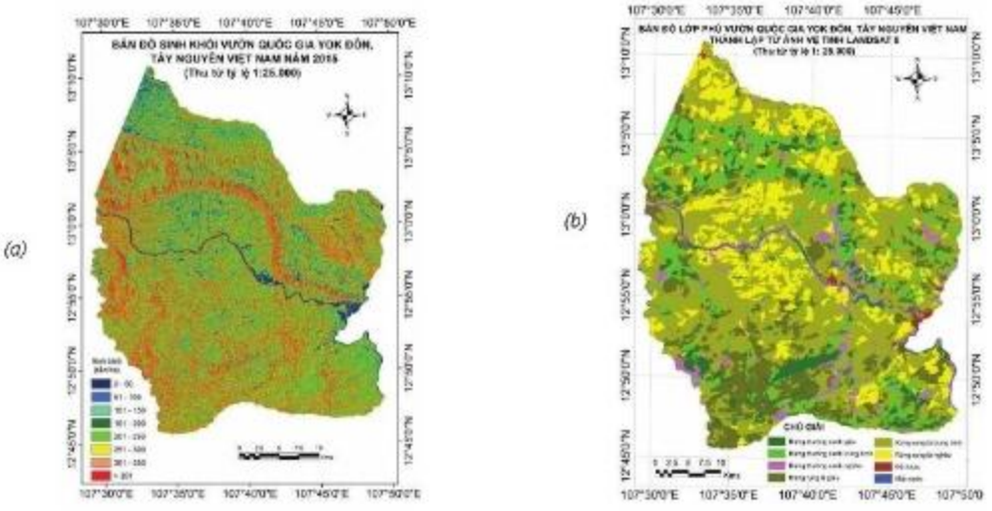
System of high resolution optical tweezers

To develop a detailed forest cover map (scale 1:25.000), where the region is a tropical monsoon area, along with distinctive wet and dry seasons, and evergreen and deciduous forests;

To develop a model for estimation of forest biomass by combining optical satellite photos & radar satellite photos and select the best model for estimation of forest biomass for study area;

To develop a forest biomass map in study area (scale 1:25.000) by combining optical setellite data (Landsat 8 OLI) and radar satellite data (ALOS 2 PALSAR);

01 paper has published in Land/MDPI Journal (ISI), 01 article was published in the Advances in



(a) Biomass distribution map and (b) Land cover map of Yok Don National Park, Central Highlands of Vietnam

Field work from Yok Don National Park, Central Highlands of Vietnam

Remote Sensing Journal and 01 article has also been published in the Vietnam Journal of Earth Sciences. The project has successfully supported 01 Ph.D. candidate from Chiba University, Japan.

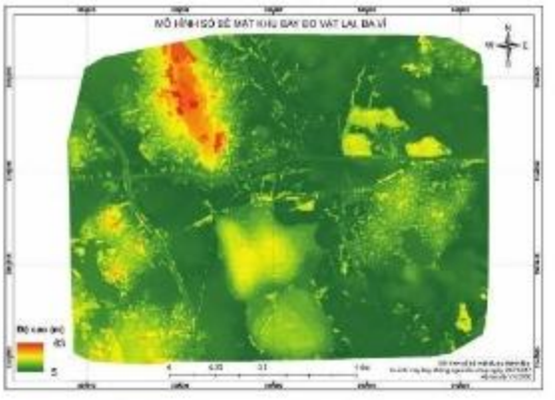
Project *"VAST01.07/16-17. Research and application of UAV photogrammetry for the derivation of ortho-photo anddigital surface model"*: An approach on exploration of UAV photogrammetry for capturing aerial photos, formulating digital surface models, derivating digital surface model was developed and implemented in pilot site in Ba Vi, Hanoi. The academic outcomes of the project consist of 02 articles on the proceedings of peer review international conferences and Vietnamese publication in scientific journal published in 2017.

INFORMATION TECHNOLOGY

Project *"VAST01.07/15-16. A hand-worn system to assist visually impaired people to read"*: a product named "Smart reading ring" that assists visually impaired people to read printed documents sucessfully investigated, designed and developed under this project. A patent application of the project was formally accepted by National Office of Intellectual Property; scientific results of the project were published in 07 national and international journals and conferences.

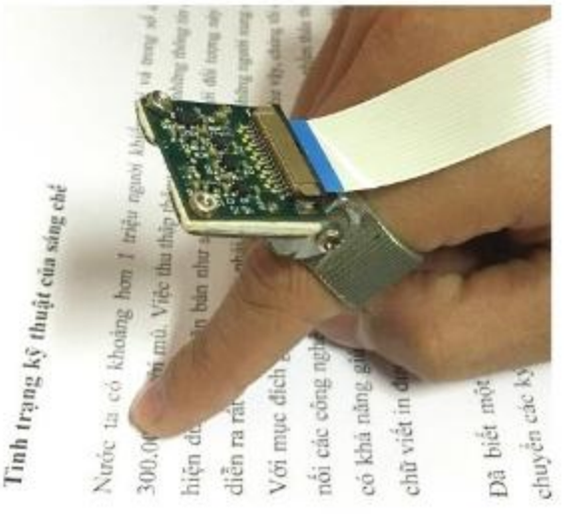
Product *"Smart reading ring"* introduced in "Technology Rhythm" program on June 10,2017, VTV2, Vietnam Television

Digital surface model in pilot site in Ba Vi, Hanoi



Digital surface model in pilot site in Ba Vi, Hanoi

According to practical application potential and humanitarian benefits of this project, the product "Smart reading ring" was introduced in the program "Technology Rhythm" of Vietnam Television (VTV) on June 10th, 2017. The product was also selected by VAST to be presented at Smart Industry World 2017 Conference & Expo. Its product and technology have been selected byVAST and Vietnam Startup Foundation (VSF) for commercialization-aid provision that enables them to be available for technology-transfer and business collaboration and production.



Smart reading ring

BIOTECHNOLOGY

Prof. Dr. Truong Nam Hai
Chairman of the Scientific Council

In 2017, Biotechnology has implemented 10 projects, of which 05 projects were performed in the period 2016-2017 and 05 projects in the period 2017-2018. The Scientific Council of Biotechnology evaluated 05 projects finished in 2015-2016 and selected 05 new projects in 2018-2019.

THE NEW PROJECTS IN 2018-2019

The Scientific Council of Biotechnology had approved 05 new projects in 2018-2019.

Project: *"Investigating the expression of polysaccharide monooxygenase genes from rice blast fungus Magnaportheoryzae in filamentous fungi system"* Dr. Nguyen Hoang Dung (Project Leader), Institute of Tropical Biology.

Project: *"Study on S1 oligomer expression from Porcine epidemic diarrhea virus (PEDV) on Nicotianabenthamiana"* Dr. Vu HuyenTrang (project Leader), Institute of Biotechnology.

Project: *"Research on creating anti-CD47 scFv h(CD28-41BB/OX40-CD3) chimeric antigen receptor T cells that target leukemia cancer cells"* Dr. La Thi Huyen (project Leader), Institute of Biotechnology.

Project: *"Studying mutations in the genes nphs1, nphs2, wt1 and plce1 in Vietnamese patients with congenital nephrotic syndrome"* Dr. Nguyen Thi Kim Lien (project Leader), Institute of Genome research.

Project *"Elucidation of the role of unknown fuctional additional regions in cellulase modularity"* Dr. Do Thi Huyen (project Leader), Institute of Biotechnology.

OUTSTANDING RESULTS

Project: *"Nanodiamond enhances immune responses in mice against recombinant HA/H7N9*

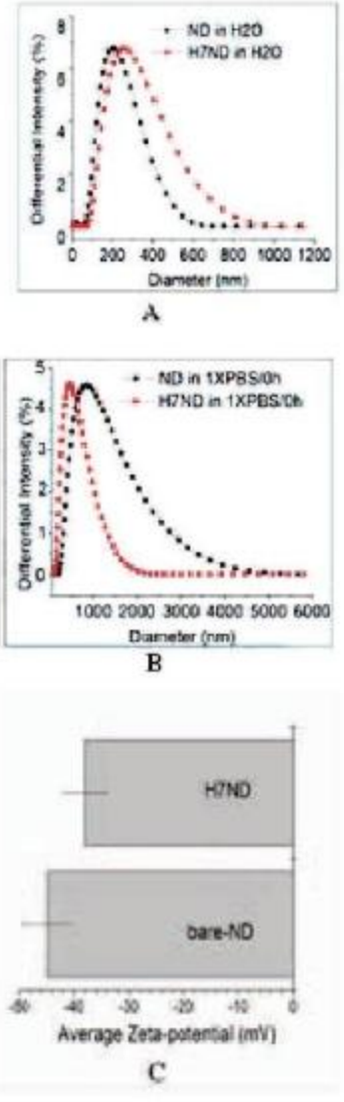
protein." Institute of Biotechnology, Hanoi.

The continuous spread of the newly emerged H7N9 virus among poultry in China, as well as the possibility of human-to-human transmission, has attracted numerous efforts to develop an effective vaccine against H7N9. The use of nanoparticles in vaccinology is inspired by the fact that most pathogens have a dimension within the nano-size range and therefore can be processed efficiently by the immune system, which leads to a potent immune response. Herein, we report a facile approach to increase antigen size to achieve not only speed but also effective responses against the recombinant HA/H7N9 protein via a simple conjugation of the protein onto the surface of nanodiamondparticles.

In this study, trimeric Haemagglutinin (H7) that is transiently expressed in N. benthamiana was purified using affinity chromatography, and its trimeric state was revealed successfully by the cross-linking reaction. The trimeric H7 solution was subsequently mixed with a nanodiamond suspension in different ratios. The successful conjugation of the trimeric H7 onto the surface of the nanoparticles.

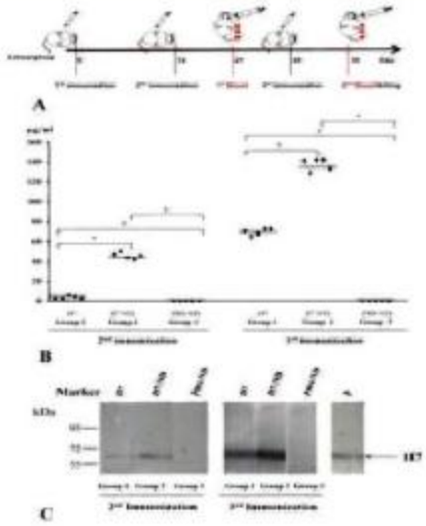
The re-suspension of nanodiamond particles before protein coating (ND) and after coating with trimeric H7 protein (H7:ND): A) in H2O; B) in 1X PBS; C) Zeta-potential of H7:ND and ND

Nanodiamond particles were demonstrated by the changes in size and zeta-potential of the particles before and after protein coating, Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), and Western-blot analysis. Next, biofunction of the protein-nanodiamond conjugates was screened using a haemagglutination assay. A mixture containing 5 µg of trimeric H7 and 60 µg of nanodiamond corresponds to a ratio of 1:12



Synthesis and physical characterization of H7-ND conjugates. The re-suspension of nanodiamond particles before protein coating (ND) and after coating with trimeric H7 protein (H7:ND): A) in H2O; B) in 1X PBS; C) Zeta-potential of H7:ND and ND

(w/w) of agglutinated chicken red blood cells at HA titer of 1024, which is 512-fold higher than the HA titer of free trimeric H7. After the 2nd and 3rd immunization in mice, ELISA and Western blot analyses demonstrated that the physical mixture of trimeric H7 protein and nanodiamond (1:12, w/w) elicited statistically significant stronger H7-specific-IgG response demonstrated by higher amounts of H7N9-specific IgG (over 15.4-fold with $P<0.05$ after the second immunization).



Immunopotentiation following immunization with an H7:ND (1/12, w/w) conjugate. A) Immunization scheme in mice. B) Measurement of H7 specific IgG amount in mouse sera via ELISA. In total, 50 ng of purified H7 (Influenza Antigen A/ Anhui/1/2013 (H7N9), NIBSC) per well were coated at the plate. The sera were diluted 1:5000 and a monoclonal mouse anti- H7N9 haemagglutinin/HA antibody (SinoBiologicalInC.) at concentrations of 0.5, 0.75, 1, 1.25, 2.5, 5, 12.5, 25, 50, 100, 150 µg/mL was applied as a standard, then analysed via ELISA. Specific immune responses were measured at 450 nm after 1 and 2 booster immunizations with H7 (group 1), H7:ND (group 2) and PBS:ND (group 3). The responses were recalculated according to the standard values as µg/ml anti H7N9 antibody in the sera. The BSA background was subtracted. A standard curve was built by the help of OD450 values corresponding to known amounts of H7N9 haemagglutinin/HA antibody. The amount of H7 specific IgG antibody in mouse sera was measured via the standard curve. Statistical analyses were performed using the t-test (SigmaPlot) and are presented. A single dot indicates the value of a single mouse serum. SD was included on a single dot that corresponds to an ELISA data variation of a single mouse serum with three replications. The bars indicate the average value of the test groups. P< 0.05 was defined as a statistically significant difference. (C) Detection of H7-specific IgG antibodies via a Western blot. Sera from five mice from each group (against H7, H7:ND and PBS:ND as a negative control) were mixed, diluted 500 times and used as a primary antibody for detecting 100 ng of purified H7 (Influenza Antigen A/ Anhui/1/2013 (H7N9), NIBSC). Anti-mouse H7N9 haemagglutinin/HA antibody (SinoBiologicalInC.) was used as a primary antibody (positive control: P). HRP-linked goat anti-mouse IgG was used as a secondary antibody.

These results indicated a potential effect inherent to nanodiamonds towards modulating immune systems, which should be further evaluated and broadly applied in nanovaccine development.

Publication(SCI, IF = 4,946): Pham NB, Ho TT, Nguyen GT, Le TT, Le NT, Chang HC, Pham MD, Conrad U, Chu HH (2017). Nanodiamond enhances immune responses in mice against recombinant HA/H7N9 protein. J Nanobiotechnology 15(1):69. doi: 10.1186/s12951-017-0305-2.

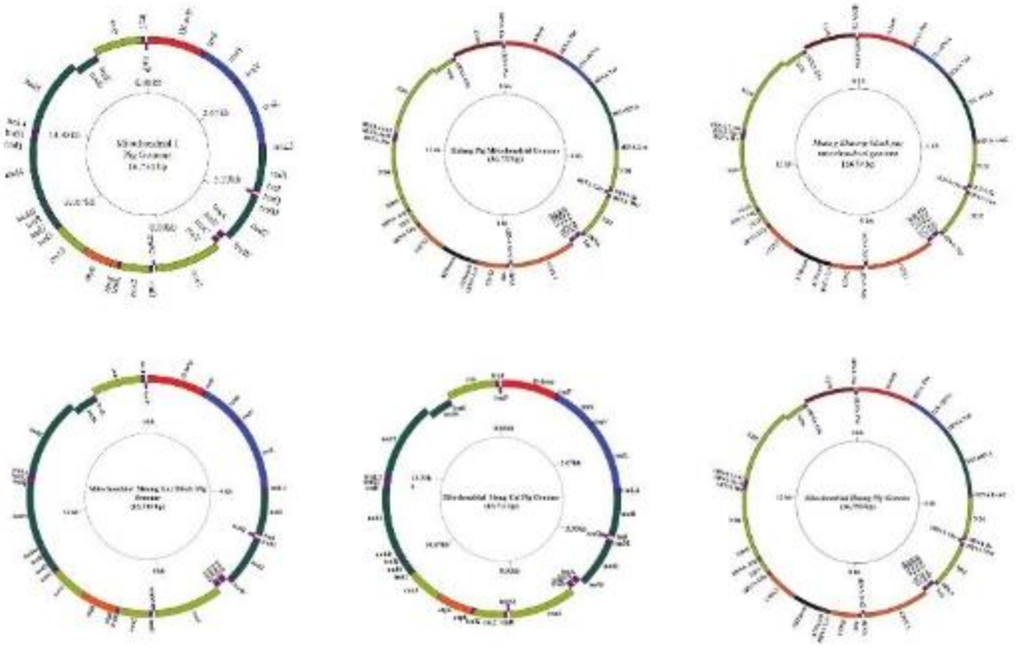
Project: *"Determination and analysis of complete mitochondrial genome sequence of the indigenous pig breeds ("I" pigs, "MongCai" pigs, "Black Muong Lay" pigs, "Muong Khuong" pigs, "Huong" pigs, and "Ha Lang" pig) in Vietnam"*. Insitute of Genome Research, Hanoi.

The influence of natural and artificial selection have formed animal breeds with distinctive traits from each nation and every region. All species contain precious traits, such as the ability to ustilise many kinds of food, high adaptability, good disease resistance, delicious meat quality, etc. These types of breed are known as indigenous genetic resources. Genetic resources are used or could be used for production purposes, research or breeding of domestic animals. In current farming conditions, indigenous pig breeds are declining in number and thus we are losing a precious local and national genetic resource. However, so far there is no scientific research work with a full genome study of these species in order to serve conservation and rational use of these genetic resources.

This study is going to sequence the whole mitochondrial genome (more than 16,000 nucleotides) with a new generation of genome sequencing devices - IlluminaSystems, and asses & analysis results with up to date bioinformatic software to determine the origin, conservation and recover some indigenous genetic resources. In addition, mtDNA sequencing data effectivelly contributes in identifying barcode type, diversity andgenetic evaluation of six pig breeds (e.g., I pigs, MongCai pigs, Black Muong Lay pigs, Muong Khuong pigs, Huong pigs, and Ha Lang pigs). It also builds on the success of planning conservation and sustainable use of indigenous animal's genetic resources globally.

The aim of this project was to do a complete sequence of mitochondrial genomes of 6 native Vietnamese pig breeds. Then, to analyze and construct their phylogenetic trees, identifying the origins and genetic relationships of six Vietnamese indigenous breeds with other pig species in Asia and Europe. Based on the results of the mitochondrial DNA studies, it is possible to study the genetic diversity of the six native pig breeds.

The results of this project were as follows: The DNA sample libraries of 06 indigenous breeds of Vietnam had been collected. The completed data on the mitochondrial genomic sequences of 06 indigenous Vietnamese pig breeds were established. The data on the phylogenetic trees, origin breeds, and genetic relationship of 06 indigenous breeds of Vietnam with some Asian and European pig breeds had been shown. The complete mtDNA sequence of 06 native Vietnamese breeds has been submitted to GenBank with accession number as KX094894 (I pig); KX147100 (MongCai pig); KX147101 (Black Muong Lay pig); KY432578 (MuongKhuong pig); KY800118 (Ha Lang pig); KY964306 (Huong pig). The results of the project had been published in international journals.



Sequence analysis of mitochondrial genomes of pigs in Mong Cai, Muong Lay, Muong Khuong, Ha Lang, Huong (Round structure of the genotype I (A), Mong Cai (B), Black Muong Lay (C), Muong Khuong (D), Ha Lang (E), Huong (F) is built by GenomeVX software.)

MATERIALS SCIENCE

Prof. Acad. Nguyen Van Hieu
Chairman of the Scientific Council

BIODEGRADATION OF POLYETHYLENE FILMS CONTAINING PRO-OXIDANT ADDITIVES

A master batch containing pro-oxidant additives, which is a mixture of Mn (II) stearate, iron (III) stearate and cobalt (II) stearate and polyethylene supported pro-oxidant additives was successfully manufactured.

The estimation of the degradation of polyethylene films containing pro-oxidant additives by thermal oxidation method according to ASTM D5510 and photooxidation method according to ASTM G154-12a was established. The results showed that LLDPE films with pro-oxidant lost 100% of their initial mechanical properties after 7 days of thermal treatment, whereas the time of that of HDPE films is 12 days. In the case of photooxidant, the elongation at break of films with pro-oxidant is < 5% (the value of which film is considered to be capable of degradation) after 96 hours, especially films with 3% of additives is only after 72 hours. In addition, the degradation of LLDPE films is faster than that of HDPE films in both cases. The degradation time of films was predicted, according to ASTM G154-12a, the decay times of films are from 1.5 to 2 months in the natural environment. According to ASTM D5510, the decay times of the LLDPE films are from 20 to 28 months and HDPE films are > 48 months in the natural environment.

The biodegradation of polyethylene films containing pro-oxidant additives in soil and activated sludge after the degradation process was also evaluated.

It was seen that after 6 months in soil, the buried LLDPE films with additives lost between 32 – 100% of its weight, the buried HDPE films with additives lost 25 –60% of its weight, while after 6 months in activated sludge, the buried LLDPE films with additives lost > 90% of its weight, the buried HDPE films with additives lost > 55% of its weight. The presence of microorganisms on the surface

of films was of observed. This is evidence for the biodegradation of films.

FABRICATION OF THE BROADBAND PERFECT ABSORBER BASED ON METAMATERIALS

Design and fabrication of the broadband perfect absorber on the basis of metamaterials (MMAs) with different structures from conventional cut-wire structure to dish, ring and dish-ring structures were performed. With each structure the influence of the structural parameters and polarization on the absorbance and absorption frequency was investigated.By using the photolithography the MMA with different structures was fabricated (Fig. 1)

Figure 2 shows the comparison of experimental results (dotted line) versus simulation (solid line). A good agreement between measurement and simulation was observed. When the radius of the dish, the outer and inner radii of the ring was carefully adjusted, the broadband MMA achieved a bandwidth of 3.7 GHz (the relative bandwidth is about 26%) and absorption rate higher than 80%. Besides, it was also demonstrated that the broadband MMA working at the THz frequency has a bandwidth of 2.19 THz and the absorption rate is higher than 80%.

The controllable MMA depending temperature was also investigated. Figure 3 shows the absorption spectra at different temperatures. The absorption peaks shift to the higher frequencies from 0.5 to 0.67 THz as the temperature increases from 260 to 380 K. This indicates that the magnetic resonance can be tuned by changing the temperature of InSb. The blue-shifted absorption peaks can be described by an equivalent LC circuit. When temperature increases, the large carrier density of InSb leads to an increase in the kinetic inductance, which raises the total inductance of the MM structure.

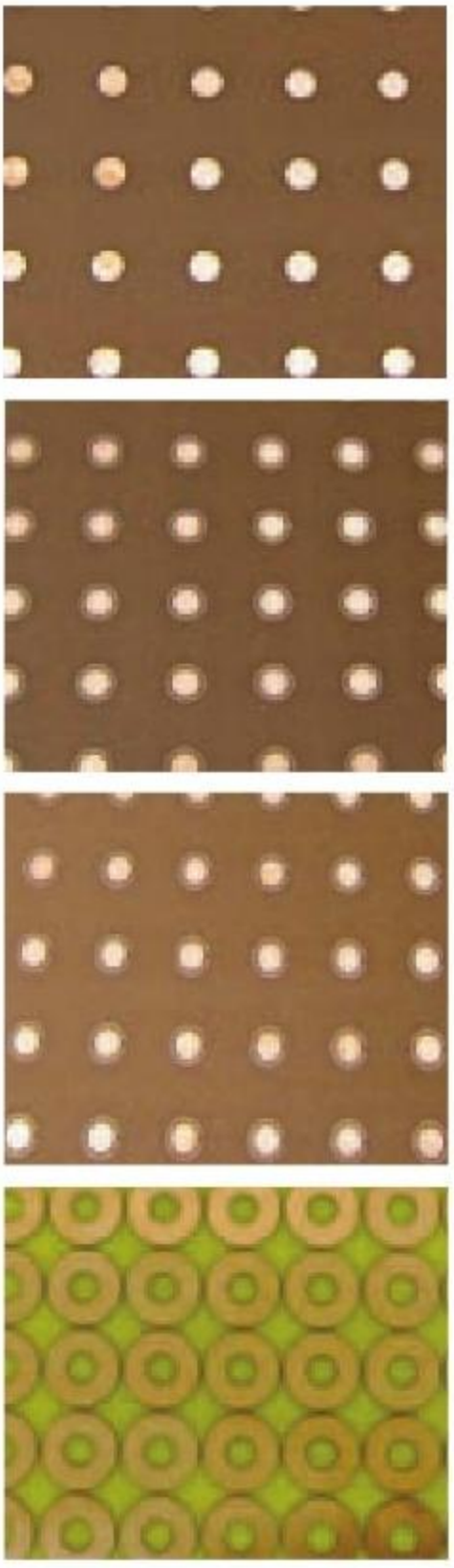


Figure 1: Fabricated MMA with different structures

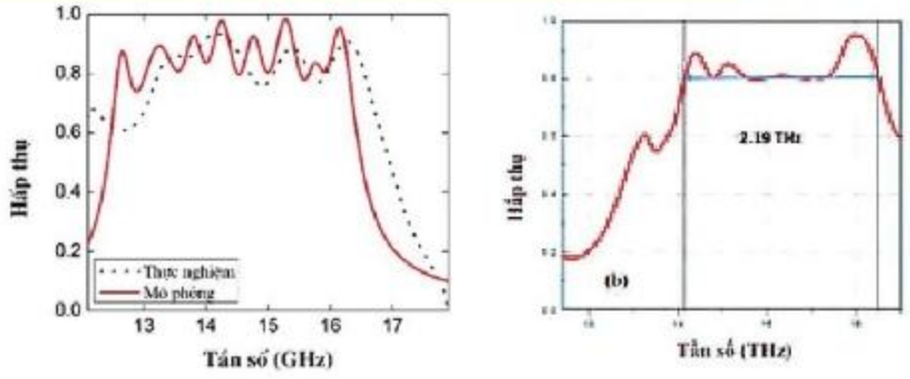


Figure 2: The absorption spectra of MMs: a) GHz regime, b) THz regime

Finally, MMs working at THz was fabricated as shown in Fig. 4. The results obtained here clearly demonstrate the promise of MM enhanced absorption spectroscopy in the THz region for detection and structural monitoring of large biomolecules such as proteins or pathogenic enzymes as shown in Fig. 5.

FABRICATION OF ALLOYS POSSESSING GIANT MAGNETOCALORIC EFFECT AT ROOM TEMPERATURE REGION, AIMING FOR APPLICATION IN MAGNETIC REFRIGERATORS.

Alloys possessing giant magnetocaloric effect at room temperature $NdPrFe_{17}$, $Fe_{90-x}Gd_xZr_{10}$ (x=1-3), $Ni_{50}Mn_{37}Sb_{13}$, $Ni_{50}Mn_{37}Sn_{13}$, $Fe_{90-x}Co_xZr_{10}$ (x = 2-4), $Fe_{85-x}Ag_xNi_5Zr_{10}$ (x = 0-2), $La_{1,5}Fe_{10}CoSi_{1,5}$ were fabricated.

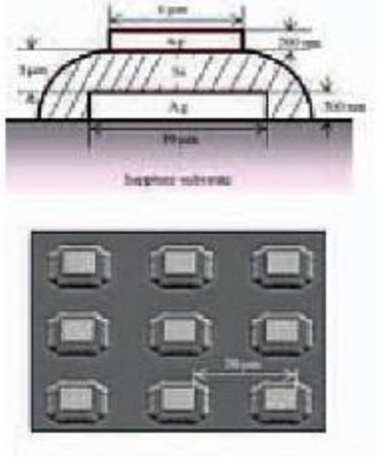


Fig 4: a) Cross-sectional illustration of the sample design with detailed dimensions of the sample and SEM image of a typical sample

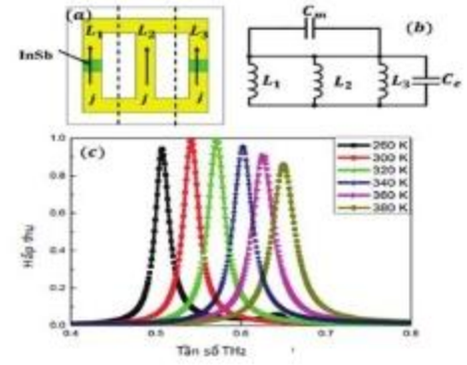


Figure 3: (a) Schematic diagram of MMA structure with InSb is filled to the two gaps and (b) the equivalent circuit of its structure, (c) simulated absorption spectra of MMA structure with different temperatures when two slits of SRR filled by InSb material

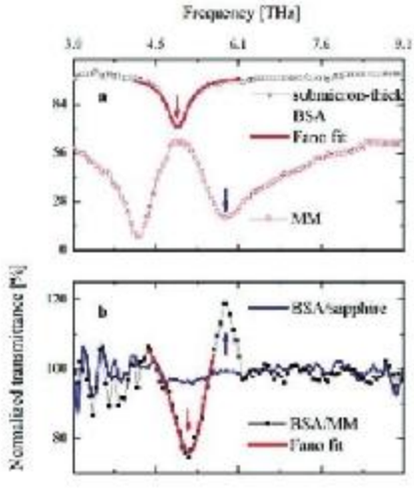


Fig 5: (a) Normalized transmittance spectrum of a submicron-thick BSA protein layer and MM resonance. Red line shows the Fano fit for the signal of the submicron-thick BSA.
(b) Normalized transmittance spectra of an ultrathin layer of BSA molecules absorbed on the MM sample and a reference sapphire substrate.

Application of magnetocaloric effect to magnetic refrigeration technology at room temperature was experimentally performed.

Magnetocaloric alloys possessing large refrigerant capacity, RC > 50 J.kg, at room temperature were prepared. A model of magnetic cooling equipment based on magnetocaloric effect at room temperature with temperature change DT = 7 K was fabricated (Fig 6)

Fig 6: Prototype of magnetic cooling at room temperature region based on magnetocaloric effect.

RECOVERY AND REFINING OF ECONOMICALLY VALUED ELEMENTS FROM SIN QUYEN COPPER WASTE AND INITIAL RESEARCH ORIENTED TO PRACTICAL APPLICATIONS

A recovery process of total rare earth oxides from Sin Quyen by enriched minerals containing rare earths from 0.7% to 3.8% with recovery performance of 84.30% and hydrometallurgical of ore enriched by H2SO4with recovery performance of 86.30% was performed. Total rare earth oxide products with over 99% purity were obtained .

The extraction with TPPO-toluene-HNO3-Al(NO3)3 system was used to separate the individual Ce(IV) and RE(III) with high purity > 99 % from the purified rare earths.

The synthesized La-Mn-Fe mixed oxides have specific surface area of 13 $m^2.g^{-1}$ and average grain size of 30 - 50 nm (Fig.7) Their ability to absorb As(V) and $NH4^+$ was invertigated .The results showed that these mixed oxides based on the composition of 0.7La/0.15Mn/0,15Fe granular in shape exhibited the adsorption capacity of 170.67 $mg.g^{-1}$ for As(V), and 54.11 $mg.g^{-1}$ for $NH4^+$.

Adsorbent based on 0.7La/0.15Mn/0.15Fe mixed oxide coated quartz sand (LFM/quartz sand) with 2% content granular in shape exhibited the adsorption capacity of 2,94 mg^{-1} for As(V) and 1,21 mg^{-1} for $NH4^+$. On the absorption column, LFM/quartz sand the retention time were 5.35 minutes for As(V) and 4.28 minutes for $NH4^+$.

Adsorption apparatus (filter) containing 18.5 kg of LFM73/quartz sand capacity reached 150 liter. $hour^{-1}$. Five adsorption filters to treat drinking water contaminated with arsenic and ammonium ions were installed for experimental use by 5 families in a village. The quality of drinking water treated through the adsorption filters sastified the Vietnam Standard 5502:2003 drinking water for arsenic, amonium.

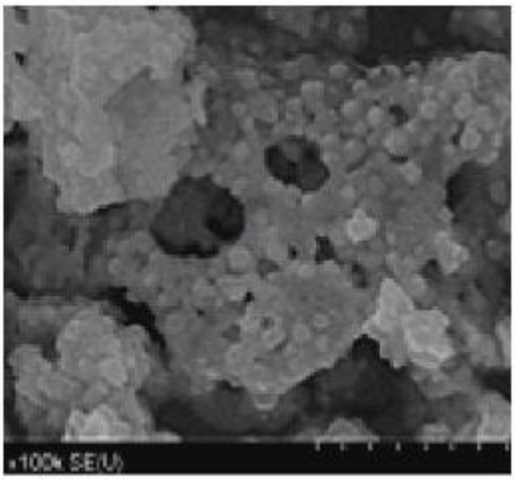


Figure 7 : SEM image of La-Fe-Mn mixed oxide

BIODIVERSITY AND BIOLOGICAL ACTIVE SUBSTANCES

Prof. Dr. Sc. Tran Van Sung

Vice-Chairman of the Scientific Council

In 2017, The Field of Biodiversity has published 351 journal articles including 259 articles in international journals (with184 SCI/SCI-E), 07 monographs / Reference books; 02 Patents (international registration WIPO); New discoveries: 03 new breeds described and 68 new species for science.

In 2017, the biodiversity of Tra Vinh province has been evaluated: For the fauna, Tra Vinh has a relatively diverse fauna system, including 09 species of amphibians, 15 species of mammals, 30 species of reptiles, 31 species of phytoplankton, 53 species of winged insect, 159 species of birds, 171 species of invertebrates, 386 species of fish; For flora, there are 41 species of mangroves, 42 species of trees timbers, 98 species of herbaceous plants, 147 species of algae- typical of the rainforest flora system. Mangrove forest flora has few rare species, it is mainly homogeneous with some typical species, with a simple structure and species composition. From the noted results, the researchers proposed solutions to conserve biodiversity in Tra Vinh.

The survey on reptile and amphibian species composition on Tho Chau Island and Phu Quoc Conservation Park showed that 04 species of amphibians and 14 species of reptiles were recorded on Tho Chau and 14 species of amphibians and 21 species of reptiles were found on Phu Quoc.

Identification of plant and animal species for flora and fauna in Vietnam has been made such as Alpinia polyantha D. Fang (Zingiberaceae); Cau-Butis Bleeker, 1856 and Bau-Butis Amboinensis (Bleeker, 1853).

- Southern Institute of Ecology has collected 115 species of fungi, 2300 fungal specimens, 345 DNA

samples; 230 plant species, 3.450 plant specimens, 690 DNA samples for the sub-project "Building a collection of mushrooms and plants in South Central Coast - Southern Vietnam", belonged to the project "Building Vietnam national nature specimen collections", in the period of 2015-2021.

- There have been recordings of approximatley 25 species of dragonflies, including at least 01 new species recorded for dragonfly reserves in Vietnam. At least 80 specimens have been completed. The total number of 51 species of large invertebrates have been identified, including 13 species of crustaceans of 04 families, 27 species of Ocarina of 10 families and 11 species of 04 families of bivalve. 300 specimens of plant and medicinal plants have been collected and used in Dak Nong Province.

- Tay Nguyen institute of Scientific Research has determined the method of Anoechitolus formosana planting with higher yield insupporting material than in the aquarial growing medium. Higher major substance content of Ginsenoside in Anoechitolus formosana hybrids planting in supporting material than in the aquarial growing medium has been recognized. A model of 5000 Anoechitolus formosana planting in supporting material and utilising hydroponic methods have been developed. The institute has also discovered 03 new plant species: Phlegmariurus lancifolius V.T Tran & N.V.Duy (Lycopodiaceae), Bulbophyllum glabrichelia Aver. (Anoechitolus formosana aceae), Bulbophyllum phitamii Aver. (Anoechitolus formosana aceae)

- Institute of Natural Product Chemistry has established and deployed one pilot production line of decreasing hydrolysis, increasing the quality and value of peppermint bee's honey from stone plateau of Ha Giang province.

- Institute of Ecology and natural resources has registrated 02 international patents for biologically active substances:

WO2017/065515
Publication date:
20 April 2017 (20.04.2017)

COMPOSITION FOR PREVENTING OR TREATING GYNECOLOGICAL CANCERS AND MENOPAUSAL SYMPTOMS CONTAINING FLEMINGIA STROBILIFERA EXTRACT OR COMPOUND ISOLATED THEREFROM AS ACTIVE INGREDIENT.

WO2017/065516
Publication date:
20 April 2017 (20.04.2017)

COMPOSITION FOR PREVENTING OR TREATING GYNECOLOGICAL CANCERS AND MENOPAUSAL SYMPTOMS CONTAINING CAJANUS CAJAN EXTRACT OR COMPOUND ISOLATED THEREFROM ASACTIVE INGREDIENT

SOME NEW PLANT SPECIES DISCOVERED IN 2017

Aspidistra cadamensis N.S. Ly & Tillich

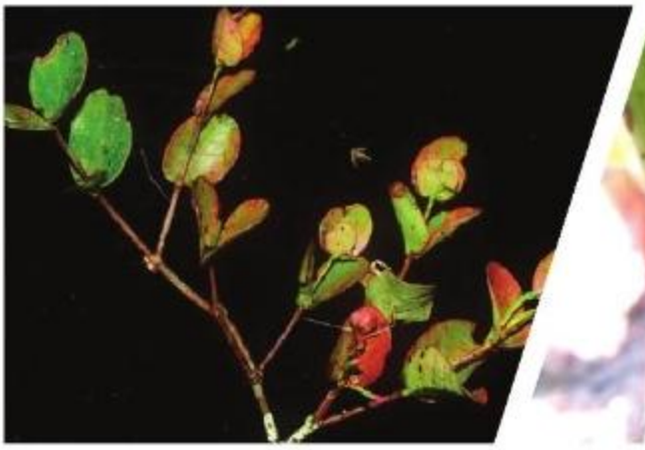
Billolivia middletonii N.S. Ly

Alpinia newmanii N.S. Ly

Podochilus rotundipetala Aver. & Vuong

Monoon vietnamesis N.S. Ly

Vietnamocasia dauae N.S. Ly, T. Haevermans, Y.S. Wong & D.V. Nguyen



Macrosolen bidoupensis Tagane & V.S. Dang

Boesenbergia quangngaiensis N.S. Ly

Garcinia hopii H.Toyama _ V.S.Dang

Polistess brunus Nguyen Carpenter, 2017 photo by Nguyen Thi Phuong Lien

Oligodon culaochamensis Nguyen, Nguyen, Nguyen, Phan, Jiang & Murphy

Fanxipan - Carpodacus vinaceus photo by Le Manh Hung

EARTH SCIENCES

Assoc. Prof. Dr. Sc. TRAN TRONG HOA
Chairman of the Scientific Council

SCIENCE AND TECHNOLOGY ACTIVITIES

Implementation of S&T projects

Natural Resources:

(1) Study of the Cu-Ni-PGE ore prospect in the Song Hien basin has determined two forming stages of the mafic-ultramafic intrusions, e.g., Silurian - Devonian (430-417 Ma) and Permian - Triassic (243-256 Ma) and two intrusive types with different geological structures, different compositions and different prospects for Ni-Cu (PGE) mineralization. These new results are fundamental for the ore-forming model and orientation for mineral exploration;

(2) Study and assessment of outstanding geological and geomorphological values in the Binh Thuan coastal zone have contributed to the discovery and identification of some local geological heritages;

(3) Based on the integrated assessment of underground water resource and quality, a numerical model was applied to develop a plan for rational exploitation of underground water in Quang Tri province;

(4) A study was conducted to complete the "hanging" water pond technology and test application of a hanging pond reservoir for increasing water use capacity and to create a touristic landscape: There are new findings on the ability to collect water from limestone mountains; some techniques for improvement of flow and treatment of water quality was proposed in order to improve the needs of clean water use of people in the Xa Phin commune, Dong Van district, Ha Giang province.

Natural Hazards:

(1) Tasks included study of geomorphologic and coastal Holocene sediment evolution under wave-tidal influence and construction of the coastal erosion model, sea level change and paleo-geographic evolution of the Mekong delta in the Holocene;

(2) Characterizing the fluctuation

of subaqueous delta of the Day River estuary; factors effecting flow bed variation and river bank erosion of the Red River; status and dynamics of coastal change from Hai Phong to Ninh Binh, coastal erosion and accretion in Tra Vinh province. The achievements serve as the scientific basis presenting solutions to mitigate the river-bank and shoreline erosion-related disasters, to propose rational land use and to promote various economic sectors in the coastal provinces;

(3) Study of the velocity structure and earthquake focal mechanism in North Vietnam using the broadband seismic data has acquired a velocity structure model and an earthquake focal distribution map in Northern Vietnam; Efficiency assessment of the Vietnam seismic station network using deviation calculation in determining basic earthquake focal parameters; Detailed study of seismic activities of Thuong Xuan - Ba Thuoc meridional fault zone. The achievements from these research directions have created new scientific bases for earthquake risk assessment and seismic zonation in Vietnam, actively contributing to the identification of related geological hazards in the important socio-economic regions, especially to those in the mountainous provinces;

(4) Study of flood disasters in Central Vietnam: a pilot experiment of combining Landsat 8 OLI and Sentinel-1 data was implemented, a new algorithm was developed for automatic classification of land cover that applied for the Vu Gia-Thu Bon watershed, the algorithm was used to interpolate the water boundary between flooded areas between two sequential observations. The preliminary results showed that the application of Sentinel-1 data in combination with interpolation algorithm can supply the general information on flood situation over a whole watershed, which appears to be the useful information for flood response and recovery missions. At the same time, the river drainage corridor in the downstream Vu Gia - Thu Bon river basin (Da Nang city) has been identified as the hydropower system in the upstream goes into operation in the context of climate change.

Environment research

(1) Application of a finite element modeling software simulating water transportation and the spread of polluted materials and salinized underground water presents a clear scientific and practical significance in serving fundamentals to a wide groundwater use and management in the coastal areas of Viet Nam;

(2) A first attempt to apply Karst Disturbance Index in the Phong Nha – Ke Bang (PN-KB) National Park of Vietnam was carried out. The work has developed a set of indicators for disturbance quantitative assessment which can serve as a useful tool for management, sustainable use and conservation of natural heritage of the PN-KB National Park and other karst areas in Vietnam;

(3) Using a combination of geophysical methods to monitor near surface changes in the geological structure caused by landfills is a new approach in geological environmental study in Vietnam;

(4) Study of material balance of biogeochemical cycles in sediment environment in cage farmareas and their impact on other ecosystems was deployed in the South-Central Coastal area aiming to serve for cage farming development and environment management in the region.

In 2017, S&T projects on the Earth Sciences were implemented as follows:

(1) Strengthening the effectiveness of universal

solutions for raising the groundwater level to solve the water deficiency during drought seasons in the basaltic areas of the Central Highlands (Institute of Geological Sciences);

(2) Researching genetic models for magma-related Cu-Ni-PGE and Fe-Ti-V deposits in Northeastern of Vietnam (Institute of Geological Sciences - IGS);

(3) Studying and applying a combination of solutions for improving and restoring the ecosystems in landfill and mineral exploitation areas in order to prevent desertification for sustainable and effective land use in the Central Highlands (Institute of Geography - IG);

(4) Establishing a seismological observation network for reservoir earthquake monitoring in the Da River terrace-shaped hydroelectric dam (Institute of Geophysics - IGP);

(5) Studying deep structure characteristics and recent movement of the earth's crust in northern Vietnam using broadband seismic data and continuous global positioning satellite system (GPS) data (IGP);

(6) Studying the heritage values of the volcanic caves, proposing on-site museum establishment for conservation in the Central Highlands, a case study of the volcanic caves in Krong No, DakNong Province (Vietnam National Museum of Nature - VNMN);

(7) Study and potential assessment of intrusive-related sulfide-gold mineralization in the Lo Gam zone, NE Vietnam (IGS);

(8) Assessment of dynamic factors affecting the erosion and deposition processes of estuarine and coastal areas from Quang Nam to Phu Yen in the context of climate change and sea level rise;

(9) Investigating and assessing the impact of An Khe - Kanak hydropower plant on downstream water resources in the Ba river basin (IG);

(10) Studying the accumulation of heavy metals (As, Hg, Pb) and residues of plant protection chemicals in surface sediments and assessing the ecological risks for sustainable development of aquaculture in the coastal area of Thai Binh Province (IG);

(11) Establishing integrated systems of remote sensing, GIS and mathematical models in the assessment of climate change in Southern Vietnam (HCM City Institute of Resources Geography - HCMCRG));

(12) Study of the Permian-Triassic boundary at the Hong Ngai and Lung Pu 2 sections and complete the results from the Lung Cam section for improving the scientific value of the geological heritage - Dong Van stone park (IGP);

(13) Study of the development history of Tertiary sediments in the Cao Bang- Tien Yen fault zone, Northeastern Vietnam and related mineral resources (Institute of Marine Geology and Geophysics - IMGG).

Earthquake and tsunami monitoring and warning

The earthquake and tsunami monitoring activity has been operated by the Institute of Geophysics throughout the year 2017. In total, 31 earthquakes with magnitudes ranging from 2.5 to 3.9 of moment scale were recorded in Vietnam and South China Sea, including 04 with magnitudes stronger than 3.5. All were instantly informed to the public.

Activities in collection of geological specimens for the Vietnam National Museum of Nature

The task of collecting rock, fossil and mineral samples on land and islands from Quang Ninh to Kien Giang has been actively implemented. A large number of representative and proper samples were obtained and

handed over to the Museum for display and research.

Publication

In 2017, the IGS, IG, HCMCIRG and IMGP alone published 39 articles in ISI journals, 93 articles in national journals and 13 monographs, some were published abroad.

International collaboration

In 2017, a number of collaborative research projects with Russia, Japan and Taiwan have been completed and achieved good results. Many results have been published in international scientific journals as a basis for further promoting S&T cooperation in the important fields of Earth Sciences. In addition, in 2017, the Institutes of Geological Sciences and Institute of Geography have implemented tasks under the project of enhancing the capacity of scientific research and technology deployment for the Lao Academy of Science: Building of a laboratory for analyzing rock and soil samples; Training in scientific research and techniques for analysis of geological and soil samples for scientific staff members of the Lao Academy of Science. Training and technical guidance is provided both in the laboratory and in the field.

SIGNIFICANT ACHIEVEMENTS

The finite element modeling groundwater flow and solute transport software is a new result which has a clear scientific and practical significance in serving fundamentals to a wide groundwater extraction management in the coastal areas of Viet Nam.

Origin: Towards-practical-implementation a fundamental study has been implemented under the leadership of Associate Prof., Dr. Eng. Nguyen Van Hoang (Institute of Geological Sciences). The software has Vietnam abbreviation PTHH NDĐ and English abbreviation GW FE attached to the window icon. The software serves as numerical tool for simulation of groundwater flow and solute transport by advection and dispersion in groundwater water in horizontal two-dimensional domain (or quasi-three dimensional) by means of finite element method (a method which had been considered as the most advanced numerical method) in neither confined or unconfined aquifers (Figure 1). The model domain may have any geometrical configuration (the model domain boundary can be a tributary and the finite elements of the mesh are the most fitted the domain), which allows a modeler to carry out modeling of any domain of groundwater flow and solute transport. The model allows determination of the groundwater hydrodynamic regime (groundwater level field and groundwater flow velocity field) and the distribution of concentration of solute in the groundwater in space and in time, which are valuable for various analyses of groundwater abstraction and salinization spreading and intrusion. Such results are the fundamentals for proposing various engineering

The finite element modeling groundwater flow and solute transport software PTHH NDĐ - GW FE

measures in sustainable regional groundwater abstraction and groundwater development. The software menus is in Vietnamese so it ensures a transparent professional terminology meaning in order to keep the users in the right specification of necessary inputs in order to have a correct intended modeling. The software has a commercial potential.

Four scientific papers published in SCI and SCIE journals on Late Holocene sediments, geomorphology and coastline changes in the Mekong Delta

Origin: NAFOSTED Projects completed in 2017 by Assoc. Prof. Dr. Nguyen Van Lap and Ta Thi Kim Oanh, HCMCRG. Research results show that the delta has been formed and prograded rapidly in natural process. However, over the past 43 years (1973 - 2015), deposition rates have decreased and erosion trends have increased. Particularly from 2005 to 2015, the severely eroded coastline has shown that the delta has retrograded and that the coastline is retreating. This result clarifies the Holocene sediment environment, formation and development of the Mekong Delta, especially the current changes in coastal areas due to human impact. Research results can be applied in the rational use planning of coastal resources in the Mekong Delta.

Discovering archeological sites in the volcanic cave in DakNong Province

Origin: Vietnam National Museum of Nature. A survey of some volcanic caves in the Krong No area (DakNong province) had discovered archaeological remains of ancient times and proved residency and tool creation of primitive people in the volcanic caves in the Krong No area, DakNong province (Figure 2). These are the first archaeological findings of the prehistoric volcanic cave in Vietnam. Stone remnants include: oval or near rectanglehacks, nearly circular things (Figure 3), stone fragments, slabs, striking stones, chock, pounding pestle,... These are common tools in tribes from the New Stone Age. Experimental and comparative ethnographic observations from archaeologists marked these tools which could have been used to cut trees, wild animal meat, herbaceous species, food processing or wood logging and bamboo chopping for hunting. Potteries discovered in the caves are scarce, but they were made with high skill (Figure 4), mainly clay pottery made from sand clay by hand, simple figures, mostly pots and containers, pottery "bone" is thin, some have overcoat, decorated with squares or other designs. These are the most common types of pottery from the Neolithic and Neo Stone Age relics.

For the first time, Vietnamese scientists have discovered the resident relics of prehistoric people in volcanic caves or under basalt roof, added a new type of residence and a new adaptation of prehistoric people in the basalt areas in the Central Highlands. This research has opened a new field of study in archeology of volcanic caves in Vietnam and Southeast Asia.

Pottery fragments discovered in C4 cave

MARINE SCIENCE AND TECHNOLOGY

Assoc. Prof. Dr.Sc. Nguyen Van Cu
Chairman of the Scientific Council

In 2017, the Scientific Council on Marine Science and Technology (SCMST) implemented the evaluation of scientific projects in the direction of marine S&T. The SCMST selected 10 out of 21 proposals so as to revise the names, objectives and content of research and products. These proposals, in the Marine S&T Program KC09/16-20 and independent projects at state level, were submitted to the President of VAST before submitting to the Ministry of S&T. The SCMST has also selected 06 out of 26 submitted proposals at VAST level (VAST06) as follows

-02 proposals of the exploration of petroleum and gas hydrate resources and study the evolution of material distribution due to erosion and deposition in estuaries of the Mekong Delta.

- 02 proposals of marine biological resources: mechanism of storage and distribution of fish seed sources and identification of spawning grounds of some fish species with high economic and ecological value at estuaries in the west coast of the Gulf of Tonkin.

- 01 proposal of tsunami disaster risk prevention.

- 01 proposal of research and development of wave power generation equipment.

The SCMST has selected 01 out of 02 submitted proposals belonged to independent project for junior researchers at VAST level.

In 2017, scientists from Institute of Oceanography, Institute of Marine Geology and Geophysics, Institute of Marine Environment and Resources, Institute of Geography, etc. have actively implemented the State Protocol tasks of Vietnam–China and Vietnam – Russia and deployed 06 marine scientific projects in the KC09/16-20 program.

According to the work plan of 2017, the SCMST held a business trip to the Korea Institute of Ocean Science and Technology (KIOST). The delegation discussed future cooperation in the field of marine research, including: information exchange, especially on satellite image data (currently, KIOST owns a remote sensing satellite), organizing marine scientific conferences, building research programs for oceanographic research, marine environment and marine resources, marine geology and minerals using the ISABU marine research ship.

Some main results:

- The project *"Assessment of oil and gas potential in the coastal area of the Red River delta"* has studied and applied a processing and analyzing methodology of geophysical data for forecasting and evaluating oil and gas potential in the coastal area of the Red River delta. The results of the project are the basis for exploration, forecasting and assessment of oil and gas potential in the coastal area of the Red River delta. The project has established a structural zoning map of oil and gas potential areas in the study area according to gravity, magnetotelluric and seismic data.

- Project: *"Assessment of anti-aging activity, enhancement of vigor of Sa sung (sea worm)"* analyzed the content of amino acids in Sa sung cultivars in QuangNinh - Vietnam. The results showed that in the sample, there were up to 12-17 kinds of amino acids, including 05 essential amino acids and 07 amino acids in the non-essential group for the human body; Some amino acids found in the studied samples were quite high, such as Proline (21.02810 mg/g), Alanine (13.11210 mg/g), Aspartate (12.14771 mg/g), Isoleucine (8.05440 mg/g), Leucine (8.42070 mg/g) and Glutamate (7.17936 mg/g).

+ Extraction and determination of polysaccharide content in sea worms: 100 g dry sea worm containing: 7.416 g total polysaccharide, of which: (i) 6.034 g was extracted with hot water (100°C) for 05 hours; and (ii) 1,382 g extracted in 05% NaOH at 60°C for 04 hours; 10.045 g total protein, of which: (i) 6.953g extracted hot water (100°C) for 05 hours; and (ii) 3,092 g are extracted in 05% NaOH at 60°C for 04 hours; The ratio of total polysaccharide/ total protein in sea worm was 1:1.35.

+ The procedure onmodulating combined betaglucan product from the monkey-shaped mushroom and product from a sea worm was developed; a mixed product from the monkey-shaped mushroom and a sea worm has been developed to enhance the health and physiology of experimental animals.

+ Having evaluated the effect of the mixed product on the physiological function of the mouse.

- The project *"Assessing the capacity of self-cleaning of Vung Ro bay (Phu Yen) for sustainable development of the marine economy"* has evaluated the current status and forecast of changes in environmental quality and self-cleaning ability. It has also proposed environmental management solutions for effective exploitation and utilization and sustainable development of the marine economy in the study area. The project has developed 03 types of software: Vung Ro database management software, material propagation prediction software in Vung Ro bay and software to calculate the loading capacity of Vung Ro bay.

- The project *"Assessment of exploitation status and artificial fertility of Paracanthurus hepatus Linnaeus 1776 in Khanh Hoa"*, in the first time has identified the biology, fertility and exploitation status of Paracanthurus hepatus Linnaeus in Khanh Hoa province. Fishing season is from

CHART OF TRANSFORMING MATERIALS WITH PETROLEUM POTENTIAL AREAS IN THE POTENTIAL GEOGRAPHIC SIGNS

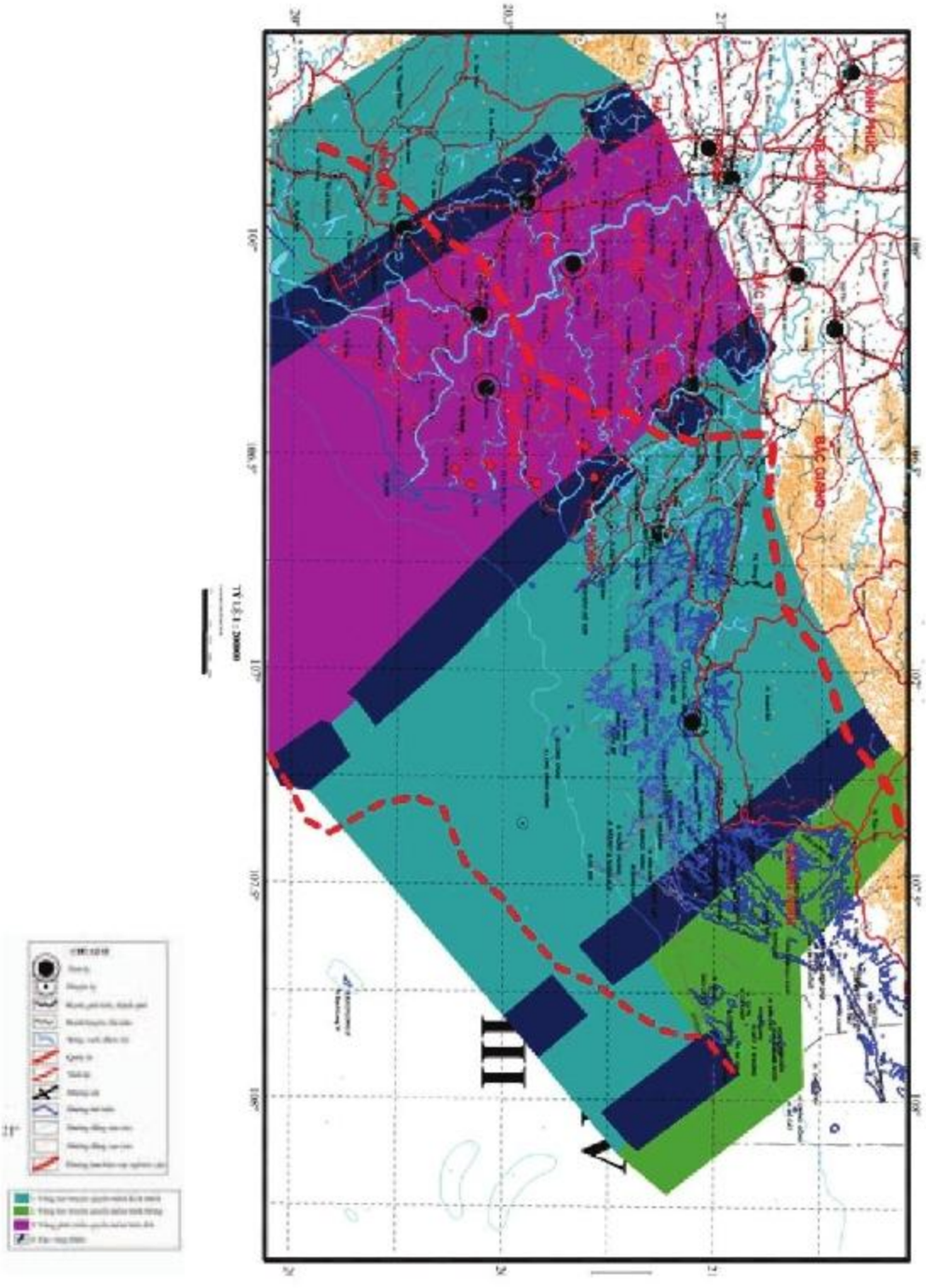
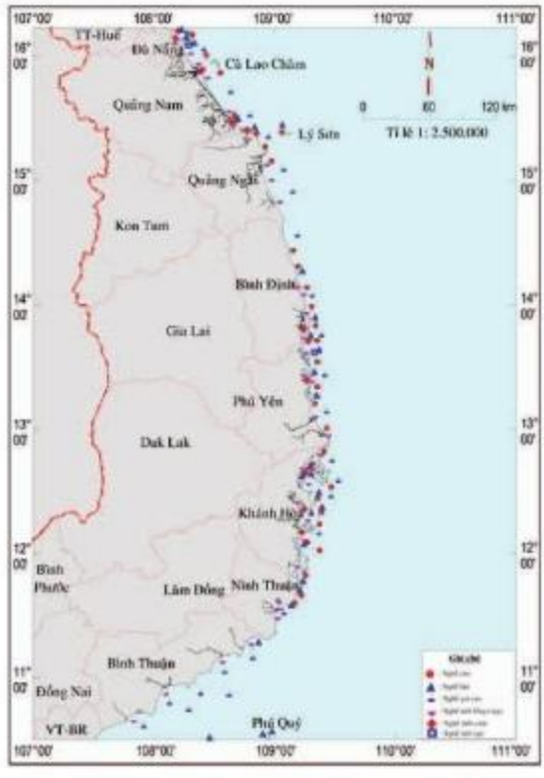


Chart of transforming materials with petroleum potential areas in the potential geographic signs (zoom out from the scale of 1:200.000)

March to October annually, mainly from April to August. Fish are caught in all sizes, average 160 - 200 mm.The average catch is about 1025 individuals per year, in which the Sprats account for 80% of the catch. In Khanh Hoa province, there are 06 establishments specializing in trading and distribution of pet animals. Aquarium fish are sold in Ho Chi Minh City and exported. Main export markets are: UK, USA, Russia, China, South Africa, Germany, France, Netherlands, Japan, Australia, Austria, Israel, Denmark, Poland, Hungary, Romania.

The research has evaluated the artificial reproduction of Paracanthurus hepatus: Paracanthurus hepatus is a fish species that breeds annually. The spawning season of Paracanthurus hepatus in Khanh Hoa lasts from March to August. The average reproduction is 9,983 ± 6,026 eggs / female (1,527-20,618 eggs / female). Relative average reproduction of Paracanthurus hepatus in Khanh Hoa is 67 ± 19 eggs / g females. The use of gonorrhea has not brought about reproductive efficiency in Paracanthurus hepatus. Biological analyzes for artificial reproduction, ability to retain and mature parentage, ability to stimulate reproduction, larval rearing ability based on background information was made. The results showed that Paracanthurus hepatus could give artificial reproduction. The project has proposed appropriate solutions to exploit and develop Paracanthurus hepatus in Khanh Hoa. Research on artificial reproduction and grow-out culture in combination with applying conservation solutions has been made. Evaluation of artificial fertility of Paracanthurus hepatus is a scientific basis for further research on artificial-reproduction, commercial fish actively provide market and reduce pressure on natural exploitation.

- Project on *"Surveying and evaluating source of broodstock and wild seed of Serranidae in the South Central Coast (from Da Nang to Binh Thuan) and proposing sustainable exploitation methods"* investigated the species composition and status of commercial Serranidae (broodstock) and seed production in the South Central Coast. The project has introduced solutions for management, exploitation and sustainable conservation of commercial Serranidae and seed. The project has added 09 Serranidae species, identifying Serranidae seedlings and estimating the yield of wild Serranidae.



Fishing grounds and harvesting seasons of commercial grouper from Da Nang to Binh Thuan

ENVIRONMENT AND ENERGY

Assoc.Prof.Dr.Vu Duc Loi
Secretary of the Scientific Council

PROJECT EXECUTION AND ACHIEVEMENT REPORT

In 2017, the Environment and Energy Division carried out 09 projects including 04 transitional projects and 05 new openings. The total budget was 2700 million VND, 1200 million VND for transitional projects and 1500 million VND for 05 new ones. In 2017, all projects were chaired and operated properly according to the plan. This year, the division has accepted 05 projects classified as either good or excellent. The results of the projects in the Environment and Energy Division have focused on research of waste treatment technology, wastewater treatment by biotechnology - membrane, waste gas treatment, etc. Optimal conditions for Struvite precipitation have been successfully studied in order to recover N (ammonia) and P (phosphate) in urine. The urine phosphate recovery process into Struvite structure is simple, easy to operate, environmental friendly since it does not cause secondary pollution, the struvite precipitates obtained can be utilized as slow release fertilizer, which has high value and practical meaning for crops.

Nano-materials, inhibiting the growth of microalgae, have provided scientific basis for the application of these nano-materials in treatment of toxic cyanobacteria blooming in fresh water bodies. Nanocomposite Ag/bentonite and Ag/silica materials have been successfully produced which prevent Fusarium oxysporium, Rhizoctoniasolani, Colletotrichum funguses, which can cause plant pathogenesis, to reduce the impact of pesticide usage and subsequent environmental pollution.

Research and design of a hot air supply system using solar radiation with high transformation efficiency and at a low cost has been conducted. The device combines solar radiation and hot air heat pump for low temperature drying. A physical

model of an active noise filter for power load up to 20 kVA has been built for low voltage power network, which is suitable for conditions in Vietnam, creating a clean power supply. High-capacity Hybrid Active Power Filters (HHAPF) have been studied and designed in order to reduce the capacity of an active power filter circuit and are to be applied for networks with higher voltage and capacity. In 2017 the projects in this division have published 02 papers in the ISI international journals, 05 papers in domestic journals, 01 Patent, 02 Utility Solutions.

Particularly, in 2017 Institute of Environmental Technology has been granted patent No. 17174 entitled "Treatment technology of wastewater containing heavy metals and high sulfate by using limestone, sawdust which was hydrolyzed and aquatic plants. Institute of Chemistry has successfully built and produced an ultra trace mercury analyzer for environmental monitoring and food safety control. The analyzer has the limit of detection (LOD) lower than 0.1 ppb that meets the requirement for ultra trace mercury analysis in environmental and food samples. In addition, this analyzer costs approximately 300 million VND which is a significantly lower price than the imported models.

PROJECT DEVELOPMENT OUTLOOK IN 2018

In 2018, the environment and energy division will open 05 new projects, which include:

- Research of ammonia – nitrogen pollutants in the water environment and removal technology by a new method: catalytic ozonation

- Research to fabricate electrochemical sensors to measure the electrical conductivity to assess the pollution of agricultural soil due to fertilizer residues.

- Evaluating the impact of ocean acidification on the health of coral reefs on the west coast of the Gulf of Tonkin

- Research, design and manufacture of high-efficiency grid inverters for solar panel power source.

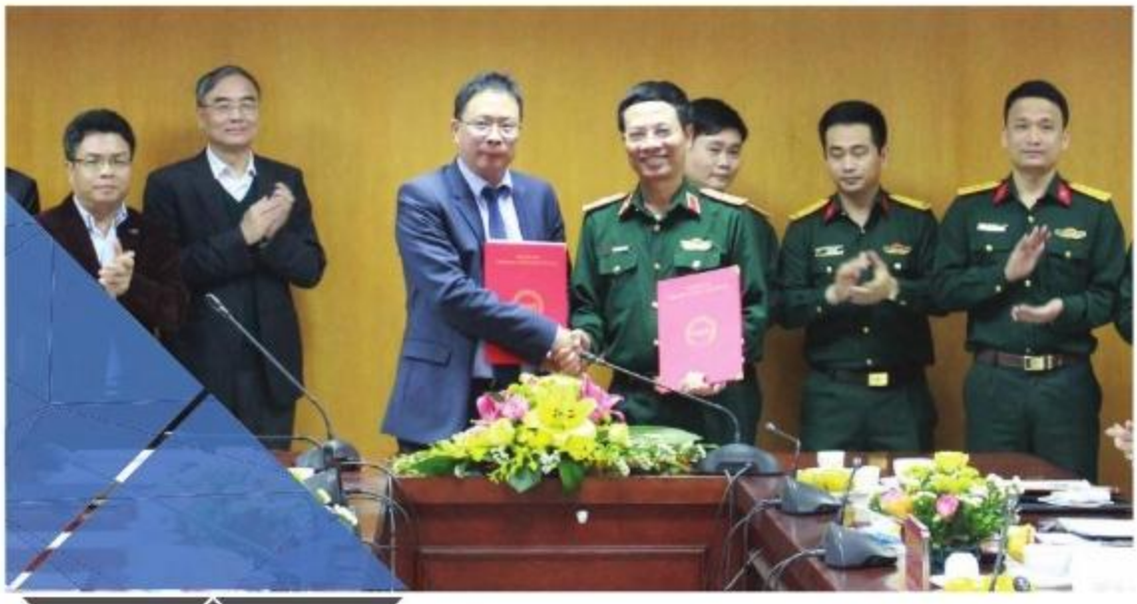
- Research on the calculation of the rational distribution of waste discharging sources and the determination of maximum daily contamination load for the control and management of water quality in river basins in Vietnam.

Ultra trace mercury analyzer

Treatment technology of wastewater containing Cr, Ni by combining sawdust with aquatic plants at pilot scale, capacity of 50 m3/ day

VAST's Exhibition of S&T products in Bac Giang province in May, 2017

TECHNOLOGY APPLICATIONS AND DEVELOPMENT



TECHNOLOGY APPLICATIONS AND DEVELOPMENT

Dr. Ha Quy Quynh
Director - Department of Application and Development of Technology

Implementing Decision No. 159-NQ/ĐUVHL of the Party Committee of VAST on "Accelerating the application and development of technology of the VAST in the 2016-2020 period with orientation towards 2030", VAST has issued many regulations to quickly bring the results of scientific research and technology development into market to promote our country's social-economic development.

Four projects are: "Management of Commercial Product Development Projects", "Management of Technology Development Projects", "Management of Ministry-Local cooperation Projects" and "Management of Pilot Projects". Those Projects of VAST has promoted the transfer of S&T products to partners outside of VAST.

There have been 1165 S&T contracts with a total budget of 567 billion VND, of which 1005 contracts were with private partners with a total budget of over 368.9 billion VND and the revenue in 2017 is 199.8 billion VND. The number of contracts with non-business sources is 160, with the total budget of more than 208.1 billion VND and the revenue in 2017 is 56.7 billion VND

MANAGEMENT OF APPLICATION DEVELOPMENT AND PILOT PROJECT

In 2017, 34 projects were implemented at the VAST's priority directions, including 08 new open projects.

Together with the promulgated new regulations, VAST approved and funded 23 new projects, including: 03 Ministry-Local cooperation projects, 06 pilot projects; 07 technology development projects, 05 commercial product development projects, 02 independent S&T development projects will be carried out in 2018;

The local provinces and ministries in cooperation with VAST are: Ha Giang, Bac Giang, Lao Cai, Quang Ninh, Thai Binh, Hai Phong, Hue, Da

Nang, Tra Vinh, Ben Tre, Dong Thap, Dong Nai and Lam Dong , Ministry of Defense, Ministry of Public Security (Vietnam) and some domestic enterprises. The projects of cooperation with ministries, local provincial and the pilot projects have been implemented so as to promote cooperation between specialized institutions and 01 local institution or enterprises in order to solve a specific task and local requirements.

COOPERATION WITH VARIOUS MINISTERIAL, REGIONAL AND LOCAL ENTITIES

Continuing to expand the network of scientific and technological units to cooperate with the ministries and local provincial through the signed MOU, including: People's Committee of Dak Nong Province (February, 2017), Viettel Military Telecommunications Group (March, 2017), Ca Mau Fertilizer Plant (April, 2017), Vietnam Startup Fund (9/2017). Re-signed the agreement of cooperation with Quang Nam People's Committee, March, 2017.

Collaborating with Bac Giang provincial Party Committee to hold a seminar about Materials Science - Physics, New Materials, Nanotechnology in Biomedicals and Agriculture for the Standing Committee of Bac Giang Provincial Party Committee.

Coordinate with the Departments of S&T of the provinces of: Ninh Thuan, Quang Ninh, Thua Thien Hue, Ha Giang, Hai Phong, Dak Nong, Quang Nam and Ca Mau; Department of Locality, State Agency for Technology Innovation, Viettel Institute of Aerospace, Viettel Military Telecom Corporation, Thanh Hoa Sugar Company, Hapras Joint Stock Company, Nam Hiep economic development, etc. in order to connect scientists with other units to develop, transfer technology from VAST to the companies.

INTELLECTUAL PROPERTY – TO PROMOTE COMMERCIALIZATION OF RESEARCH RESULTS

Recognizing the role intellectual property possesses in the commercialization of research results, VAST has focused on raising awareness amongst its scientists. VAST organized meetings with World Intellectual Property Organization (WIPO) and Vietnam Intellectual Property Office on helping Vietnam increase its competitiveness based on technology innovation (3/2017). Organized seminars, training courses, "Enhancing Patent Description Writing Skills" for research staff of VAST in Hanoi and in Ho Chi Minh City:

As of November 30th, 2017, the VAST was granted 40 Intellectual Property Rights, including: 20 Patents, 19 Utility Solutions, 01 Software License, these numbers are three times more than those 05 years ago.

In 2017, VAST held many events to introduce and promote technology with more than 300 technologies and equipment, attracted the attention of the leaders of enterprises, ministries and the country as follows: During the Tech Demo event held by the Ministry of Science and Technology in Da Nang on November 22nd to 24th, 2017, VAST was placed at the center of the exhibition by the Organizing Committee with more than 100 technologies from 16 subordinate units; The Smart Industry event organized by the Central Economic Commission on December 4th-5th, 2017; Organizing the seminar on S&T Information service for small and medium enterprises in Korea on September 21st-23rd; Exhibiting and introducing products and technologies of female scientists of VAST at the S&T Application Center of the Women's Intellectual Association in May

2017; Organizing workshops to introduce the new value of Dong Van stone geological park in Ha Giang province in February, 2017; Laboratory open days for students and researchers of VAST on the day of S&T on May 18, 2017; Deploying Techmart to introduce the technologies of VAST at the Technology Exchange of Hai Phong and the Department of S&T of Lao Cai province. Co-ordinating with Tra Vinh People's Committee to organize seminar on "Application of biological processes and preparations for shrimp farming and organic production" to introduce technologies of VAST to more than 200 enterprises and managers in the Mekong Delta region.

In 2017, there were more than 20 technologies edited by Vietnam Television2 (VTV2) and broadcasted on the channel and 07 technologies broadcasted on" path of knowledge programme" on VOV1 channel. The technologies have been published on the mass media many times.

HIGHLIGHT RESULTS HAVE BEEN APPLIED INTO PRACTICE

In 2017, VAST technology transfers achieved many initial results, the number of technologies that were transformed into production increased significantly compared to the previous year, reaching many enterprises and organizations.

Particularly, 19 technologies were brought into production; 06 technologies have been produced, 04 are ready to be delivered. 06 out of the 19 technologies are from research contracts.

The transferred technologies include: (1) The Institute of Chemistry transferred technology for preserving lychee fruit by wrapping atmosphere Map for its business and export in Bac Giang. This technology is also used to preserve asparagus in Ninh Thuan. Metaherb production process for Hoang Chau Company and Phuong Dong Company. (2) Nha Trang Institute

The opening ceremony and supply-demand connection of Techmo Danang 2017

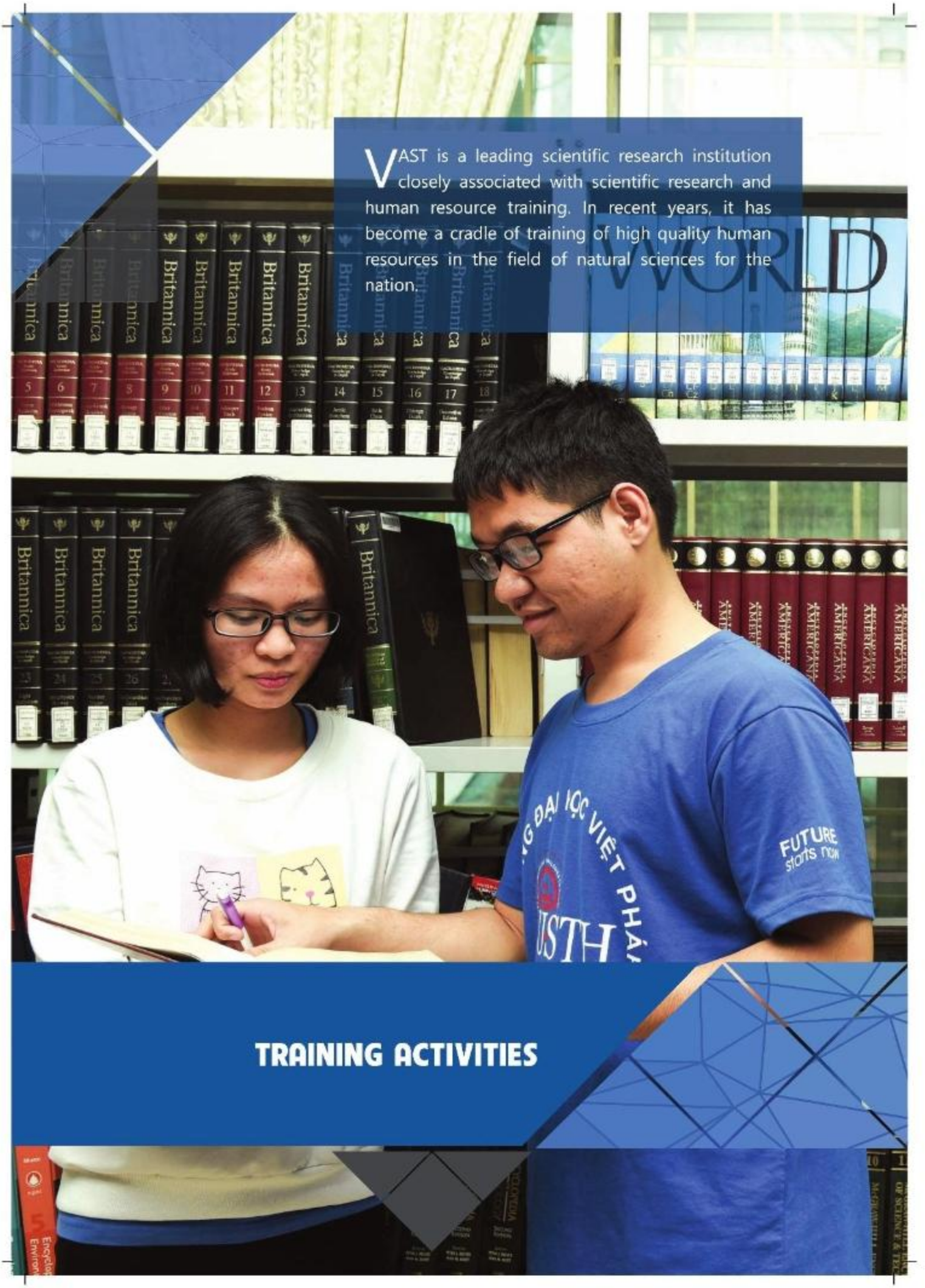
The workshop on the application of biological processes and finished products for shrimp farming and organic products in Tra Vinh in October, 2017

The signing ceremony of the cooperation between VAST and Startup Vietnam Foundation, non-profit fund and Seminar on S&T market held at VAST in September, 2017

Research and Applied Technology transferred technology for manufacturing NANO EXTRA XFGC Complex, which is used in prevention and supports cancer treatment "for Gold Health Vietnam Pharmaceutical Joint Stock Company; (3) Institute of Oceanography transferred the results of "Research on application of LEDs for offshore fishing combined with light for offshore exploitation" for Central Coastal Enterprises and Fishermen and Rang Dong Company. (4) Central Institute for Scientific Research transferred results of "Research on the Dispersal of Quinoa for Quang Nam and Quang Tri provinces" (5) Institute of Marine Chemistry, Information Technology, Natural Products Chemistry, Geology and Vietnam Museum of Natural Natureorganized the transfer of 02technological lines and 02 technological processes, 01 software, 01 database on quality of 11 medicinal plants, database on the new value of the rock plateau and collection of specimens for the units of Ha Giang province to put into application; (6) Institute of Tropical Biology transferred 02 technologies for cosmetic production; (7) Research Center for Development and Technology Transfer has transferred the equipment for An Thinh Construction Investment Company Limited;(8) Institute of Geography transferred "Technical measures to maintain and improve soil fertility, contributing to productivity and quality of lychee fruit in Bac Giang province"(9) The Institute of Natural Products Chemistry has successfully transferred the product of bone and joint to the production. (10) The Institute of Biotechnology has transferred 05 technologies in the field of biotechnology.

The Prime Minister visits the exhibition area of VAST's products and technologies at the Exhibition of Intelligent Technology Hanoi (December, 2017)

Delegates visit VAST's technology at Products Introduction of VAST in Lao Cai province (December, 2017)



VAST is a leading scientific research institution closely associated with scientific research and human resource training. In recent years, it has become a cradle of training of high quality human resources in the field of natural sciences for the nation.

TRAINING ACTIVITIES

GRADUATE UNIVERSITY OF SCIENCE AND TECHNOLOGY (GUST)

Dr. Nguyen Tien Dat

Vice Director, Graduate University of Science and Technology

Established on September 22th, 2014, GUST is a public educational institution with the function of postgraduate training in the fileds of VAST's research institutes. GUST is the focal point for efficiently utilizing the resources of specialized research institutes such as staff members, infrastructure, laboratories for postgraduate training.

GUST has been approved by the Ministry of Education and Training to open new course code numbers for Ph.D. and MSc. programs. It is going to issue licenses for Ph.D. programs by the Ministry of Education and Training in the following fields: Energy Engineering, Natural Resources and Environmental Management, Remote Sensing Mapping and Geographic Information Systems; Licensing 04 MSc. code numbers for GUST. As of November 30th, 2017, GUST has been licensed by the Ministry of Education and Training 53 PhD code numbers and 18 MSc. code numbers.

Developing a list of Faculty members; Establishing and restructuring 12 faculties and faculty staffs with total 746 faculty staffs (including 55 professors, 190 associate professors, 501 PhDs, doctor of science).

At present, GUST has had approximately 40 full-time staff of 05 functional Departments together with nearly 750 part-time lecturers.

GUST has implemented a project so as to well-equipped facilities for post-graduate training with a total budget of 10 billionVND

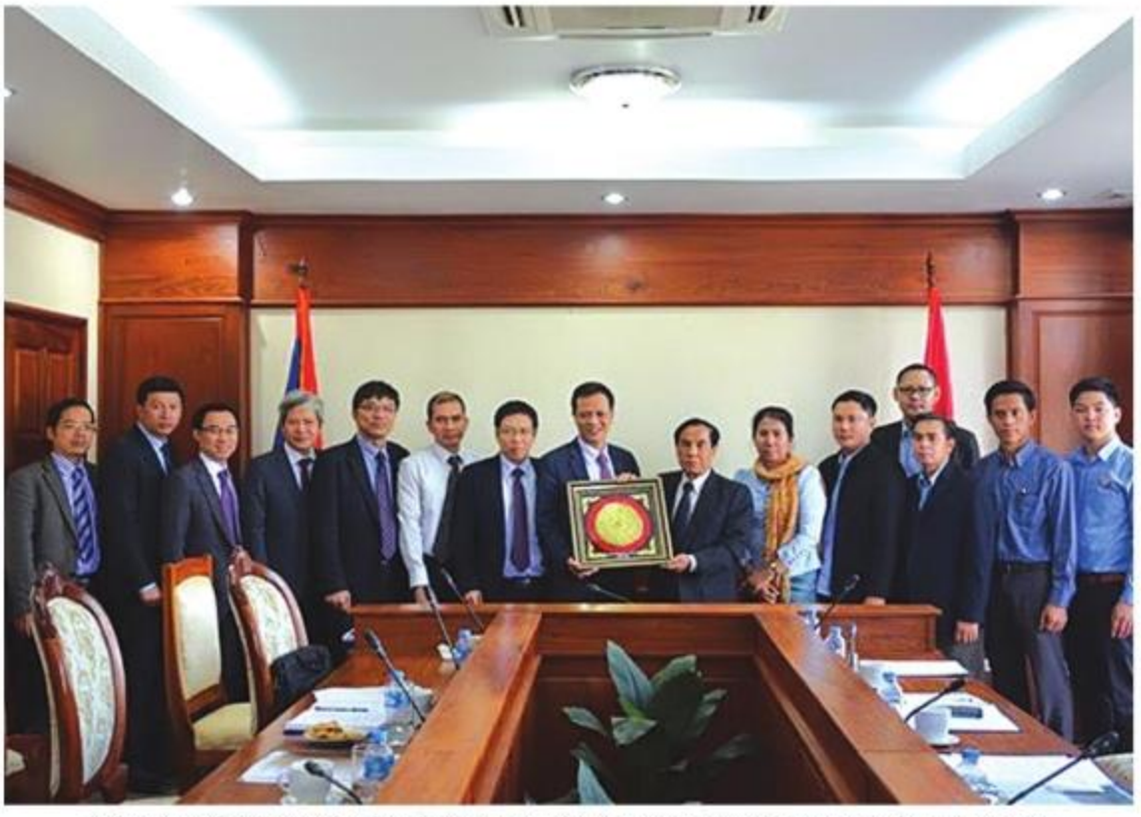
The enrollment in 2017-2018, there are more than 160 applicants for Ph.D. programs and more than 170 applicants for MSc. programs; Having completed the selection of Ph.D. students and two-time MSc. degree examinations at the faculties in accordance with the regulations and issued the decision to recognize 158 Ph.D candidates and 167 master's candidates. As of October 31st, 2017,

GUST trained 823 Ph.D students and 167 MSc. students.

GUST organized the dissertation of Ph.D. degrees and issued the Degree of Accreditation for 91 Ph.Ds.

In 2017, GUST successfully implemented the Modernization of Geo-science Training Program. This project was funded around 800,000 EUR by the European Fund, of which 81,000 EUR will be awarded for the implementation of the project. This year, GUST has submitted an application for an educational project among Austria-Italy-Ukraine-Vietnam to form the capacity of higher education institutions to meet the requirements of business environment and labor market based on global values (950,000 EUR funded by Erasmus Fund).

Signing Ceremony of MOU between GUST and McMaster University, Canada



Delegations of VAST visited and worked in Lao People's Democratic Republic to promote human resources training (February 25-27, 2017)

UNIVERSITY OF SCIENCE AND TECHNOLOGY OF HANOI (USTH)

Prof. Patrick Boiron

Rector, University of Science and Technology of Hanoi

University of Science and Technology – USTH (also known as Vietnam France University) offers training courses at three levels: Bachelor, Master and Ph.D. with about 650 students including 489 Bachelor students, 135 Master students, 16 Ph.D. candidates. USTH has been training 08 programmes, namely Information and Communication Technology; pharmacology, Medical and Agronomical Biotechnology; Space and Applications; Advanced Materials Science and Nanotechnology; Medical Science and Technology; Food Science and Technology.

From the academic year 2018-2019, with the approval of the University Council, 06 new programmes are launched, including 05 Bachelor programmes: Applied Mathematics, Cyber Securities, Chemistry, Engineering Physics and Electronics, Aeronautical Engineering and 01 Master program in Air Transport Operations Management, which increased the total number of Bachelor programs up to 13

The Bachelor program in Aeronautical Engineering and the Master program in International Air Transport Operations Management are designed based on the comprehensive cooperation with Vietnam Aviation Corporation (Vietnam Airlines), Vietnam Airlines Engineering Company (VAECO), Airbus Corporation, the French Civil Aviation University (ENAC) and Institut aéronautique et spatial (IAS). Accordingly, Vietnam Airlines commits to recruit 30 USTH Bachelor graduates per year for the period from 2018 to 2023 and Airbus commits to donate 2, 5million USD for building the program.

Especially, also from the academic year 2018-2019, USTH launches a one-year intensive English program to help students whose natural science

The Signing Ceremony Cooperation agreement of aeronautical training programs between USTH and Vietnam Airlines/ VAECO (December 15th, 2018)

knowledge meets the admission requirements of USTH but English still needs improving before entering the main courses.

In 2017, USTH obtained a number of achievements in different fields.

In terms of admission and training, the number of enrolled Bachelor students increased by 25% and the percentage of students doing interships abroad also rose by 38.5% compared with the previous year.

All Master and Bachelor training programs of USTH were officially accredited by The High Council for Evaluation of Research and Higher Education (HCERES)in June 2016 and in April 2017 respectively for the period of five years.

In terms of scientific research, USTH witnessed an increase of joint international laboratories to 09 and organized 10 international workshops. The number of publications on reputational science journals also increased with 36 ISI-indexed publications, 06 international publications and 10 national publications. The university was proud to be listed among 10 universities and research institutes in Vietnam for the highest number of high quality scientific articles ranked by Nature Index along with VAST. Many research projects at the Ministry and VAST level are currently conducting at USTH.

In the academic year 2018-2019, USTH will work with HCERES to evaluate the scientific research activities.

USTH students study and do research in the multi-culture environment with well-equipped and modern facilities

In terms of international cooperation, USTH

welcomed 200 foreign lecturers and researchers; signed 30 MOUs and cooperative agreements with domestic and international partners; welcomed 35 international groups and sent 31 groups abroad for working purposes.

Besides, thanks to the support from VAST, the infrastructure of USTH was upgraded. USTH alsorestructured its divisions and issued internal expenditure regulations to facilitate upcoming activities.

USTH students study and do research in the multi-culture environment with well-equipped and modern facilities

The Opening Ceremony of the academic year 2017-2018

Prof.Dr.Sc. Nguyen Dinh Cong, Vice President of VAST and Mr. Andrew Tein, Vice President of Global External Relations, Wiley-Federal Republic of Germany have a mutual exchange for Prospects for Publishing Journal of Chemistry in the Wiley System. (May, 2017)

Project launching workshop between VAST and International Institute for Applied Systems Analysis (IIASA) "Application of GAINS model in the management of the air in Vietnam" (December, 2017)

Prof.Acad. Chau Van Minh signed "the Cooperation Program in the field of aerospace between VAST and ROSCOSMOS Corporation in 2017-2022" in the presence of the President of the Socialist Republic of Vietnam Tran Dai Quang and the President of Russian Federation Vladimir Vladimirovich Putin.

Assoc. Dr. Nhan Van Kiem, Vice President of VAST receives a delegation from Australian Academy of Science, led by Prof. Cheryl Praeger, General Secretary in charge of foreign affairs

INTERNATIONAL COOPERATION ACTIVITIES

Assoc.Prof.Dr. NINH KHAC BAN

General Director, Department of International Cooperation

In 2017 VAST continued enhancing international cooperation, exchanging high-level delegations, implementing and developing joint research projects with traditional partners as well as extending collaboration with new partners. VAST organized 11 international directorate trips; signed 08 new and renewed General cooperation Agreements; organized 41 international conferences, meetings and workshops with the attendance of more than 1000 foreign delegates; implemented 84 bilateral projects with 14 partners, in which 09 projects have been carried out with 04 new organizations (Polish Academy of Sciences, Slovak Academy of Sciences, Siberian Branch of Russian Academy of Sciences and Eurasian Association for promotion of science); and evaluated 17 bilateral projects. At least 01 international article has been released from each project, bilateral projects contributed significantly to the total number of international publications in VAST as well as providing young scientists the gateway to new trends in S&T, laboratory skill improvements as well as international working experience.

Recently, VAST has negotiated, discussed and cooperated with many international partners including: JAXA, NASA, French Republic, Russian Federation to accomplish the missions in "Strategy for Research and Application of Space Technology to 2020" assigned by the Vietnamese Prime Minister and signed the "Program on cooperation in the field of space

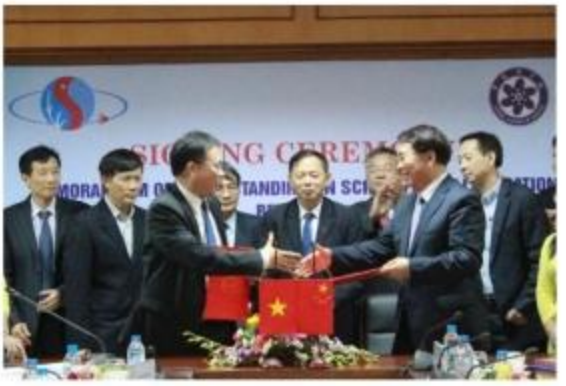
activities in the period of 2017-2022" with the State Space Corporation ROSCOSMOS, Russian Federation under the witness of the President of Socialist Republic of Vietnam and the Prime Minister of Russian Federation. Vietnam's first Earth-observation satellite VNREDSat-1, in cooperation with French partners, was successfully launched into orbit in 2013 and has been maintained well for over 04 years, providing more than 60,000 satellite photos of Vietnam and the world in order to monitor natural disasters and environmental resources in Vietnam. Being the biggest Vietnamese ODA project in S&T, the Project "Vietnam National Space Centre" has been constructed main buildings at Hoa Lac Hi-Tech Park in 2017, executed 04 basic satellite training courses in Japan and successfully organized The 10th GEOSS Asia-Pacific Symposium in Vietnam participating by more than 250 international researchers. In particular, the first Vietnamese observatory in Nha Trang within the project has become one of ten outstanding scientific and technological events in 2017. Besides, the Vietnamese Governmental ODA project namely "Strengthening the Capacity of scientific research and technological development for Laos Academy of Science", has been implemented in VAST in 2017. VAST has established successfully 02 laboratories in Earth and Life Sciences and equipped more than 60 modern experimental facilities in Laos Academy of Science and trained 05 masters, 10 doctors and 10 researchers for utilising these laboratories.

Global integration and multilateral cooperation have been strengthened in VAST with numerous international scientific organizations through diversified activities such as joint research at the Joint Institute for Nuclear Research (DUBNA); coordinating and attending international conferences, meetings and workshops with the Association of French-speaking Universities (AUF), the Asia Pacific Center for Theoretical Physics (APCTP) and The Association of Academies and Societies of Sciences in Asia (AASSA). In particular, being nominated as the National representative at the International Institute for Applied Systems Analysis (IIASA), an international organization has conducted research into the critical issues in 21st century global environmental, economic, technological and social change. VAST has contributed actively to the IIASA network in Vietnam; received and transmitted information about IIASA programs; appointed young researchers to IIASA summer programs and co-funded joint research projects: "Scientific support to pollution management in the Hanoi region". The project was launched at the end of 2017 via the international workshop: "Application of GAINS model in air environment management in Vietnam" with the appearance of IIASA professionals and VAST's researchers, fostering the investigation and application of advanced approaches for the sustainable development goals in Vietnam.

In conjunction with research, training of high quality human resources in S&T is one of the priorities in VAST. In 2017, more than 200 foreign lecturers /researchers were involved in research and training at the University of Science and Technology of Hanoi, contributing significantly to the internationalization of education and training in VAST. Additionally, the MOU between VAST and Osaka University, Japan regarding the Joint campus office signed in 2017 is a linkage for young scientists approaching the advanced education and training, enhancing quality and efficiency of postgraduate education towards the goal of developing a new generation of qualified young scientists in VAST.

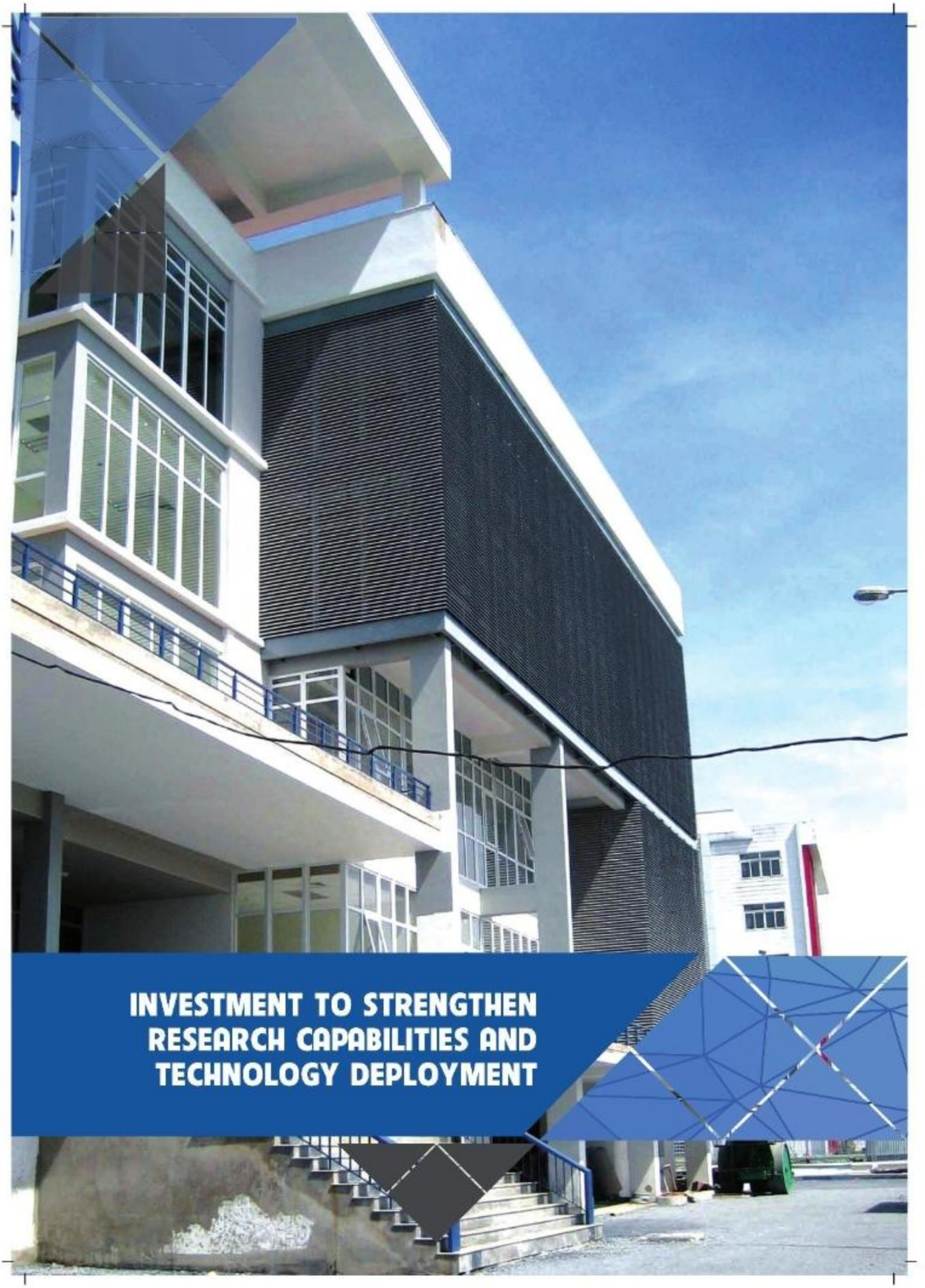
Prof.Acad. Chau Van Minh, President of VAST and Prof.Acad. BoviengkhamVongdara, Lao Ministry of S&T cut the ribbon and transfer the laboratory to Lao National Academy of Science (December, 2017)

Prof.Dr.Sc. Nguyen Dinh Cong, Vice President of VAST and Prof.Dr. Kawahara, Vice President of Osaka University, Japan cut the ribbon on opening ceremony for the Joint Campus Office at VAST



Prof.Acad. Chau Van Minh, the President of VAST and Prof. Acad. ChunliBai, the President of Chinese Academy of Sciences signed MOU between two Academies (April, 2017)

The 10th Global Earth Observation System (GEOSS) Asia-Pacific Symposium held at VAST (September, 2017)



INVESTMENT TO STRENGTHEN RESEARCH CAPABILITIES AND TECHNOLOGY DEPLOYMENT

MSc. TRAN VAN NGOC

Vice Director of Department of Planning and Finance

In 2017, VAST implemented 20 projects and 02 ODA projects (Vietnam Space Center and Hanoi University of Science and Technology projects), of which: 06 projects were completed; 16 projects were transited and completed in 2017; no new projects. Allocated budget: 419,069 billion VND from State budget (including 152,129 billion VND for ODA-counter capital) and 241,618 billion VND of foreign capital (ODA), excluding budget for University of Science and Technology of Hanoi.

All projects are being implemented in accordance with the approved plan. Of which, 03 projects have been completed and transferred: Institute of Space Technology and Marine Biochemistry; the Incubator of VAST; Institute of Applied Material Science. Projects of genetic analysis equipment and DNA assessment of missing and unknown martyrs their equipment is basically provided and ready for operation.

Plan for major repairs and minor construction work in 2017 of VAST: prioritizing budget for transitional projects/tasks from 2015 and 2016: 17,068 billion VND, including 13,068 billion VND for 06 completed projects, 5.0 billion VND for 01 transitional project; New projects: 2.0 billion VND for 01 project.

Building of the Incubator

Front of the Main building and Pilot Laboratory

Centre for informatics and computing

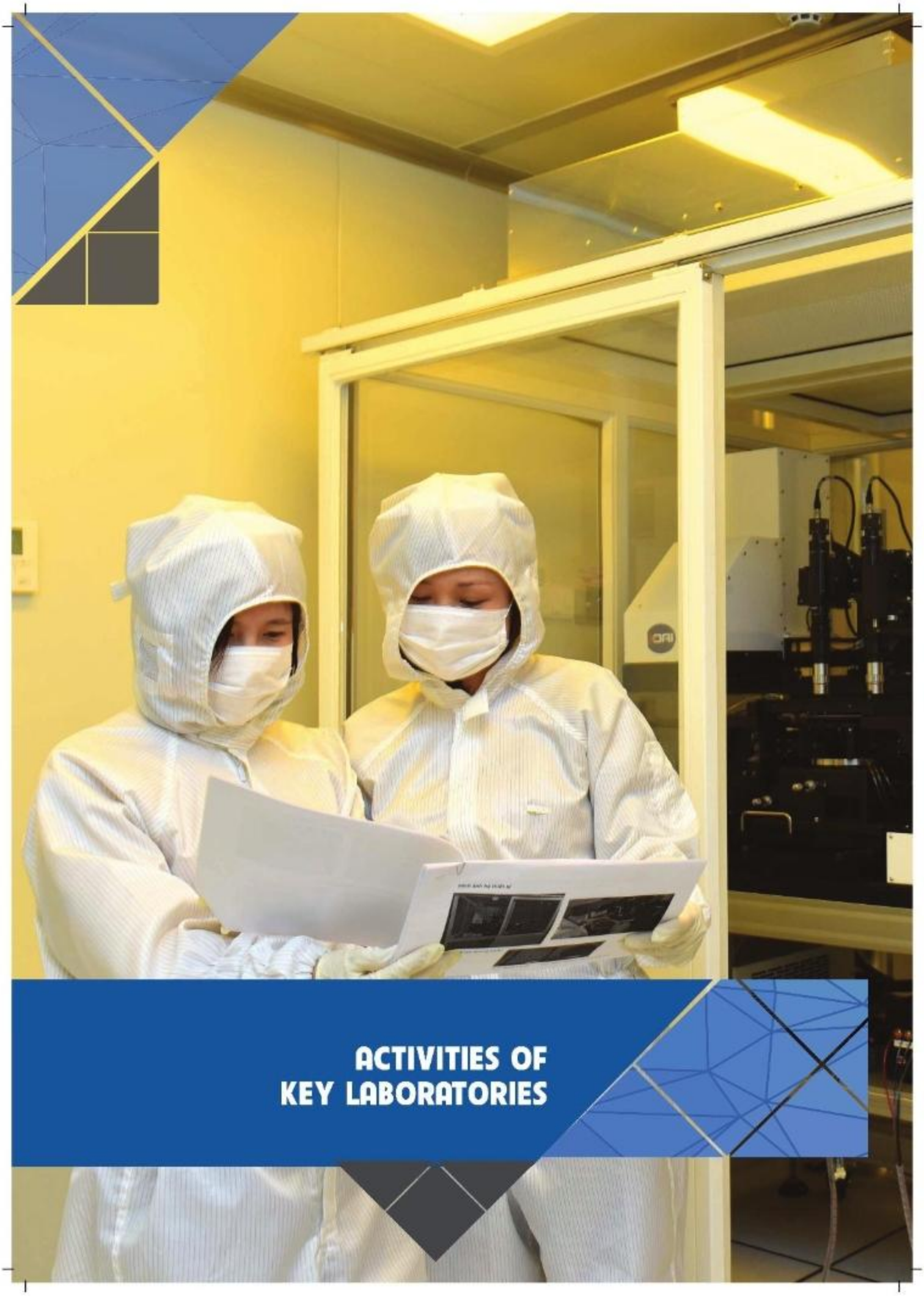
Institute of Southern ecology

Renovation and additional storeys of institute of Environmental Technology

Repair and renovation of A18, Institute of Chemistry

Renovation of A27 Building

Vietnam Spoce Center in Hoa Lac



ACTIVITIES OF KEY LABORATORIES

Dr. Nguyen Thi Trung
Department of Planning and Finance

In 2017, VAST was granted 6,237 million VND to organize the operation of four key laboratories (FKL). FKL have carried out the projects under its function and general activities.

FKL conducts hundreds of S&T key projects at State and VAST levels. FKL is also the place for internships of various students from many universities in North Vietnam. In general, FKL have been fully utilised so as to serve well the S&T projects.

SOME HIGHLIGHT RESULTS:

The key laboratory of network technology and multimedia

It has signed 25 economic contracts with a total expense of over 06 billion VND. There have been 10 national articles and 30 international articles published and 90 Ph.D. students training.

The key laboratory of materials and electronic components

It has published 18 articles in ISI journal as well as 17 national and international articles. In 2017, 03 patents were issued and more new patents and commercialized products will be issued in the coming years. It has been in collaboration with numerous training institutions in order to train students and MSc. & Ph.D. students.

The key laboratory of plant cell technology in Southern of Vietnam

It has published: 01 monograph book, 08 national articles and 21 international articles. In 2017, 02 staff members of the laboratory were evaluated Ph.D. and 03 are Ph.D. students.

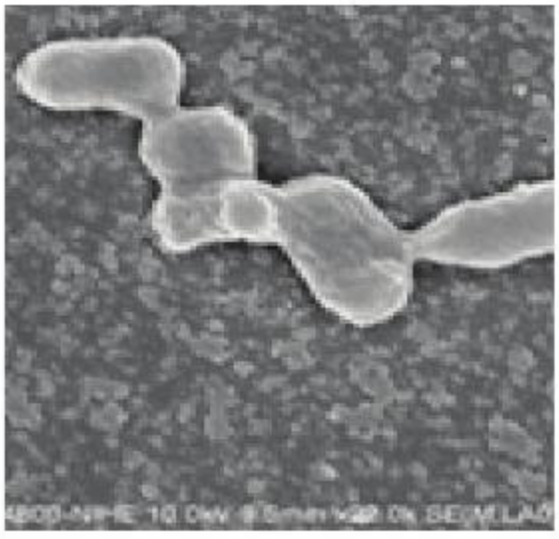
The key laboratory of gene technology

It has published 21 international articles and

46 national articles. It has been in collaboration with several training institutions so as to train 27 Ph.D. students, 8 MSc. students and 35 students. A typical S&T product is known as bacteria TM7 strain isolated and identified as Bacillus sp. This bacterium has the ability to dissolve chitin, gelatin, secrect IAA and kills nematode causing disease on coffee plants.

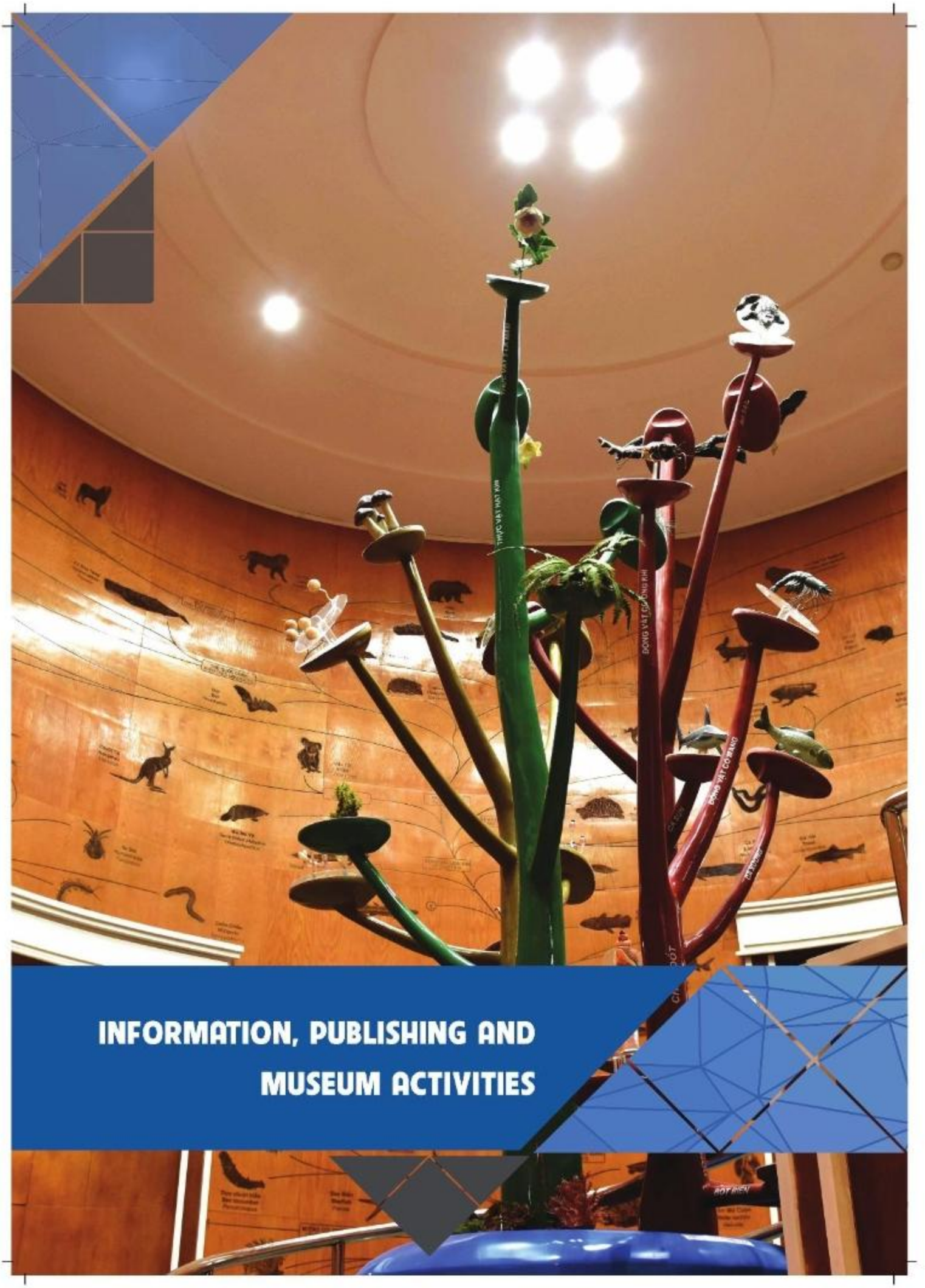
The ability to dissolve chitin of TM7 strain

TM7 strain colonies



The microscopic structure of the TM7 strain

Gram-stain of the TM7 strain



INFORMATION, PUBLISHING AND MUSEUM ACTIVITIES

ACTIVITES IN SCIENTIFIC INFORMATION

Assoc.Prof.Dr. Nguyen Hong Quang

Director, Institute for Scientific Information

Home page of the electronic website of VAST

ACTIVITES IN SCIENTIFIC INFORMATION

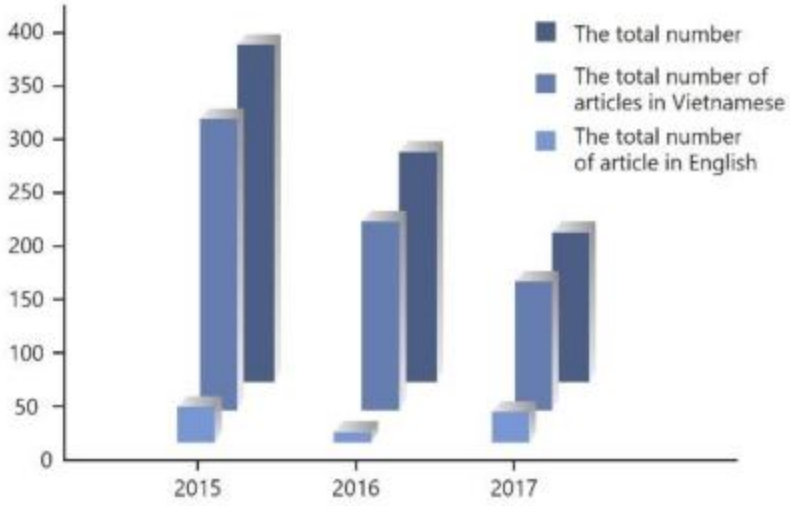
In order to raise social awareness about the role of S&T, to shed light on scientific and technological achievements and to publish the results of applied research, the VAST actively implemented scientific and technological information activities through many different channels.

The electronic website, (http://www.vast.ac.vn), regularly updates comprehensive activities and is the main information channel of VAST. By the end of 2017, the total number of unique visits to the website reached 27.6 million for its Vietnamese version and nearly 2.8 million for its English version.

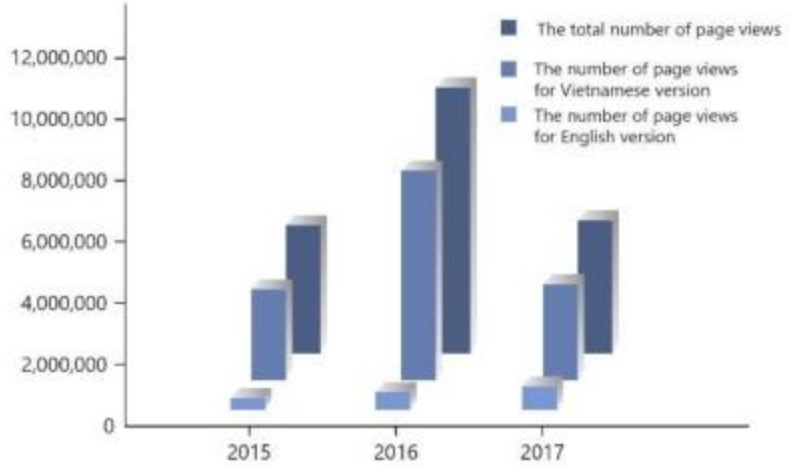
In addition, a monthly S&T Newsletter has been maintained in order to provide information of VAST's outstanding S&T research activities and to update multifaceted S&T information all over the country and globally.

This year, VAST has actively organized many activities, seminars on S&T information and communications, such as:

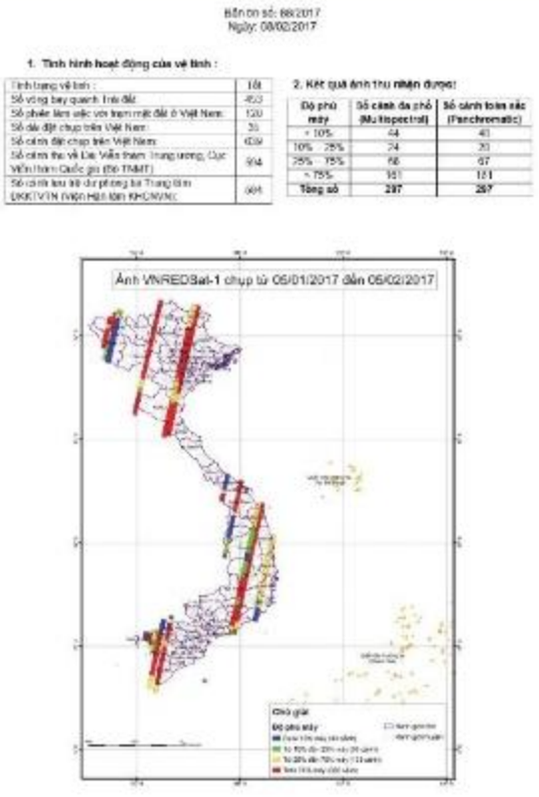
- In June 2017, the annual workshop on "S&T Information Activities" in Da Nang with more than 50 participants from different units under VAST, various institutions under the Ministry of S&T and universities.



The number of articles on the electronic Website of VAST



The number of page views of VAST's electronic website



Bản tin số: 88/2017
Ngày: 08/02/2017

1. Tình hình hoạt động của vệ tinh :

Tình trạng vệ tinh :	tốt
Số vòng bay quanh Trái đất	453
Số phiên làm việc với trạm mặt đất ở Việt Nam:	120
Số dải đặt chụp trên Việt Nam:	28
Số cảnh đặt chụp trên Việt Nam:	639
Số cảnh thu về Đài Viễn thám Trung ương, Cục Viễn thám Quốc gia (Bộ TN&MT)	914
Số cảnh lưu trữ dự phòng tại Trung tâm UNKTVTN (Viện Hàn lâm KH&CNVN)	661

2. Kết quả ảnh thu nhận được:

Độ phủ mây	Số cảnh đa phổ (Multispectral)	Số cảnh toàn sắc (Panchromatic)
< 10%	44	40
10% - 25%	24	20
25% - 75%	68	67
> 75%	161	181
Tổng số	297	267

VNREDSat-1 Newsletter

- Organization of the 5th Vietnam-Korea Seminar on S&T with the Korea Institute of Science and Technology Information (KISTI) and the Institue of Information Technology (IoIT)

- In collaboration with the Publishing House for S&T so as to organize a workshop and a book exhibition on Vietnam Book Day on April 21st, 2017.

- Signing MOU and LOI with MISOTECH Company, Korea in a joint project "Developing Intelligence Technology System for S&T information."

On Vietnam S&T Day, May 18th, 2017 VAST opened the laboratories of its various departments to welcome various students and officials.

In addition, collating information and publishing S&T research results of activites of VAST via public media have been actively implemented; In 2017, VAST and People's Daily signed a Joint Program

Bản tin Khoa học Công nghệ

Số 34
Tháng 12 2017

TRUNG TÂM THÔNG TIN - TƯ LIỆU, VIỆN HÀN LÂM KHOA HỌC VÀ CÔNG NGHỆ VIỆT NAM

KỶ NIỆM 30 NĂM HOẠT ĐỘNG VIỆN VẬT LÝ ĐỊA CẦU VÀ ĐÓN NHẬN BẰNG KHEN CỦA THỦ TƯỚNG CHÍNH PHỦ

Các giải Nobel về khoa học năm 2017

Trong số này

Kỷ niệm 15 năm hoạt động của Viện CNHT >> Trang 3

Trang tiêm Thông tin – Tư liệu kỷ niệm 35 năm ngày thành lập >> Trang 5

Hiệu quả chống ăn mòn của lớp phủ epoxy chứa nano oxit sắt từ biến tính với các ức chế ăn mòn hữu cơ để bảo vệ chống ăn mòn cho thép các bon >> Trang 7

TS Hà Phương Thư được vinh danh tại Giải thưởng Phụ nữ Việt Nam 2017 >> Trang 8

PGS.TS Đặng Thị Cẩm Hà: Phụ nữ nghiên cứu khoa học cần s xy ênh và biết kiến tạo những giá trị >> Trang 9

Tin vắn >> Trang 10

Một số đề tài nghiệm thu >> Trang 11

Công bố mới >> Trang 12

The online-S&T Newsletter

on Propagation in 2017-2020, aiming to: timely inform of scientific research activities, results of S&T applications, photographs of scientists, the opinions of scientists about policy & mechanisms as well as treatment for scientists in Vietnam in general and in VAST in particular.

The Signing Ceremony between VAST and People's Dailyon the Joint Program of propaganda in 2017 - 2020 (July 10th, 2017)

INTELLECTUAL PROPERTY ACTIVITIES

In 2017, VAST stimulated dissemination of intellectual property information and intellectual property registration procedures. Department of Intellectual Property Information has also supported 07 GPHI application forms accepted in a short time.

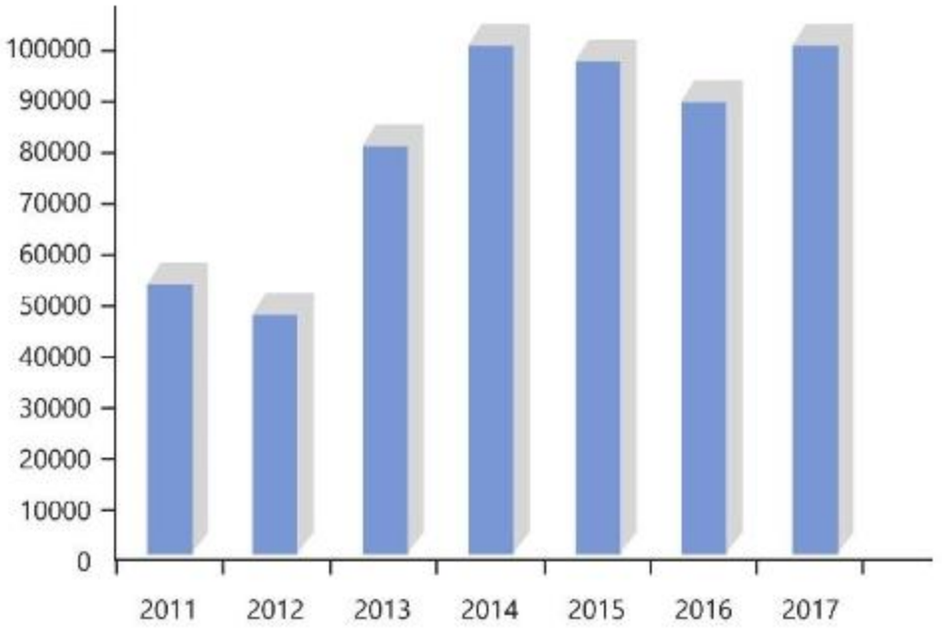
ELECTRONIC LIBRARY ACTIVITIES

Library activities:

- Maintaining continuous operation of electronic

library; Professional service and readers supporting in effective use of e-Library. As of November 2017, 110.610 full text articles were downloaded for scientific research. In particular, some of the frequently loaded databases are: ScienceDirect: 98.592 items, Springerlink: 7,930 items, ACS: 2,686 items, APS: 726 items.

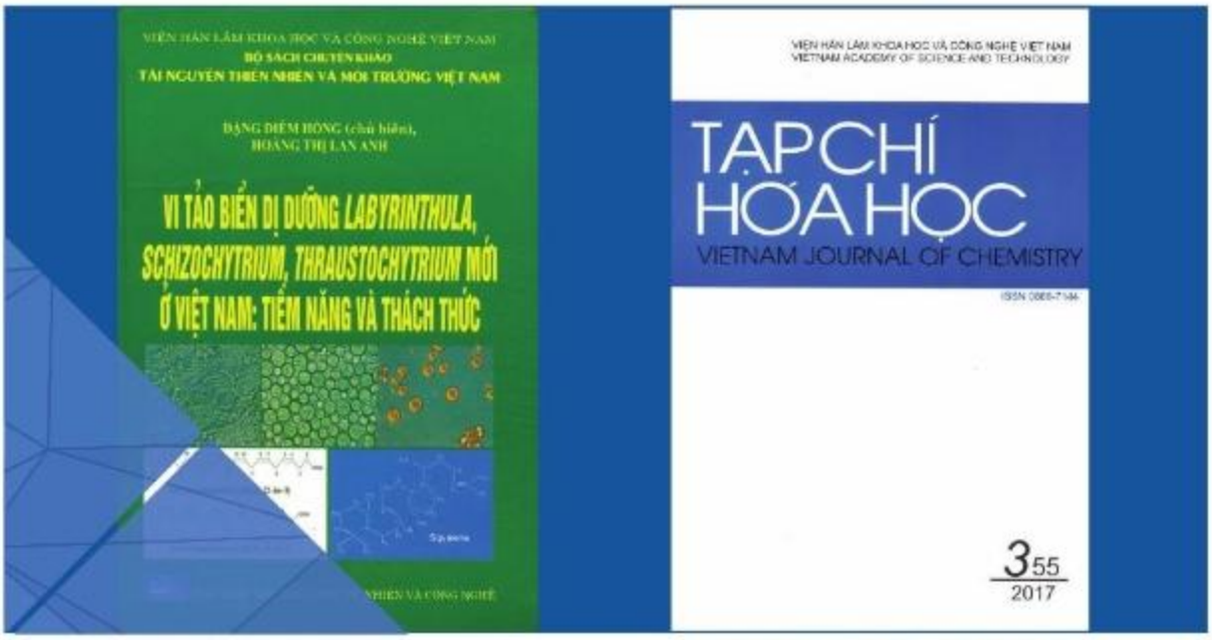
- Institute for Scientific Information (ISI) has cooperated with University of Science and Technology, Hanoi (USTH) in re-organizing the Library so as to serve better the staff members in VAST and the students at USTH.



The Chart of the number of articles downloaded from Elsevier's ScienceDirect database

Statistics of full-text articles downloaded

Year	ScienceDi-rect	Springer-Link	ACS	APS	AIP	IOP	Total
2011	53018	7680	2406	204	10	5038	68356
2012	46575	7749	6184	809	103	523	61943
2013	79096	9068	6381	1878	156	898	97477
2014	99093	9249	4997	1390	534	734	115997
2015	96213	6759	4413	1547	364	824	110120
2016	87891	7564	3086	2029	801	666	102037
2017	98592	7930	2686	726	287	389	110610



SCIENTIFIC PUBLISHING ACTIVITIES OF VAST

MSc. Tran Van Sac

Director, Publishing House for Science and Technology

The Publishing House for Science and Technology (PTS) is the state administrative unit under the VAST. Its assignment is to produce publications such as: scientific and technological journals, monographic books, reference books, postgraduate and higher education textbooks, etc. This is an important annual activity of S&T of VAST, with its various highly qualified scientists who have been leaders of many key projects at state level. Annually, thousands of high level science articles are published in national journals of S&T and prestigious international journals. 12 scientific journals were published by VAST and are well developed and 03 out of 12 journals have already published in international journals.

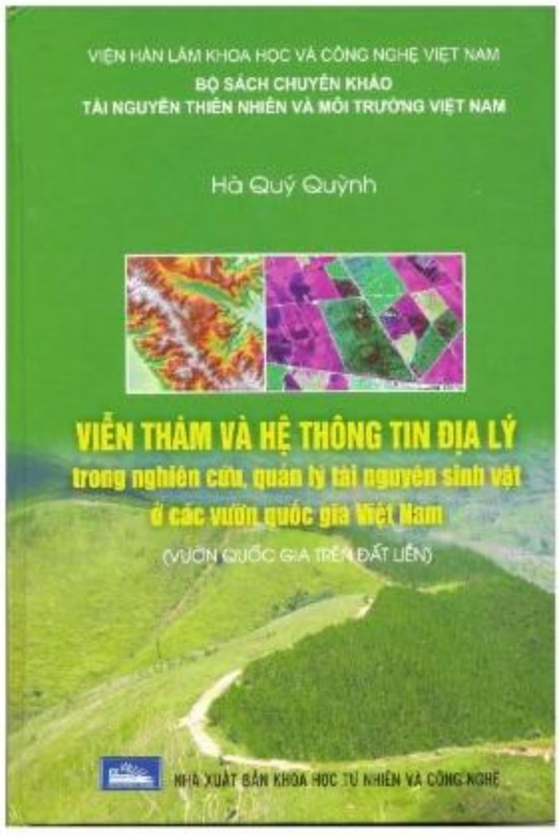
In 10 years, thousands of high quality books have been published. A large number of books have won Vietnam Book Awards over the years.

Journal cover of Mathematics

1. Publishing S&T journals.

Recently, VAST published 12 journals specializing in S&T with widely-read national journals, recognized and licensed by the government. Several journals have been upgraded from Vietnamese into English such as Vietnam Journal of Mathematics, Vietnam Journal of Mechanics, communications in Physics and Journal of Advances in Natural Sciences: NanoSciences and Nanotechnology (ANSN), Journal of Acta Mathematica Vietnamica, Journal of Computer Science and Cybernetics. Particularly, the Vietnam Journals of Mathematics and Acta Mathematica Vietnamica have been published by Springer and internationally issued and came up SCOPUS standard in 2013. The Journal of ANSN has been published byIOP Publishingand came up SCOPUS standard in 2011. Other journals have been upgraded the quality ofcontent and form, quantity and frequency of publication toward the regional and international standards. Moreover, the transition to English publication has contributed to meet the demand of publishing works, scientific study results nationally and abroad. 03 international standard journals (ANSN; Vietnam Journal of Mathematics; Acta Mathematica Vietnamica), frequently receive hundreds of articles from all over the world. The number of accesses and downloads have been increased considerably. Vietnam Journal of Mathematics and Acta Mathematica Vietnamica were recognized into the Emerging Sources Citation Index – one of the Web of Science.

The editorial board of journals is well organized with the contribution of many national and international leading scientists. In 2016, all journals strengthened their editorial board. Currently, more than 300 national scientists and over 100 foreign scientists have taken part in the Editorial board of journals. These participations are of a high enough standard for the journals to gradually reach the international journal.



Monograph cover

Articles published in the journals have to meet the requirements of scientific integrity, accuracy and the imposed copyrights following the current regulations of the State and the regulations of the editorial boards. Normally, an article must undergo strict assessment, evaluation, editing and review to ensure its scientific quality and other requirements of the editorial boards before being published.

2. Publishing scientific works in the form of books

In addition to publishing periodical scientific journals, VAST also has a large annual budget for publishing scientific works in the form of books.

A Monographic Book Volume has been published and is divided into 04 fields:

- Monographs within the field of technology and technological development

- Monographs within the field of natural resources and environment of Vietnam

- Monographs within the field of sea and marine technology

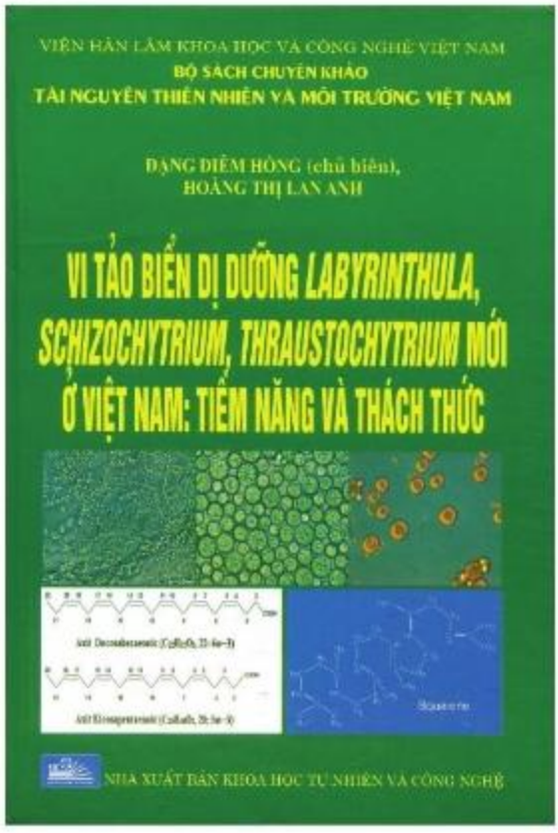
- Textbooks forgraduate and postgraduate training.

The editorial boards were set up following their fields.

The monographs are selected and published to contain relevant results of specific field of S&T by the author or the co-authors after many years of research. In general, the monographs aim to provide and elaborate overview and a contribution to scientific theory as well as highly appreciated by scientists and managers. The form of the monographs is presented consistently, printed with high quality and solemnity. After publication, the PST has released to the required addresses, according to the plan. Annually, about 07-10 book sets are published and in 2017 alone, 08 monograph book sets were published, contributed to the growth of the total of monographic books to 100 books.

PST has published a book set about the Vietnamese Sea – Islands, which are the predominant fields of VAST. By the end of 2017, 50 books of the book set about Vietnamese Sea – Islands were published. According to scientists and other readers, this book set has high scientific value as well as is very useful in popularizing and improving people's knowledge about the marine sector, contributing to National Sea Strategies up to 2020.

In 2017, PST registered the plan of 60 publishing times for 120 books, issued the publishing decisions for publications in accordance with its principles and objectives permitted by the State. There were no mistakes in publications published in 2017.



A monograph within the field of natural resources and environment of Vietnam

MUSEUM ACTIVITIES

Assoc.Prof.Dr. Nguyen Trung Minh

General Director, Vietnam National Museum of Nature

The natural history museum of VAST is not only a place for displaying and preserving thousands of ancient artifacts, but also for education and research of Vietnam's nature. In 2017, the name Vietnam National Museum of Nature (VNMN), Museum of Oceanography and Museum of Biology have become familiar with the community and also welcomed thousands of visitors in the country and abroad.

Display and promotion activities

Biochemical Evolution Gallery of VNMN improved its operational activities. From December 1st, 2016 to November 30th, 2017, the Gallery welcomed more than 61,000 visitors: including 41% of primary, junior secondary, high school and university students; 37% of preschool age children and other groups accounted for 22% of total visitor numbers. The Museum also organizes and guides students from 49 schools to study in the exhibition room with the participation of experts and researchers: Moreover, various activities were implemented in order to respond to International Museum Day, Science and Technology Day on May 18th, 2017 and International Day for Biological Diversity on May 22th, 2017.

Museum of Oceanography is a centre of public education, where school children, students and visitors can learn about marine organisms and resources, marine environment protection and national sovereignity at sea. As a response to the campaign launched by the European Commission, the exhibition "Reduce marine litter" was opened in September 2017 to raise public awareness about the serious effects of waste on the oceans, especially plastic waste. It also appealed for marine environmental protection by using recycled materials and reducing waste which take long time to decompose such as plastic, glass, etc. In 2017, the museum received approximatley 431,000 visitors, of which more than 90,000 were foreigners.

During the year, Museum of Biology also welcomed

Students learn about marine waste reduction at Nha Trang Oceanographic Museum

about 24,000 domestic and foreign visitors to visit and study, including about 50% students at schools in the Central, Central Highlands and the Southern Vietnam.

The conservation models accompanying the environmental education program at the Me Linh Biodiversity Station has attracted more than 5,000 visitors to study in 2017.

VAST is building the Museum of Oceanography (under Institute of Marine Environment and Resources) in Hai Phong to serve visitors in the near future.

International cooperation

In the context of Vietnam's closer integration with the international community the museum system of VAST has paid full attention to international cooperation as the most important part of its development. Its information has been introduced rapidly on websites, news channels, national and international television.

Up to December 2017, VNMN signed 57 MOUs and Cooperation Agreements (in effect) with series of Museums of Natural History, the famous research institutes, universities and international organizations in 22 different countries around the world. In 2017, VNMN welcomed and worked with 31 groups of researchers abroad, including 106 scientific researchers.

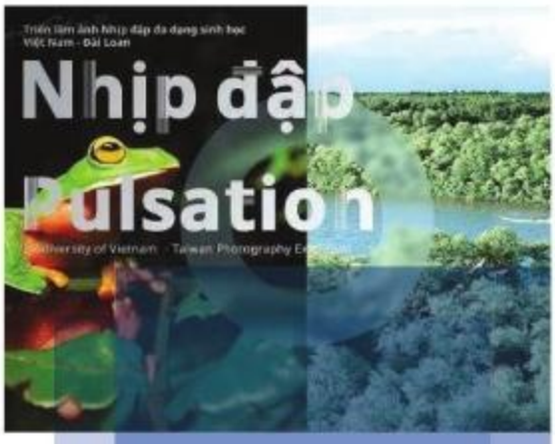
Some outstanding international cooperation activities in 2017:

VNMN is an official member of International Council of Museums (ICOM) ICOM Vietnam. In particular, Assoc. Prof. Dr. Nguyen Trung Minh, General Director of VNMN has a great honor of beingVice President of ICOM Vietnam.

VNMN has become the 54th official member of Global Genome Biodiversity Network (GGBN). Its collection of 5,000 DNA samples and 300 tissue samples of more than 50 plan and aninal species.

In April 2017, the VNMN, in collaboration with Royal Belgian Institute of Natural Sciences, held an international conference on "The results of 10 years international cooperation between VNMN and the Royal Belgian Institute of Natural Sciences". It has attracted a large number of scientists in different countries.

In December 2017, VNMN, in collaboration with Hanoi Museum and National Taiwan Museum, organized a photo exhibition on "Biological Diversity of Vietnam and Taiwan" at Hanoi Museum. It lasted for three months.



Nha Trang Museum of Oceanography implemented the second year of the project "Research on comparison of resilience of coral reefs in the South of Vietnam Sea to conserve marine biodiversity in a changing world". It also carried out the tasks of international cooperation with

The exhibition "Biological diversity of Vietnam-Taiwan" opened on December 1st, 2017

VNMN participates in the "Green Heritage Tourism Week - Where to meet people and nature" in Hanoi in 2017 (Opening ceremony on December 21st, 2017)

Institute of Far Eastern Studies Russian Academy of Sciences on "Biodiversity and biochemistry research in Vietnam Sea".

The project *"Overall Planning of Vietnam National Museum of Nature in 2014" accordant with the Prime Minister's Decision No. 86/2006 / QD-TTg dated on April 20th, 2006*

In 2017, the Museum organized the workshop on "Exchange of some projects to build the Nature Conservation VNMN", in collaboration with the Department of Natural Resources and Environment of Dien Bien province on the the project:"construction of Northwest Nature Museum"; with People's Committee of Lam Dong Province and Department of Science and Technology of Dong Nai province on the project:"building Museum of Nature at region level". Other supports are practised in professional activities.

The project on *"Building National specimens collection on Vietnam nature"*

In 2017, the project on "building Vietnam national nature specimen collections" implemented 14 component projects. With the efforts and dedication of scientists, most of the contents registered under the plan are completed. The number of specimens as registered is collected. Results of some component projects are as follows:

The Museum of Oceanography has carried out the project "Building a collection of marine species in Southern Vietnam" collected 3,750 specimens and manipulated 335 display samples, including numerous rare samples such as coral and marine plants along the coast of Hoang Sa (50 specimens), Truong Sa (150 specimens).

The project *"Building the set of animals (on land) of Central Vietnam - Central Highlands, Vietnam"* has collected and created 03 display specimens and 01 specimen of animal research; 12 display specimens and 08 specimens of birds; 02 display specimens and 08 specimens of amphibians research; 03 display specimens and 07 specimens of reptile research; 21 display specimens and 100 specimens of fish research; 180 display specimens and 300 specimens of insect research.

The project *"Building a collection of Vietnam archaeological specimens."* collected 1032 specimens of 108 types (Cambrian fauna, Ordovician, Silurian flora and fauna, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous, Paleogene) Neogen, Quaternary), including 234 display specimens, 798 research specimens; 250 specimens processing, 15 species definition & commenting, 250 specimens attenuating, 500 specimens inputting, 50 specimens analysis of silicate, microbiological analysis of 50 specimens, 50 specimens analysis of pollen spores, 50 specimens analysis of electron microscope.

The project *"Building a collection of rocks, marine minerals of Northern Vietnam (from Thua Thien Hue)"* collected 165 display & research specimens, 13 collections of (metamorphic sedimentary rocks, siliceous lime stone, siltstone, marine and coastal sediments, minerals).

The project *"Building a collection of animal specimens (on land) in the Northeast Vietnam"*, collected and processed 01 large mammal specimens, 85 small mammal species, 60 frog reptile specimens, 150 fish specimens, 1,545 insects specimens for research and display.

The project *"Building a collection of Botanyand Fungi in South Centra Coast - Southern Vietnam"* collected and processed 1845 plant specimens

and 300 large specimens of fungi for research and display.

The project " *Building a collection of minerals specimens (metal, non-metal, energy, etc.) on land, Vietnam*", collected, and processed 300 ore specimens such as: Molipdenores, Cu-Ni-Co ore containing plationid, gold mercury antimony ore, Cu ore, rare earth ore, ruby in marble, Metacarbonate, apatite ore, white limestone.

The project *"Building a collection of biological resources in South Centra Coast - Southern Vietnam"* collected and procecced 225 samples of plant resources, 25 reptile amphibian specimens, 57 fish specimens for research and display.

The project "Building a collection of rock samples, marine minerals of Northern Vietnam" collected 54 specimens of 6 types of rock sedimentary rock sand loose sediments for research and display.

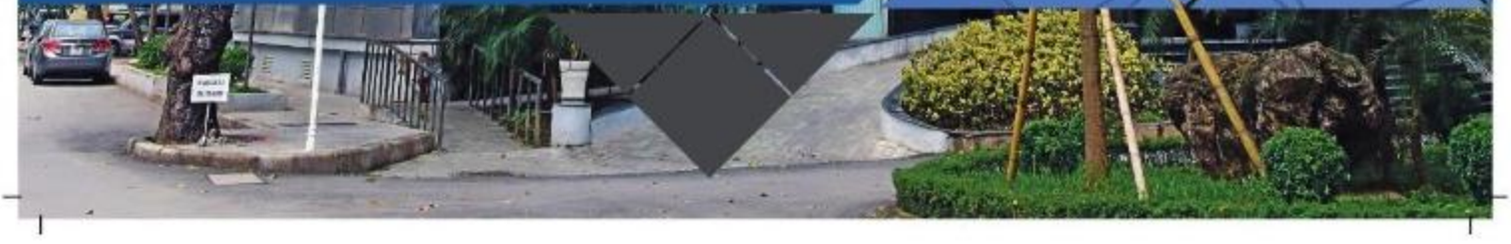
The project *"Collecting, processing and manipulating specimens"*

VNMN has also received 38 specimens from Ha Tinh Provincial Police, Thach Thanh district police, Thanh Hoa province, Hanoi Zoo, Soc Son wildlife rescue center, Hanoi, Bach Ma National Park, Nghe An Provincial Police, received 125 animal specimens, processed 20 leather specimens, 17 bone specimens, 06 leather specimens on processing for manipulation. Geologically, the Museum has received 06 columns of basalt stone in Dak Mil, DakNong (Tay Nguyen), 02 types of wood cutting-boards Hoang dan and double-leaf pinewoods in large-size in Bidoup Nui Ba National Park, Da Lat, Lam Dong, 03 specimens of tungsten ore core in Dai Tu area, Thai Nguyen province, 01 specimen of Aquamarine in Sao An, Thuong Xuan, Thanh Hoa.

Nha Trang Museum of Oceanography has also regularly maintained 30 large specimens and received 229 new specimens. It has continued to upgrade and receive 05 new specimens.

Moster plan: "Vietnam National Museum of Nature Building"

ORIENTATIONS AND PLANS FOR THE YEAR 2018



2018 is the third year of the Governmental five-year plan (2016 – 2020). Based on socio-economic development and VAST's human resources, some major orientations and Plans in 2018 are as follows:

- Closely following the development planning of VAST up to 2020 and looking towards 2030, (approved by Vietnam's Prime Minister) and an effective use of scientific human resources and a budget funded by the government for research and development of S&T in 2018.

- Fulfilling the S&T development plan in 2018 in order to accomplish a five-year plan (2016 – 2020) and meet the requirements for the period of development, exchange and deep integration in all fields.

- Increase the number of articles, focusing on the quality of international publications; Improve the quality of S&T products in different tasks; Strengthen technology incubators, S&T application in production, life and intellectual property; promote S&T information service and publication of scientific results so as to elevate the quality of VAST's journals; Develop two International Centers of Type II for Mathematics and Physics, under the auspices of UNESCO; Promote training, bringing Graduate University of Science and Technology and University of Science and Technology of Hanoi into high quality and efficient operations.

- Achieve important satellite & space research projects ; "the national collection of specimens on nature in Vietnam", Tay-Nguyen 3 project, the program of space research in 2016-2020; Actively speed up the construction of the Museum of Nature in the area of the 32 hectare site in Quoc Oai, the building of a high-tech zone in Hoa Lac; Better the effective operation of four national key laboratories and earthquake observation networks - tsunami warning system in Vietnam; Implementation of the "National Physics program and 04 new programs on life sciences, earth sciences, marine science and technology and the national chemistry up to 2020".

- Direct implementation of key tasks at VAST's level with remarkable results; strengthen research facilities supported and financed by different Ministries; Put projects into highly effective operation.

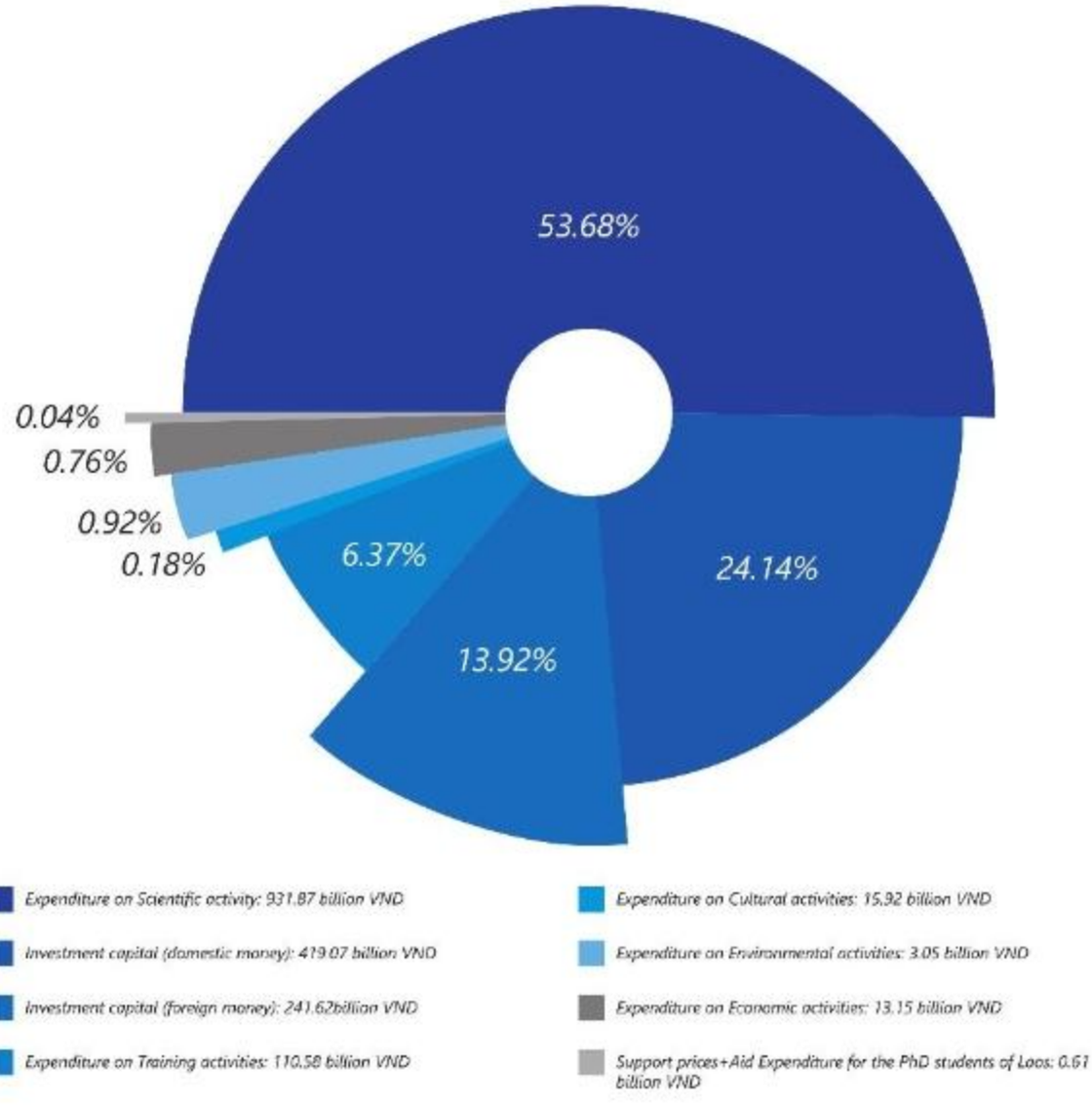
- Develop a number of major projects in order to submit to the Government of Vietnam: Vietnam - Japan Advanced Center Project in Hoa Lac; Marine Research Ship Building Project of VAST; Projects on Planning in Biotechnology Development up to 2020; Vietnam small satellite monitors natural resources, environment and natural disasters - Phase 2 - VNREDSat-2 and 2B (VNREDSat-2 and 2B).

- Attain projects of basic construction and investment carried out from 2017 and new projects in 2018; Development of materials & facilities so as to create a new face of a leading national scientific agency; Centralize building and gradually implementing the medium-term investment plan in 2017-2020.

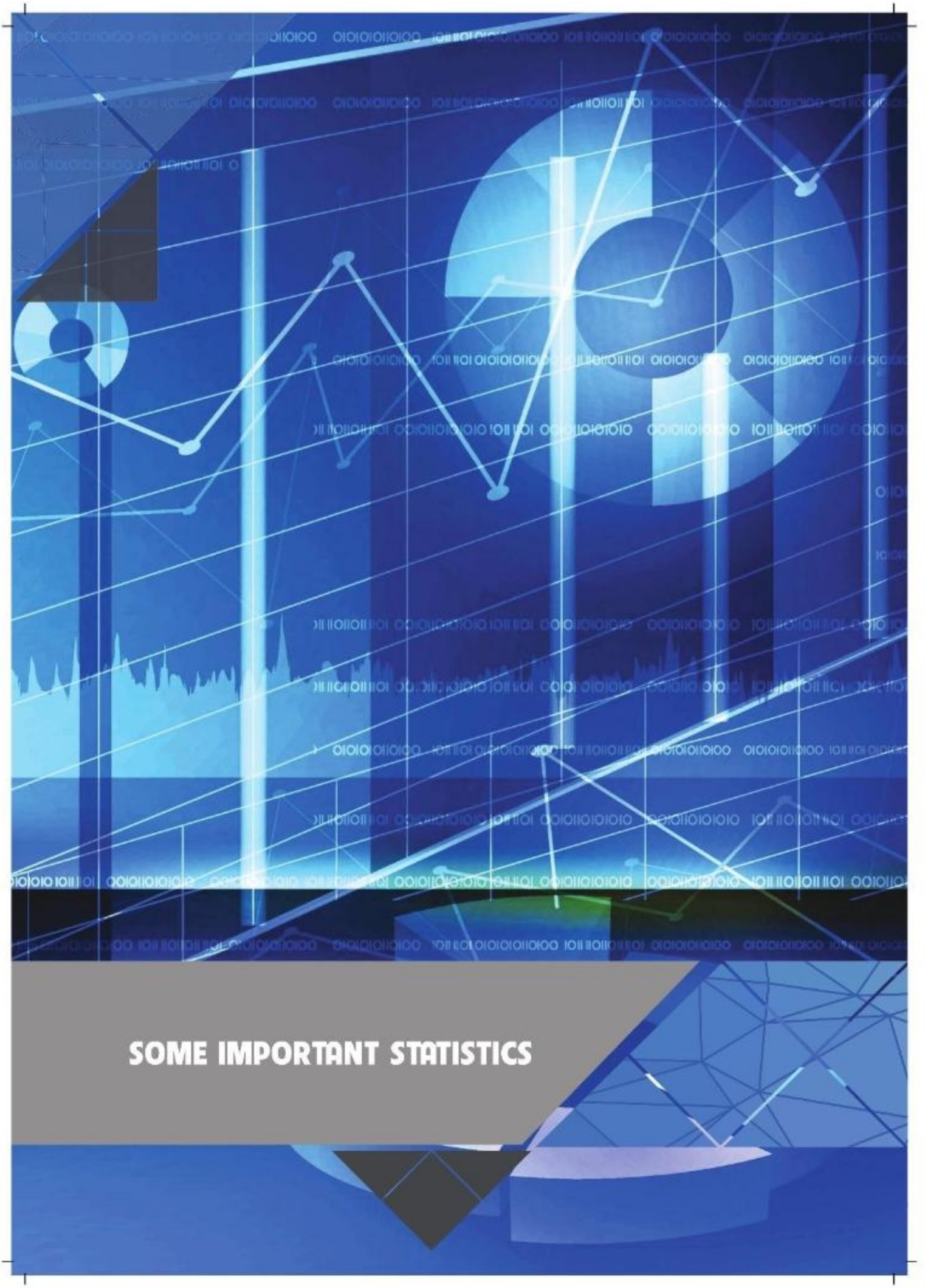
- Advance the junior researchers program as well as senior researchers support program; effective usage of VAST's incubator in order to support young staff members.

- Renew the management work, advance the inspection and supervision of the implementation of budget, the deployment of S&T projects at all levels, the projects of basic construction investment: economically and efficiently use facilities and work area in each unit in VAST; accelerate completion of settlement report in the unit.

The Prime Minister and the Ministry of Finance have decided to allocate an amount of 2,535 billion VND as the 2018 governmental budget of VAST, including 1,356.9 billion VND for development investment, 1,178.1 billion for recurrent expenditure.



Expenditure estimates for 2018 VAST's budget



SOME IMPORTANT STATISTICS

NUMBER OF BASIC RESEARCH PROJECTS OF THE VAST IN THE 2013-2017 PERIOD (*)

No.	Sponsored feld	The total number of basic research projects Sponsored annually *(as of November 30, 2017)*					Total
		2013	2014	2015	2016	2017	
1	Mathematics	2	18	5	2	10	**37**
2	Information and Computer science	2	2	0	0	1	**5**
3	Physics	15	17	16	11	16	**75**
4	Chemistry	15	14	14	12	14	**69**
5	Earth sciences	3	6	2	3	2	**16**
6	Bio-agriculture	12	11	23	12	9	**67**
7	Biomedical	5	3	2	1	2	**13**
8	Mechanics	3	2	7	2	1	**15**
	Total	**57**	**73**	**69**	**43**	**55**	**297**

**Source: NAFOSTED. Number of projects approved by year*

TABLE OF STATISTICS FOR SCIENTIFIC PUBLICATIONS, PATENTS, UTILITY SOLUTIONS FOR 2013-2017 PERIOD (*)

No.	Statistics Category	2013	2014	2015	2016	2017
A	Total number of scientific publications (1+2+3+4+5)	2.298	2.074	2.197	2.007	1.836
B	Number of publications in international journals (1+2+3+4)	660	803	802	996	888
C	Number of publications in SCI, SCI-E journals (1+2)	435	523	588	742	688
1	Number of publications in SCI journals	282	298	317	387	381
2	Number of publications in SCI-E journals	153	225	271	355	307
3	Number of publications in international journals with ISSN/ISBN codes *(2017 only count the number of articles for journals ISSN)*	225	246	176	248	178
4	Number of publications in 3 VAST1 journals (**)		34	38	6	22

5	Number of publications in national journals	1.638	1.271	1.395	1.011	948
6	Number of patents	7	3	11	11	20
7	Number of utility solutions	6	10	7	17	20

(*) Statistics taken for the period: 01/12/previous year - 30/11/following year.

(**) VAST1: 03 journals (Advances in Natural Sciences: Nanoscience and Nanotechnology, Vietnam Journal of Mathematics, Acta Mathematica Vietnamica)

STATISTICS OF SCIENTIFIC PUBLICATIONS, INTELLECTUAL PROPERTIES OF VAST IN 2017 (*)

(Sort by total number of publications in SCI and SCI- E journals)

No.	Name	Articles in International journals					Articles in local journals			Books	Patents	Utility Models
		Total	SCI	SCI-E	VAST 1 (**)	ISSN	VAST 2 (***)	Other	Total			
1	Institute of Ecology & Biological Resources	91	38	53		29	22	17	39	6	2	
2	Institute of Materials Science	74	60	14	3	13	55	18	73	1	4	
3	Institute of Mathematics	60	33	27	9	6			0			
4	Institute of Marine Biochemistry	54	25	29	1	3	39	13	52	1	4	3
5	Institute of Physics	44	37	7	3	14	7	24	31	1		
6	Vietnam National Museum of Nature	44	12	32		18	9	26	35	2		
7	Institute of Chemistry	36	16	20		1	92	12	104	3	1	2
8	Institute of Biotechnology	32	17	15		6	56	49	105	2		6
9	Institute of Tropical Biology	31	10	21	1	19	4	49	53	1		
10	Institute of Mechanics	20	8	12		9	7	15	22	2	1	
11	Institute of Environmental Technology	19	12	7		1	19	28	47	1	1	2
12	Institute of Natural Products Chemistry	17	8	9			19	19	38	1	1	2
13	Institute of Applied Materials Science	15	4	11	2	8	16	6	22	2		2
14	Institute of Oceanography	14	9	5	0	5	20	19	39	2		

No.	Name	Articles in International journals					Articles in local journals			Books	Patents	Utility Models
		Total	SCI	SCI-E	VAST 1 (**)	ISSN	VAST 2 (***)	Other	Total			
15	Southern Institute of Ecology	14	7	7		1			0			
16	Institute for Tropical Technology	13	11	2	2	1	27	10	37	3	1	2
17	Institute of Geophysics	12	8	4	0	1	6	13	19	2		
18	Institute of Geological Sciences	12	7	5	0	6	8	20	28	7		
19	Institute of Marine Environment & Resourceces	12	6	6	0	4	7	8	15	2		
20	Institute of Chemical Technology	12	2	10		7	15	11	26	2		
21	Institute of Genome Research	12	4	8		3	12		12	1		
22	Hochiminh city Institute of Resources Geography	10	7	3	0	1	4	6	10	1		
23	Institute of Marine Geology & Geophysics	9	4	5	0	4	10	6	16	2		
24	Nha Trang Institute of Technology Research & Application	9	9			1	11	12	23			1
25	Institute of Information Technology	8	4	4	1	2	4	7	11			
26	Centre for High Technology Development	8	4	4	0	2	4	11	15		1	
27	Mien Trung Institute of Scientific Research	6	3	3	0	6	8	9	17			
28	Hochiminh City Institute of Physics	6	6			1			0	1		
29	Center for Informatics and Computing	5	3	2	0	1			0			
30	Vietnam National Satellite Center	5	5	0	0	0	2	0	2			
31	Institute of Geography	5	2	3	0	2	12	24	36	3		
32	Center for Research and Technology Transfer	5	5				2		2			
33	Tay Nguyen Institute of Scientific Research	3		3		2	14	5	19	2		

No.	Name	Articles in International journals					Articles in local journals			Books	Patents	Utility Models
		Total	SCI	SCI-E	VAST 1 (**)	ISSN	VAST 2 (***)	Other	Total			
34	Space Technology Institute	3	2	1	0	2	1	1	2			
35	Institute of Applied Physics & Sci. Instruments	3	3			2		7	7			
36	Institute of Energy Science	2	1	1		6	2	14	16	2	1	
37	Institute for Scientific Information	1	1						0			
38	Institute of Applied Informatics & Mechanics	0						1	1		1	
39	Publising House for Natural Science and Technology	0					5		5			
	Trainging units											
40	Graduate University of Science and Technology	95	50	45	3	13	85		85		1	
41	University of Science and Technology of Hanoi	35	23	12	2	4	8	2	10			
	Total (****)	**688**	**381**	**307**	**22**	**178**	**502**	**446**	**948**	**53**	**20**	**20**

(*)Statistics taken for the period 01/12/2016 - 30/11/2017;

(**) VAST1: 03 journals (Advances in Natural Sciences: Nanoscience and Nanotechnology, Vietnam Journal of Mathematics, Acta Mathematica Vietnamica)

(***) VAST2: 09 remaining VAST journals: Communications in Physics, Vietnam Journal of Mechanics, Journal of Computer Science and Cybernetics, Journal of Science and Technology, Journal of Chemistry, Journal of Marine Science and Technology, Journal of Biotechnology, Vietnam Journal of Earth Sciences, Journal of Biology;

(****) The publications with coauthors belonging to different institutes is counted only once;

STATISTICS OF S&T CONTRACTS IMPLEMENTED IN 2017 (*)

Unit: million VND

No.	Name	Contract with usage of state budget			Contract without usage of state budget			Total		
		Number of contracts	Total value	Value in 2017	Number of contracts	Total value	Value in 2017	Number of contracts	Total value	Value in 2017
1	Institute of Environmental Technology	11	9.504	2.185	575	96.586	96.586	586	106.090	98.771
2	Institute of Energy Science	5	3.476	1.219	108	117.275	19.369	113	120.751	20.588
3	Institute of Chemistry	2	1.518	448	29	23.381	19.344	31	24.899	19.792
4	Institute of Materials Science	5	5.307		16	19.762	19.762	21	25.069	19.762
5	Vietnam National Museum of Nature	11	51.546	12.580	5	3.951	2.078	16	55.497	14.658
6	Institute of Natural Products Chemistry	9	20.223	7.688	25	6.523	5.993	34	26.746	13.681
7	Institute of Geological Sciences	4	5.266	1.223	30	21.865	8.173	34	27.131	9.396
8	Institute of Physics	27	42.231	7.832	8	876	876	35	43.107	8.708
9	Institute of Mechanics	13	11.198	1.375	5	5.095	3.188	18	16.293	4.563
10	Hochiminh city Institute of Resources Geography	4	4.211	1.711	5	5.459	2.796	9	9.670	4.507
11	Institute of Marine Biochemistry	3	7.664	4.235				3	7.664	4.235
12	Southern Institute of Ecology	2	463	173	13	11.236	4.036	15	11.699	4.209
13	Institute of Geography	3	5.671	2.948	7	9.088	1.255	10	14.759	4.203
14	Nha Trang Institute of Technology Research & Application	3	289	116	13	5.091	4.000	16	5.380	4.116
15	Centre for High Technology Development	5	5.986	2.697	1	2.400	1.200	6	8.386	3.897

No.	Name	Contract with usage of state budget			Contract without usage of state budget			Total		
		Number of contracts	Total value	Value in 2017	Number of contracts	Total value	Value in 2017	Number of contracts	Total value	Value in 2017
16	Institute of Information Technology	23	5.802	2.714				23	5.802	2.714
17	Space Technology Institute	4	3.948	1.645	1	3.276	1.029	5	7.224	2.674
18	Institute of Chemical Technology				12	3.226	2.408	12	3.226	2.408
19	Institute of Oceanography	5	6.389	943	5	4.441	1.410	10	10.830	2.353
20	Institute of Biotechnology	6	3.920	1.790	10	2.159	114	16	6.079	1.904
21	Institute for Tropical Technology	0			33	2.106	1.720	33	2.106	1.720
22	Institute of Genome Research	7	7.229	1.694				7	7.229	1.694
23	Institute of Tropical Biology				32	2.524	1.466	32	2.524	1.466
24	Institute of Applied Materials Science				8	2.673	1.336	8	2.673	1.336
25	Tay Nguyen Institute of Scientific Research	3	3.755	868	2	151	151	5	3.906	1.019
26	Center for Research and Technology Transfer				13	1.026	996	13	1.026	996
27	Institute of Geophysics				6	6.182	502	6	6.182	502
28	Mien Trung Institute of Scientific Research	5	2.487	423	3	86	41	8	2.573	464
29	Institute of Applied Physics & Sci. Instruments									
30	Institute of Applied Informatics & Mechanics				40	2.433		40	2.433	

No.	Name	Contract with usage of state budget			Contract without usage of state budget			Total		
		Number of contracts	Total value	Value in 2017	Number of contracts	Total value	Value in 2017	Number of contracts	Total value	Value in 2017
31	Institute of Marine Environment & Resourceces									
32	Institute for Scientific Information									
33	Graduate University of Science and Technology									
34	Publising House for Natural Science and Technology									
35	Center for Informatics and Computing									
36	Vietnam National Satellite Center									
37	Representative Office in Hochiminh City									
38	Administration Office									
39	Institute of Marine Geology & Geophysics									
40	Institute of Ecology & Biological Resources									
41	Institute of Mathematics									
42	Ho Chi Minh City Institute of Physics									
	Total	**160**	**208.083**	**56.507**	**1.005**	**358.871**	**199.829**	**1.165**	**566.954**	**256.336**

(*) Statistic data for the period 30/11/2016-30/11/2017.

THE OVERALL STAFF OF VAST IN 2017

No.	Name	Permanent Staff	Female	Title		Academic degree				
				Prof.	Assoc. Prof.	Doctor of Science	Doctor	Master	Bachelor	Other
1	Department of Organization and Personnel	11	8	0	2	0	2	1	8	0
2	Department of Planning and Finance	14	7	0	2	0	5	4	5	0
3	Department of International Cooperation	9	6	0	1	0	3	2	4	0
4	Department of Application & Development of Technology	5	3	0	1	0	3	0	2	0
5	Department of Inspection	4	1	0	0	0	0	3	1	0
6	Administration Office	39	22	0	0	0	0	7	25	7
7	People Party units	9	8	0	0	0	0	1	7	1
8	Institute of Mathematics	76	18	16	12	18	36	12	10	
9	Institute of Physics	83	24	5	10	0	47	22	13	1
10	Institute of Chemistry	117	55	2	16	0	58	36	21	2
11	Institute of Natural Products Chemistry	42	25	1	4	0	28	8	6	0
12	Institute of Mechanics	89	29	2	5	3	26	38	20	2
13	Institute of Ecology and Biological Resources	111	42	0	10	0	53	37	20	1
14	Institute of Geography	84	40	1	5	2	24	45	11	2
15	Institute of Geological Sciences	100	33	1	8	1	26	54	17	2
16	Institute of Geophysics	69	16	0	2	1	22	19	19	8
17	Institute of Oceanography	88	26	1	3	0	23	33	26	6
18	Institute of Marine Environment and Resources	43	10	1	1	0	20	16	5	2

No.	Name	Permanent Staff	Female	Title		Academic degree				
				Prof.	Assoc.Prof.	Doctor of Science	Doctor	Master	Bachelor	Other
19	Institute of Marine Geology and Geophysics	54	22	0	1	0	16	25	12	1
20	Institute of Energy Science	36	12	0	0	0	5	22	8	1
21	Institute of Materials Science	194	73	2	13	0	79	65	40	10
22	Institute of Information Technology	116	32	0	5	0	22	56	38	0
23	Institute of Biotechnology	143	96	5	10	0	80	52	10	1
24	Institute of Environmental Technology	48	17	1	5	0	22	21	5	0
25	Institute of Chemical Technology	39	12	0	0	0	18	12	8	1
26	Space Technology Institute	41	11	0	1	0	6	20	13	2
27	Institute of Mechanics and Applied Informatics	65	13	0	3	0	6	20	37	2
28	Institute of Tropical Biology	67	27	0	1	0	22	23	20	2
29	Institute of Tropical Technology	72	30	2	6	0	30	25	13	4
30	Institute of Applied Materials Science	40	14	1	3	0	18	16	4	2
31	Nha Trang Institute of Technology Research and Application	43	17	0	2	0	13	20	9	1
32	Institute of Marine Bio-Chemistry	40	22	1	1	0	23	9	7	1
33	Tay Nguyen Institute of Scientific Research	28	15	0	1	0	7	16	3	2
34	Vietnam National Space Center	34	11	0	1	0	9	21	4	0
35	Institute of Genome Research	15	9	0	3	0	15	0	0	0

No.	Name	Permanent Staff	Female	Title		Academic degree				
				Prof.	Assoc.Prof.	Doctor of Science	Doctor	Master	Bachelor	Other
36	Institute of Applied Physics and Scientific Instruments	15	5	0	0	0	2	7	6	0
37	Mien Trung Institute for Scientific Research	19	11	0	1	0	4	14	1	0
38	Hochiminh city Institute of Physics	36	13	0	0	0	8	17	11	0
39	Hochiminh city Institute of Resources Geography	36	15	0	1	0	10	14	10	2
40	Southern Institute of Ecology	11	3	0	0	0	5	5	2	0
41	Institute for Scientific Information	28	18	0	1	0	1	7	18	2
42	Vietnam National Museum of Nature	33	13	0	5	0	16	9	8	0
43	Publishing House for Natural Science and Technology	24	18	0	0	0	3	11	10	0
44	Center for High Technology Development	32	12	0	0	0	7	10	15	0
45	Center for Informatics and Computing	16	6	1	1	0	3	5	8	0
46	Graduate University of Science andTechnology	17	11	2	1	1	6	4	6	0
47	Center for Research and Technology Transfer	15	3	0	2	0	6	5	4	0
	TOTAL	**2.350**	**934**	**45**	**150**	**26**	**838**	**869**	**550**	**68**

Note: Data reported by institutes of VAST as of 30/9/ 2017