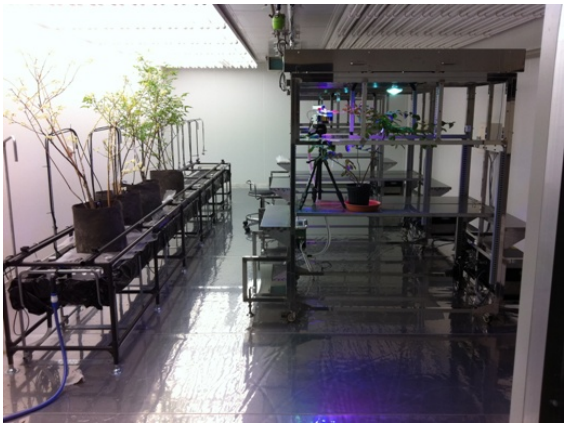
1. Advances in Industry-Government-Academia Collaboration Activities at Tokyo University of Agriculture and Technology

Tokyo University of Agriculture and Technology (TUAT) distinctively focuses on research in the fields of agriculture and engineering that constitute the core of industry today and harmonization of agriculture and engineering, which is not found among other universities. Despite being a mid-sized university, TUAT is ranked as top-class domestically for its research strength and ability to communicate research results. Based on powerful research strength and centered around practical science, TUAT's industry-government-academia collaboration activities are highly respected among small and medium-sized businesses. In 2005, TUAT was ranked second nationally in a survey by businesses for universities that are easiest to work with in collaborative research (survey conducted by the Ministry of Economy, Trade and Industry). This and other achievements serve as proof that TUAT has the ability to compete with much larger universities.

This university considers its industry-government-academia collaboration activities as the "engines" of education and research. By taking actions such as the placement of University Research Administrators (URAs) primarily in the University Research Administration Center, TUAT proactively promotes industry-government-academia collaboration activities in a systematic manner through comprehensive cooperation with businesses, matching businesses with projects for collaborative research, and other means. The establishment of the TUAT Strategic Headquarters in 2008 has further strengthened the industry-academia collaboration system, allowing the president to demonstrate a high level of leadership.

With the end of two Ministry of Education, Culture, Sports, Science and Technology research support system improvement projects, the university is committed to expanding research involving industry-government-academia collaboration in an effort to improve the system for training and securing URAs. In order to promote efforts to improve research strength, suggestions for large-sized research projects which identify seed technology through quantitative analysis are provided to the TUAC Strategic Headquarters, specialized agencies and other institutions are utilized, effort is placed into the expansion of research involving industry-government-academia collaboration, and industry-government-academia collaboration activities are strategically implemented.

TUAT will support research projects for excellent young faculty members in order to continue producing achievements over the mid to long term as a university. In addition, the Advanced Plant Research Facility, which was established through subsidies from the Ministry of Economy, Trade and Industry, has gained attention both in Japan and internationally as a developer of technologies used in agro-industry collaboration. From administration to research, TUAT is placing great effort in industry-government-academia collaboration activities.



Establishment of a strategic decision-making method (based on needs analysis, quantitative index analysis, and other types of analysis)

University Research Administration Center

- Planning of university-wide research projects (including proposals for research agendas and systems)
- Selection of next-generation researcher candidates that must be supported

Planning and Proposals →

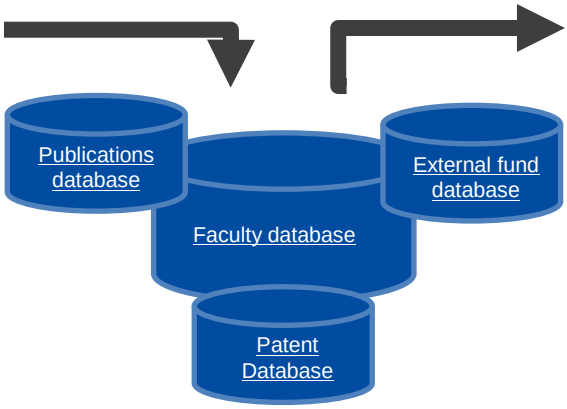
← Decisions and Approvals

TUAT Strategic Headquarters

(Headquarters Director: President)

Researcher information can be found searching by:

- Researcher Name
- Affiliation (research section, subject)
- Age
- Position
- Other search items



Displays

- Publications information
- External funds acquisition information
- Industry-academia collaboration information
- Patent and other types of intellectual property information
- Researcher's scientific society status

Creation of a database that centralizes information such as publication information (qualitative and quantitative) and external fund information in order to display quantitative indexes.

2. Development of Human Resources in Science and Technology by TUAT

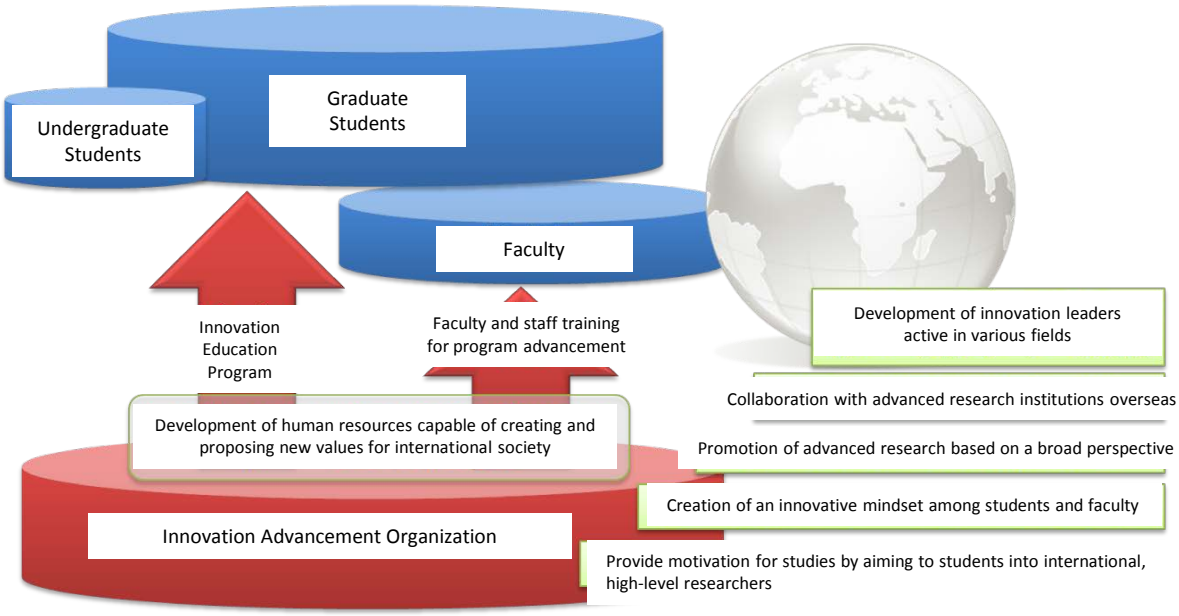
❖Innovation Advancement Organization

In addition to improving Japan's underlying scientific and technological strength, it is important to develop human resources that can create and propose new values that correspond to society's needs and are capable of creating real innovation by utilizing technology and ideas in order for Japan to show initiative in international society from here onward.

Through various industry-academia collaboration activities, this university has given attention early on to the importance of training such human resources responsible for future innovation. Therefore, the Innovation Advancement Organization was established in April 2010 directly under the TUAT Strategic Headquarters, which is directed by the president, for the advancement of training of future innovators on a university-wide level.

The Innovation Education Program run by the organization implements practical education that allows participants to experience methods and processes that lead to innovation first hand through group-based workshops. The program also conducts seminars for providing and making participants aware of the required theory and knowledge, and provides internships at companies and research institutions in Japan and overseas. Through this systematic approach, the program aims to develop human resources responsible for creating Japanese-style innovation in the future through team leadership by having participants learn about the importance of creating innovation at the organization level rather than at the individual level, methods for team creation, and methods and processes for executing projects at the organization level.

Furthermore, we are involved with providing our educational faculty with the skills they require in order to improve educational effectiveness university wide for the development of future innovators. This includes training at institutions overseas, seminars, workshops, and other activities designed to increase awareness among faculty, and faculty skill development. These efforts are designed to lead to a shared mindset for innovation between students and faculty. The entire university is taking steps toward the development of human resources that can create and propose new values for society by remaining aware of the methods and processes for innovation learned through the education program during daily research and other activities, and by providing an environment where students are able to put such methods and processes into practice.



❖ Ministry of Education, Culture, Sports, Science and Technology human resources development project efforts

	Theme Name	Project Periods	Description	Budget for 2013
1	Acceleration of female researcher development system reforms "Career Acceleration Program for Female Scientists"	2009-2013 (5 years)	Designed to accelerate the capabilities of women to become outstanding researchers in the fields of engineering and agricultural science.	69,230,000 yen
2	Strategic Program for Fostering Environmental Leaders "Education Program for Field-Oriented Leaders in Environmental Sectors in Asia and Africa= FOLENS"	2009-2013 (5 years)	Training of human resources (environmental leaders) capable of providing leadership aimed at solving environmental problems in developing countries.	70,577,000 yen
3	Project for the Development of Leaders in Practical Research "Modeling Program for the Development of High-level Researchers with Practical Skills Capable of Responding to Evolving Needs"	2010-2014 (5 years)	Training of leaders capable of maximizing team strength which is indispensable for the creation of innovation in regional industries and project style research and development.	22,904,000 yen
4	Tenure Track Expansion and Entrenchment Program	2011-2017	Designed for tenure track expansion and entrenchment by supporting research funds for tenure track faculty, etc.	374,800,000 yen
5	Supporting Activities for Female Researchers (location type) "Formation of a Network Providing Career Support to Female Scientists"	2013-2015 (3 years)	To provide support for female researchers by forming a network of female researchers to spread the female researchers support base and know-how related to the support of female researchers by this university to other universities, businesses, and other institutions.	15,000,000 yen (est.)

3. Recent Status on Research Potential

❖Growth of Research Publication Quantity and Quality

As Japan's international competitiveness in the area of research papers becomes a topic of focus, TUAT was ranked number one among national universities for the highest growth rate for number of papers, and ranked number three among national universities for its growth rate for number of adjusted Top10% papers. This means that our university offers very high research potential. A primary factor behind this is the establishment of an appropriate and effective research environment through our president's leadership and the efforts of staff since TUAT was transformed into a national university corporation 10 years ago.

Comparison of National Universities

Quantity

Growth of published papers during two periods ten years apart

The chart lists national universities which published 2,000 papers or more during the five year period from 1997 to 2001.

Rank	Name of University	Number of Papers		Growth Rate
		1997-2001	2007-2011	
1	TUAT	2,272	3,357	47.8%
2	Ehime University	2,342	3,247	39.7%
3	Kobe University	4,533	6,123	35.1%
4	Tokyo Medical and Dental University	3,357	4,254	26.7%
5	Kyoto University	21,600	27,295	26.4%

Quality

Growth for number of adjusted Top10% papers during two periods ten years apart [Change in quantity]

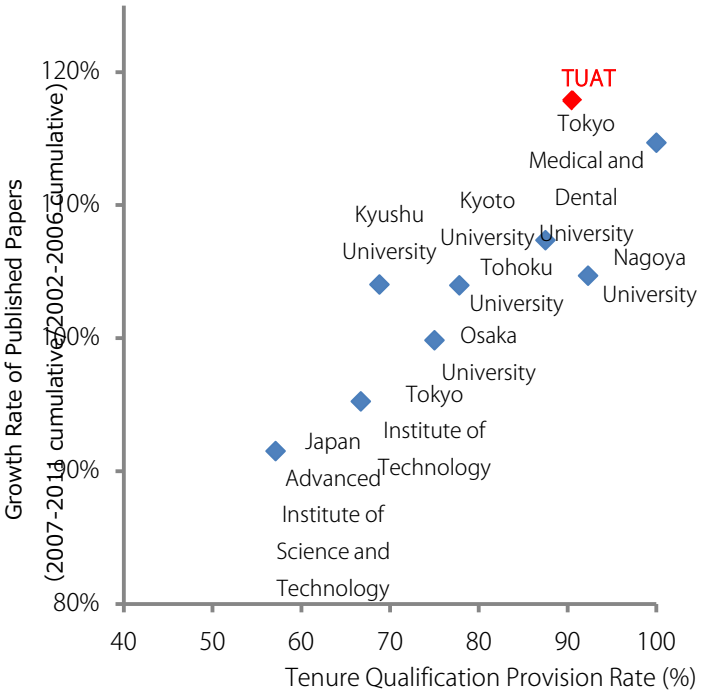
The chart lists national universities which adjusted 50 Top 10% papers or more during the five year period from 1997-2001

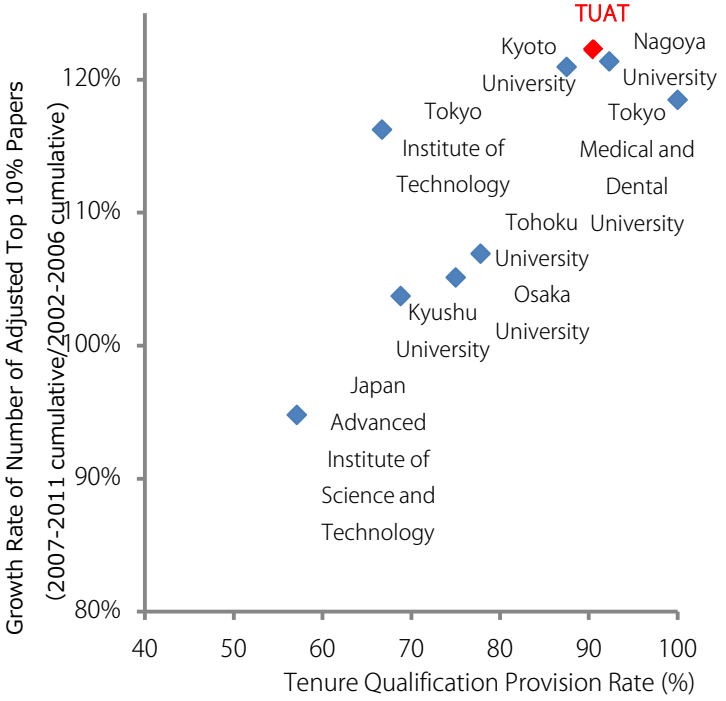
Rank	Name of University	Number of Papers		Growth Rate
		1997-2001	2007-2011	
1	The Graduate University for Advanced Studies	94.1	299.4	218.2%
2	Okayama University	380.9	681.9	79.0%
3	TUAT	142.4	253.1	77.7%
4	University of Tsukuba	630.2	1,027.4	63.0%
5	Ehime University	173.3	275.8	59.1%

❖Creating opportunities for young researchers to flourish

TUAT was the first university to introduce the tenure-track system in 2006. Related to the recruitment of faculty, the introduction of this system has expanded opportunities for young researchers to flourish. Strong support is provided for training through means including the recruitment of mentors by management of the entire university with the Organization for Promotion of Tenure-Track System (Akira Murata, Organization Director) front and center.

In regards to the Tenure-Track Program of the Ministry of Education, Culture, Sports, Science and Technology which was finished by nine universities in 2010, looking at the correlation between the Tenure Qualification Provision Rate (the rate comparing the number of eligible persons who pass the tenure screening after the tenure-track period with the number of eligible persons) and the Growth Rate of Published Papers, and the Tenure Qualification Provision Rate and the Growth Rate of Number of Adjusted Top 10% Papers, we notice a broad proportional relationship. The reason why the Tenure Qualification Provision Rate is high is because many outstanding research results were produced during the tenure-track period by the subject young researcher candidates. In order to create these conditions, it is essential to take measures such as establishing a research environment which easily produces outstanding research results under the leadership of the president and other administrators, accepting young researchers as senior faculty, and creating a supportive climate. Here is one example that shows the special characteristics of TUAT, a university that demonstrates a high propensity for improvement.



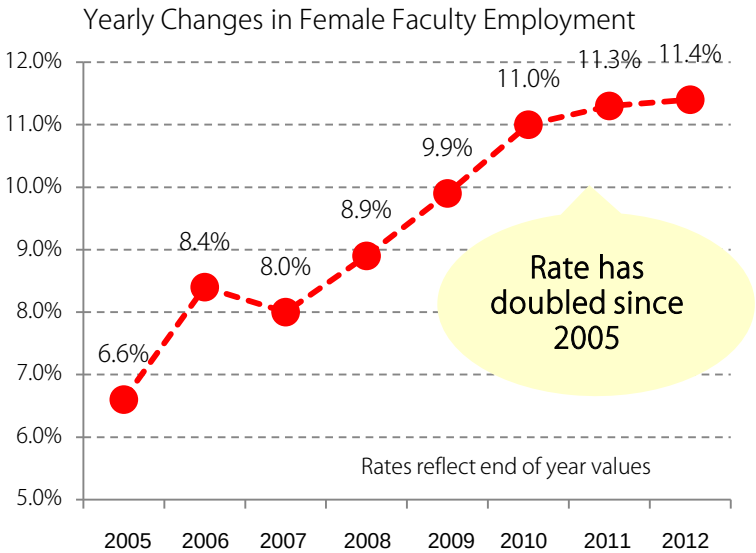


Note: Charts created from "Benchmarking Research & Development Capacity of Japanese Universities 2011" (NISTEP, 8/2012), and the evaluation report for themes selected for 2006 in the "Initiative for the Promotion of Young Scientists' Independent Research" program funded by Special Coordination Funds for Promoting Science and Technology commissioned by the MEXT.

❖Encouragement of Female Faculty

Under the gender equality promotion policy, this university places effort in establishing an environment designed to take into account both life events (such as childbirth and child rearing) and research in order to enable female faculty to display their abilities to the maximum extent. The Women's Future Development Organization (Chisato Miyaura, Organization Director) provides primary support. As a result of this effort, the number of female faculty grew to 11.4% by the end of 2012 and continues to grow.

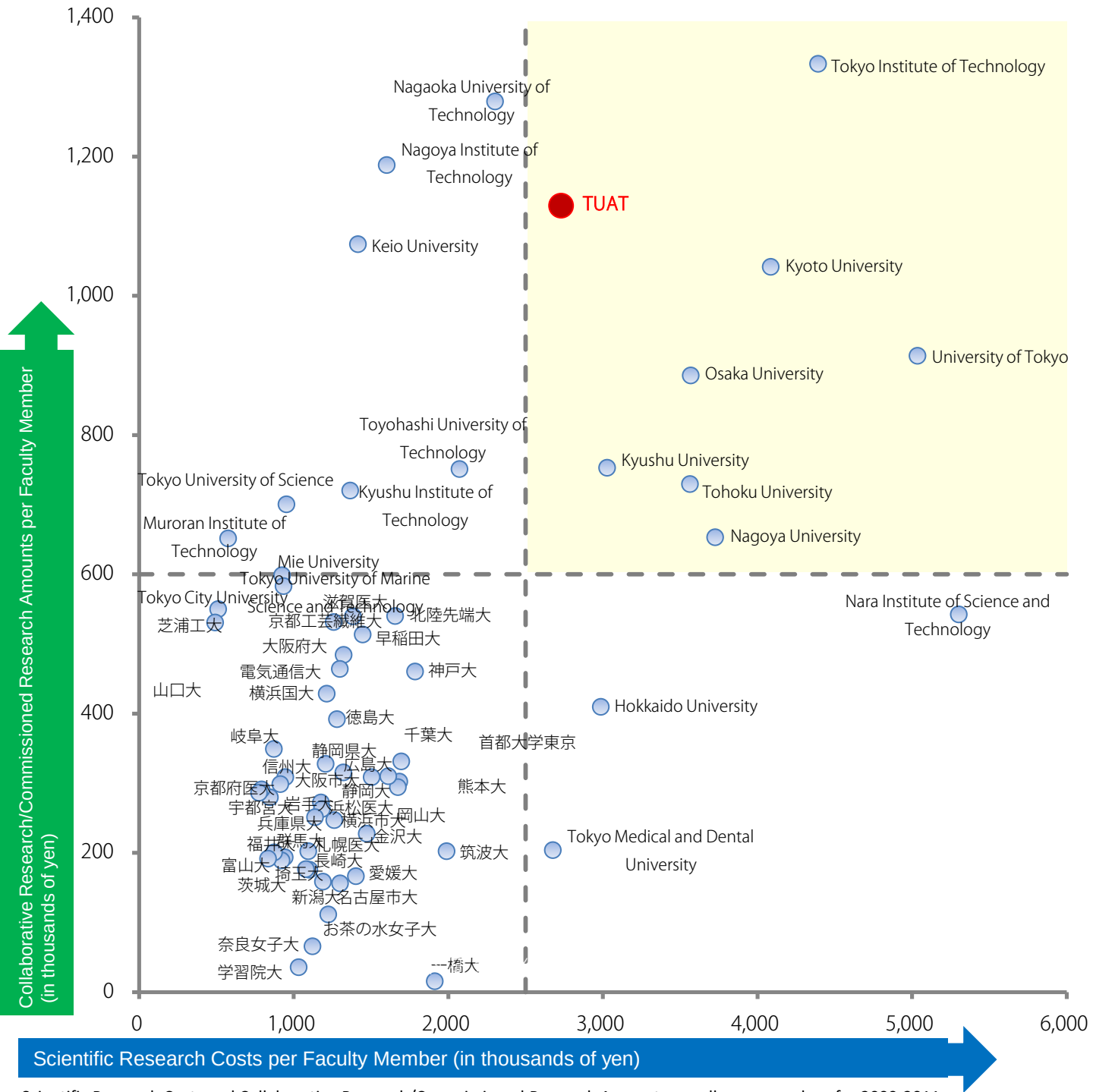
September 2013: This university was selected to participate in a "Supporting Activities for Female Researchers (location type)" project supported by the 2013 MEXT Fund for the Development of Human Resources in Science and Technology. The project will further promote the support of TUAT's female faculty and also allow for the expansion of efforts through collaboration with outside institutions, such as other universities and businesses.



❖Demonstration of High Performance by Researchers

A university's research strength is provided by how much each researcher puts into their performance. Also, in order for a university to continue to be highly valued for its research that has an impact on society, it must achieve a cycle that connects the creation of new seeds through academic research with the innovation for those seeds created (support of society through industry-academia collaboration). Constant reciprocal verification is always considered to be important.

The graph below shows the scientific research cost per researcher and collaborative research contribution amount provided by private businesses. When looking at both research activities aimed at seed creation (scientific research cost per faculty member) and research activities aimed at innovation (collaborative research contribution amount for each faculty member), you will see that TUAT is one out of the eight top performing universities located in the upper right quadrant of the graph.



Scientific Research Costs and Collaborative Research/Commissioned Research Amounts are all average values for 2009-2011.
The graph displays universities with Scientific Research Costs per Faculty Member and Collaborative Research/Commissioned Research Amounts which total one million yen or more when added together.

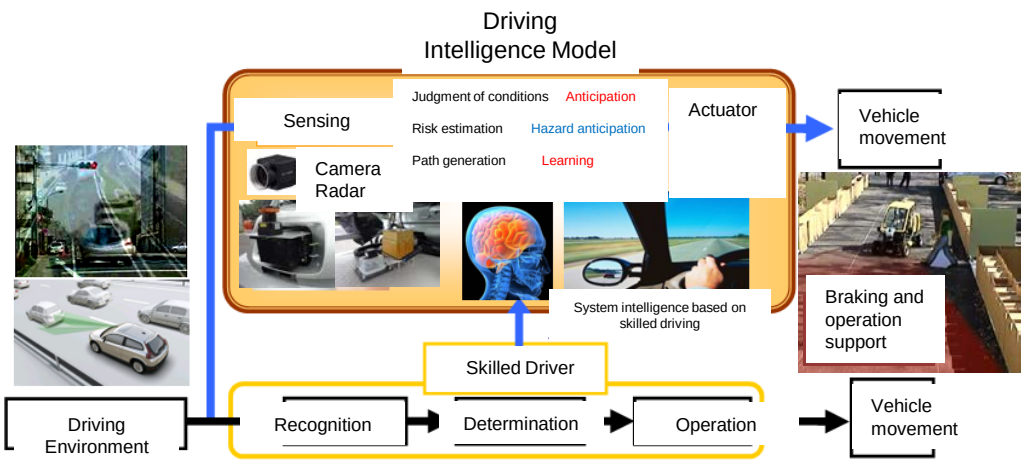
4. Examples of Results from TUAT Industry-Government-Academia Collaboration

Intelligent Autonomous Driving System that Supports the Independence of the Elderly and Realizes Safe and Secure Society

In 2030, one out of three people in Japan will be a senior citizen, and one out of five people in Japan will be 75 years old or older. In the field of mobility, it is estimated that licensed drivers 60 years old or older will account for half of all licensed drivers in Japan. This means that the number of elderly drivers will increase drastically along with concern about traffic accidents.

Taking into account the rapid increase in the number of elderly drivers, the Smart Mobility Research Center is attempting to develop systems that support safe driving that can be introduced at low cost on a wide scale limited to a comparatively limited area. By making the issue of providing mobility support particularly to elderly people on a daily basis most important and focusing on this limited area, our primary aims are early implementation and introduction of the system to society. In addition to conventional accident prevention safety technology, the underlying technology for this system is supported by technologies including high-precision road environment sensing technology (images, radar, GPS), digital data (map data, area image data), intelligent autonomous driving technology (area recognition, knowledge database, risk potential prediction), elderly driver diagnostic technology (driver model, driver acceptability), and HMI optimization technology for driving operation. By integrating these technologies so that they work together in a coordinated fashion, we develop intervention control using intelligent autonomous driving which takes over when the system determines that it would be difficult for the elderly driver to avoid hazardous driving situations in an operating range where the system is highly reliable and effective.

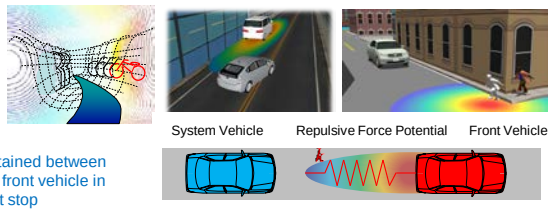
In addition to automatic driving demonstrations featuring obstacle avoidance conducted at both the 42nd and 43rd Tokyo Motor Show (2011, 2013), research results based on the developed technology have been widely released through domestic and overseas lectures, television, newspapers, and other channels.



Intelligent Autonomous Driving System

Anticipative driving technology through experiential learning and hazard anticipation

Anticipation of pedestrians that cannot be seen



Safe distance maintained between system vehicle and front vehicle in anticipation of a fast stop

Experimental Vehicle Configuration

Key point

The proposed advanced driving support system is based on the concept of enabling first time drivers and elderly drivers who are concerned about driving to safely operate vehicles at the same level of a skilled driver by making the vehicle imitate the skilled driving behavior of model drivers. The key point of this research was to formulate a "negative expectation driving" model by predicting the potential dangers in the road environment through risk potential prediction, and develop an intelligent driving support system integrated into this model. Through the creation of this underlying technology, it is thought that safe and secure driving can be achieved by coordinating the system with human drivers in order to avoid dangers on the road.

Demonstration of automatic pedestrian crash avoidance technology at the Tokyo Motor Show 2011

Demonstration of automatic pedestrian crash avoidance technology at the Tokyo Motor Show 2013

Market terms

Automatic driving, driving support technology correspondence, collision avoidance vehicles, intelligent mobility, sensor fusion, etc.

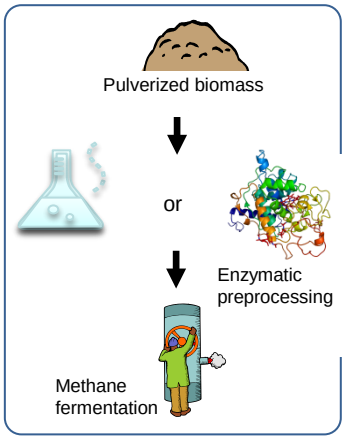
Development of a preprocessing method for the biogasification of lignocellulosic biomass

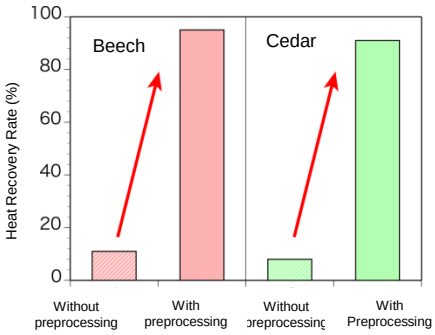
In recent years, carbon neutral renewable resources have been gaining attention from the standpoint of contributing to the reduction of greenhouse gas emissions and to the improvement of the energy self-sufficiency rate. Among these resources, lignocellulosic biomass, which is agricultural waste such as thinned wood and other material found in forests and rice straws, shows great promise for use as a resource due to its abundance.

Through collaborative research with Tokyo Gas Co., Ltd., the research lab of Makoto Yoshida at TUAT has successfully produced biogas at a high energy recovery rate by supplying herbs, wood, and other types of lignocellulosic biomass for oxidative preprocessing using chlorous acid leading to the removal of lignin, a complex polymer which provides plants stability.

Changing the oxidative preprocessing mentioned above from a process which uses chemicals, such as chlorous acid, to a process using an enzyme is thought to be greatly beneficial when looking at costs related to preprocessing input energy and equipment maintenance, environmental burden, and other factors.
Therefore, the group is putting effort in the development of a preprocessing method that uses a lignin-degrading enzyme found in microorganisms (wood rotting fungus).

So far, the laboratory has successfully developed technology for acquiring the new lignin-degrading enzyme from nature and have obtained a patent for this technology. Furthermore, the researchers are working toward the clarification of the metabolic pathway of the microbial community involved in biogas creation through metagenomic analysis of glycosylation by microorganisms and the fermentation process. Utilizing this technology and information in an integrated fashion, the group is continuing development of a highly efficient biogasification system which uses lignocellulosic biomass.





Effect of chlorous acid preprocessing in biogasification of Woody biomass

Use of chlorous preprocessing caused a dramatic increase in the heat recovery rate during the biogasification of woody biomass.

Related Patent

Patent Publication No. 2011-160770 Oligonucleotide screening method for the detection of lignin peroxidase genes and manganese peroxidase genes, and screening method for lignin peroxidase genes and manganese peroxidase genes that utilize oligonucleotide.

Market terms

Renewable Energy, biogas, effective utilization of lignocellulosic biomass, processing of waste products including forest products waste and agricultural waste, etc.

Key points

1) Since biogas has a high energy recovery rate, it has great potential as an energy product created from the conversion of lignocellulosic biomass.

2) Waste products can be used as resources through the utilization of lignocellulosic biomass, which is agricultural waste such as thinned wood and other material found in forests and rice straws.

3) Enzymatic preprocessing is greatly beneficial when considering the input energy used during the chemical reaction and the environmental burden.

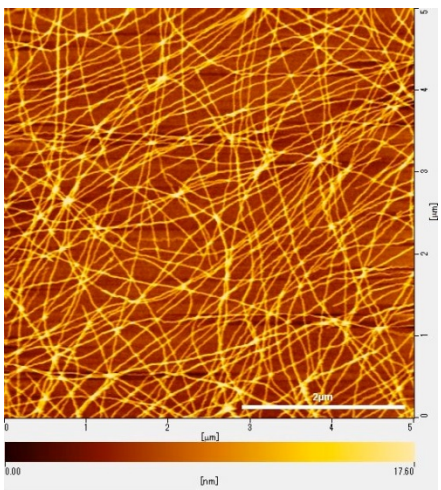
Development of environmentally friendly antifouling agents

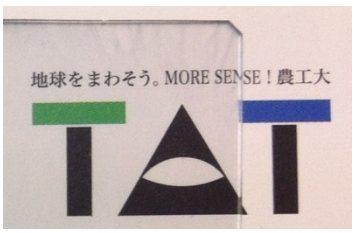
In collaboration with the Central Research Laboratory of Hitachi, Ltd., the research lab of Takeshi Shimomura, part of the TUAT Faculty of Engineering, has developed a field-effect transistor (FET) comprised of several conductive polymer nanofibers with an active layer thickness of 10 nm. Compared to when using thin film of the same material, it became apparent that the use of nanofibers increased electron field-effect mobility by one digit (5.6 × 10–2 cm2V–1s–1). Although mobility is unnecessary for silicone at the present time, the researchers were able to obtain results which demonstrate the effectiveness of nanofiber use.

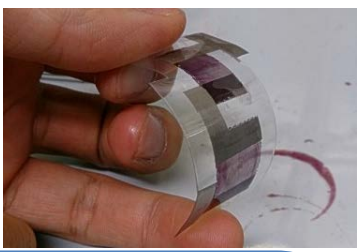
Nanofibers can be created using a simple process of dissolving poly (alkylthiophene) conductive polymer at a high temperature in a properly-adjusted solvent and then cooling it. As a result of the production conditions, it was possible to adjust the thickness and crystallization, resulting in the creation of a FET by distributing the nanofibers between electrodes with an order gap of 100 nm.

In addition, these nanofibers can also be formed from general-purpose high polymers, such as poly (methyl methacrylate), which can function as the active layer of nanofiber-embedded composite film or transistors. The material is expected to serve as post-silicone sheet substrate for new flexible electronics due to its flexibility and relative strength. Furthermore, it is possible to use the material as a transparent conductive film through doping.

In regards to non-transistor applications, research is being carried out which examines the use of the material in thermoelectric conversion sheet devices.







Market terms

Organic transistors, flexible transistors, and transparent conductive film

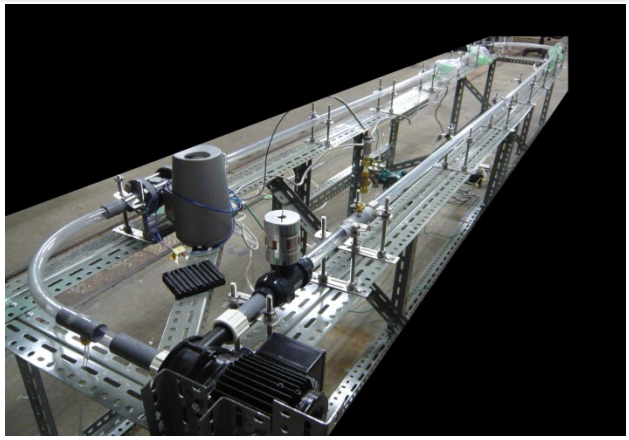
Key point

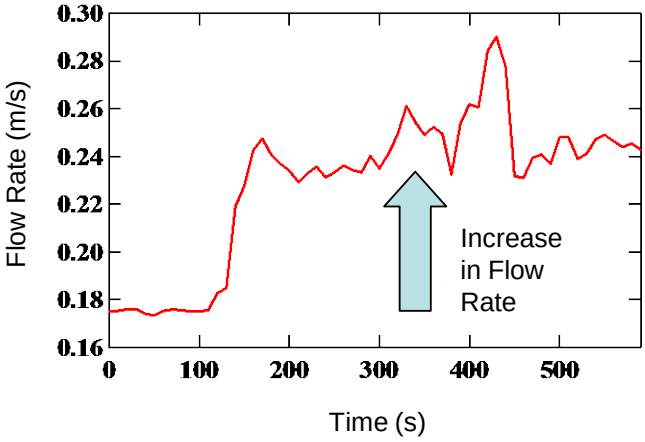
Result: Creation of a transistor comprised of several conductive polymer nanofibers with a active layer thickness of 10 nm. Compared to thin film material, nanofiber displayed strong carrier mobility performance.

Spillover Effect: It can be expected that composite film consisting of general-purpose high polymer nanofiber will be used for post-silicone sheet substrate for flexible electronics applications. In addition, this material is being examined for use in non-transistor applications, including use as transparent conductive film and thermoelectric conversion material.

Friction Drag Reduction Technology in Turbulent Pipe Flow by Applying Biotic Pulsating Principle

As part of the NEDO Industrial Technology Research Grant Program, the research lab of Kaoru Iwamoto at TUAT successfully completed the verification test for frictional resistance friction drag reduction technology in turbulent pipe flow through flow pulsation and relaminarization, a technology created based on the concept of blood flow pulsation. This was able to reduce power at a maximum rate of approximately 58%. In addition to being able to pipeline virtually all types of fluids, this technology can also find possible application in the pipelining of gases, such as natural gas, hydrogen, and carbon dioxide, making it possible to easily create systems by merely changing pump control methods used to propel fluids. Due to the mutual similarity of heat and momentum, heat loss in piping has been greatly reducing while raising the heat insulating effect. If this new system is adopted and proliferates for uses such as the pipelining of oil and natural gas and refrigerants for regional air conditioning, energy loss will be drastically curbed by reducing frictional resistance which accounts for most of the energy consumption within pipelines.





Related Patent

Patent No. 510529 Fluid Transfer Apparatus and Method of Transferring Fluid

Media Reports

Information about the technology has appeared in The Nikkei, Yomiuri Shimbun, Nikkei Sangyo Shimbun, Tokyo Shimbun, Chunichi Shimbun, The Environmental News, Sekiyu Kagaku Shinbun, The Chemical Daily, Nikkan Poropan Butan Jyoho, and other publications.

Market terms

Energy loss reduction in fluid pipelining, regional air conditioning, pipelining of natural gas, oil, CO2, and hydrogen, lifeline services such as gas, water and sewage

Key points

Strengths over competing technologies

	Pulsating Method (This technology)	Conventional method which adds polymers, surface-active agents, etc.	Conventional methods which use uniformly positioned riblets on inner pipe surfaces
Power Reduction Rate	◎ Approx. 60%	◎ Approx. 60%	× Approx. 8%
Pipelinable Products	◎ Both fluids and gases	△ Fluids only	◎ Both fluids and gases
Contamination	◎ Absolutely no contamination	△ Possible that head exchanger additives will be mixed	◎ Absolutely no contamination
Effect on pipeline products	◎ Absolutely no effect	△ Necessary to remove additives after pipelining products	◎ Absolutely no effect
Cost of Method Adoption	△ Only the currently installed pumps need to be changed at each location	◎ When first adopted, it is necessary to add equipment that will mix the additives	× It is necessary to install riblets on inner pipe surfaces
Running Costs	◎ Only pump operation costs	△ Cost for additives which must be added as needed	× Cost to remove debris that builds up on riblets
Effect on Heat Exchanger	◎ Effect can be avoided by positioning reverse tanks in front of heat exchangers to stop pulsation	× Basically, this method diminishes heat exchanger performance. Professional redesign work is necessary to reduce the negative effect.	◎ No particular effect

Discovery Contribution

5. TUAT Comprehensive Organizational Collaboration

❖Organizational Collaboration with Businesses

Fujifilm Corporation

The agreement regarding organizational collaboration with Fujifilm Corporation was entered for the purpose of promoting continuous organizational collaboration to strengthen business research and development work and vitalize academic research and educational activities at TUAT. Both Fujifilm and TUAT plan to create new technology by sharing and exchanging knowledge from the early stages of technology innovation, and plan to collaborate in the fields of life science, performance materials, and in other research fields in which both Fujifilm and TUAT agree to collaborate.

Nippon Express Co., Ltd.

The agreement regarding collaboration with Nippon Express Co., Ltd. is primarily aimed at research and development in agriculture-related fields, environmental fields, vibration control/base isolation, IT, and machine system engineering. In addition, Nippon Express and TUAT plan to collaborate in the development of a new business model. Fusing together the logistics know-how and facility that Nippon Express possesses in Japan and in nations around the globe with TUAT's wisdom and technology will lead to the development of new services and logistics technology needed by society. Primary collaboration activities are the implementation of collaborative research and commissioned research, exchange among researchers, and various human resources training activities. In addition, activities will be implemented which are necessary for the promotion of these collaboration efforts.

Hitachi, Ltd.

TUAT and Hitachi, Ltd. entered an organizational collaborative agreement for promoting mutual cooperation in areas such as research and development and human resources training. Based on this agreement, TUAT and Hitachi will cooperate to develop technologies including cellular function analysis aimed at making breakthroughs in the biological systems field and user friendly interactive human interface technology. In addition, students of this university will perform long-term internships at Hitachi while researchers from that company will be assigned to TUAT as instructors, and MOT: Management of Technology lectures are some of the efforts designed to lead to the creation of educational and human resources development frameworks that are mutually complimentary.

Tokyo Gas Co., Ltd.

TUAT entered a basic agreement with Tokyo Gas Co., Ltd. related to collaborative research and other activities agreement aimed to strengthen business research and development work and vitalize academic research and educational activities at TUAT by promoting continuous organizational collaboration. The aim of this agreement is innovation creation through the implementation of collaborative activities in energy related fields and in all other fields where mutual cooperation can occur. These efforts are taken in order to promote mutual collaboration and cooperation, benefit the company's and TUAT's interests, and contribute to the improvement of Japan's science and technology and human resource development which are mutually beneficial.

Seibu Shinkin Bank

TUAT entered an industry-academic collaboration agreement with Seibu Shinkin Bank with the aim of creating collaborative research activities involving small to medium size businesses and university researchers, and providing management support for venture businesses incubated in the university. The promotion of this agreement is expected to pay back more to society through TUAT research results, create new industry-academia activities, and vitalize regional economies.

❖ International Organizational Collaboration

UK: University of Brighton

In addition to entering a university academic exchange agreement with the University of Brighton (UK) in January 2006 for academic exchange between faculty and students, TUAT also entered an international industry-academia collaboration agreement with the university in November of the same year. This effort aims at the international development of intellectual property of each partner country through the establishment of a mutual liaison office and mutual use of TLOs (Technology Licensing Organizations) functions. In the future, we will, before charging into other fields and begin collaborating in the bio field, an area which both universities have made outstanding achievements. In addition, our universities will conduct exchange between faculty and students, implement wide-scale collaborative research in multiple fields, improve language education at both universities, conduct exchange to improve the qualifications and quality of administrative staff, and implement other similar efforts.

China: East China University of Science and Technology

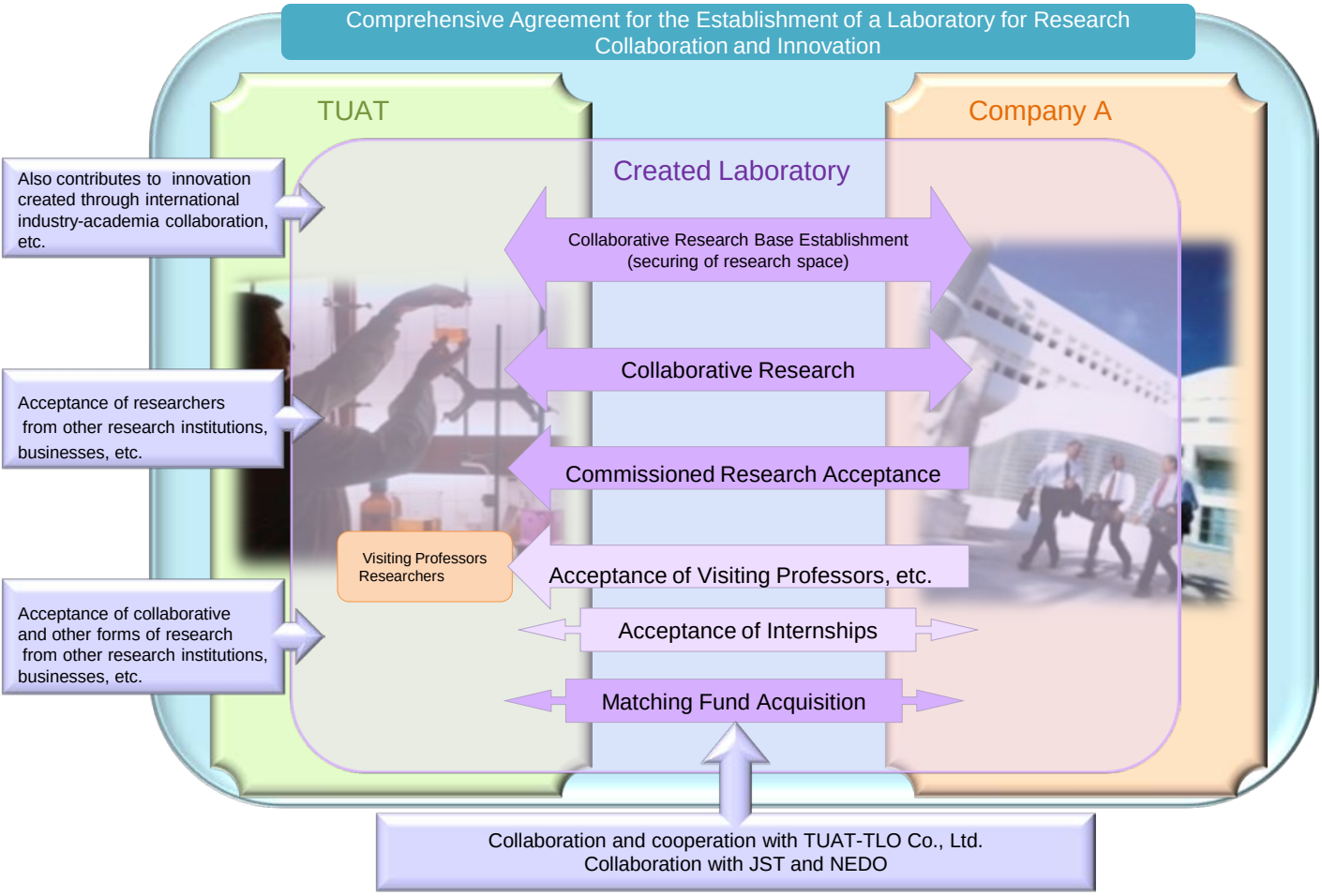
TUAT entered an agreement related to industry-academia collaboration and similar cooperative efforts in December 2005 with one of its sister schools, East China University of Science and Technology. This is a specialized agreement for industry-academia collaboration under the sister school agreement, which is expected to further strengthen cooperation between the two universities.

Taiwan: Industrial Technology Research Institute

First started as an exchange activity as a way for TUAT to enter the Taipei Int'l Invention Show and Technomart, TUAT's University Research Administration Center (formerly the Center for Innovation and Intellectual Property) and Taiwan's Industrial Technology Research Institute exchanged bilateral cooperation certificates related to industry-academia collaboration and similar cooperative efforts and held a signing ceremony in September 2012. In addition to promoting research exchange involving individual themes, this cooperative effort is expected to increase future interaction between students and researchers of both institutions in the future. It is also expected to contribute to the Program for Leading Graduate Schools, which was adopted by TUAT last year.

6. Laboratories for Research Collaboration and Innovation

TUAT established the laboratories for research collaboration and innovation in 2007 as a way to take a more specific effort as part of a framework agreement with businesses and other institutions. In addition to donated lectures and collaboration with graduate schools, laboratories focus on multiple efforts such as collaborative research and commissioned research under the framework. The laboratories were established to offer flexibility through comprehensive agreements for the acceptance of donations, collaborative research, establishment of collaborative lectures, visiting professors, etc. A framework is established that allows handlings of intellectual property depending on the forms of accepting inventions by the inventor, etc., such as donations, collaborating research, commissioned research, internships, and welcoming of visiting professors.



❖Principles for handling inventions by collaboration type

Type	Handling of inventions, etc.	Notes
Collaborative Research	Interest in the invention will be determined based on degree of contribution, etc., and either a single or joint patent application will be filed.	Determined by the collaborative research agreement
Commissioned Research	In principle, commissioned research inventions belong to the university	Determined by the commissioned research agreement
Donations to the university	Inventions belong to the university	Special conditions cannot be established regarding donations
Internships	According to the provisions of research institutions, businesses, and other institutions where internships will take place	Carried out with the consent of students, etc.
Visiting Professors (employed)	Considered as an invention by an employee when research results are achieved within the university under an employment agreement	The university's regulations regarding invention by an employee are applied
Participation in research by students	Considered as an invention by an employee when a student making the discovery participates in an agreement or employment-based project	When not employed, a separate written oath is required regarding confidentiality, invention transfer, etc.

❖Innovation Laboratory

Nippon Chemi-Con Corporation	Innovation laboratory for collaborative research in nanohybrid technology (started in April, 2009)

7. TUAT Research Rankings

2012

❖Number of collaborative research projects with private companies per faculty member

Rank	Name of University
1	Nagoya Institute of Technology (0.623)
2	TUAT (0.507)
3	Kyushu Institute of Technology (0.483)
4	University of Electro-Communications (0.469)
5	Tokyo Institute of Technology (0.4)
6	Osaka Prefecture University (0.356)
7	Iwate University (0.328)
8	Mie University (0.276)
9	Kyushu University (0.255)
10	University of Tokyo (0.25)

❖Funding for collaborative research with private companies per faculty member (in thousands of yen)

Rank	Name of University
1	Nagoya Institute of Technology (2,439)
2	Nagaoka University of Technology (1,358)
3	Tokyo Institute of Technology (1,050)
4	Kyoto University (1,021)
5	TUAT (911)
6	University of Tokyo (801)
7	Tohoku University (794)
8	Osaka University (724)
9	Kyushu University (632)
10	Nagoya University (611)

❖Funding for collaborative research with small and medium size businesses (in thousands of yen)

Rank	Name of University
1	University of Tokyo (763,377)
2	Tohoku University (347,791)
3	Kyushu University (218,427)
4	Tokyo University of Science (207,765)
5	Nagoya University (187,449)
6	Osaka University (151,182)
7	University of Tsukuba (134,466)
8	Kyoto University (126,341)
9	TUAT (109,861)
10	Hokkaido University (109,523)

❖Funding for collaborative research with small and medium size businesses per faculty member (in thousands of yen)

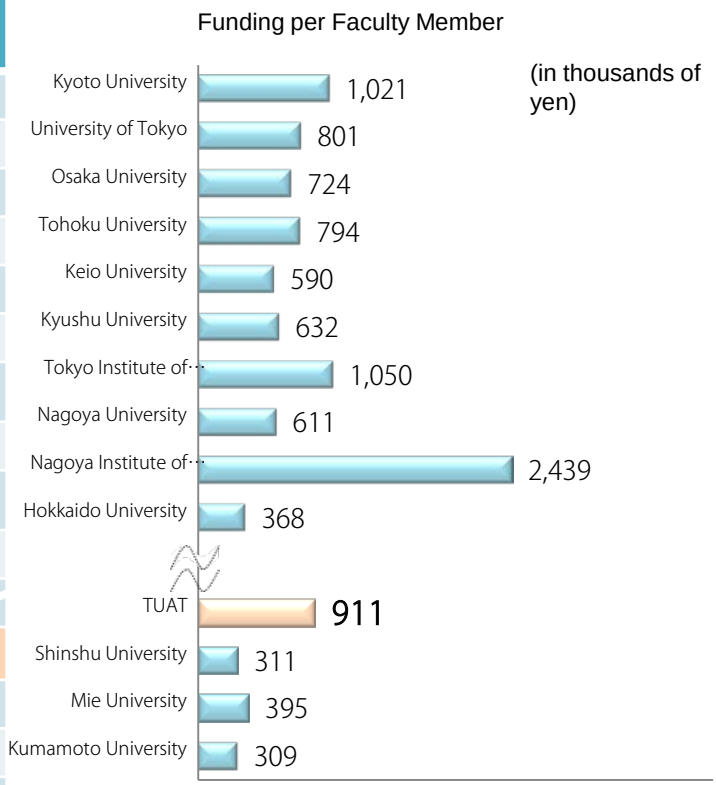
Rank	Name of University
1	Gifu Pharmaceutical University (654)
2	TUAT (264)
3	Tokyo University of Science (247)
4	Shibaura Institute of Technology (170)
5	University of Tokyo (158)
6	Kyushu Institute of Technology (133)
7	Tohoku University (121)
8	Osaka Prefecture University (117)
9	Nagoya University (107)
10	Kyushu University (104)

(Calculations based on “Status of Industry-Academia Collaboration and Similar Activities at Universities and Other Institutions in 2012” (November 2013) published on the MEXT website)

8. Comparison of Collaborative Research at TUAT with those at Other Universities in 2012

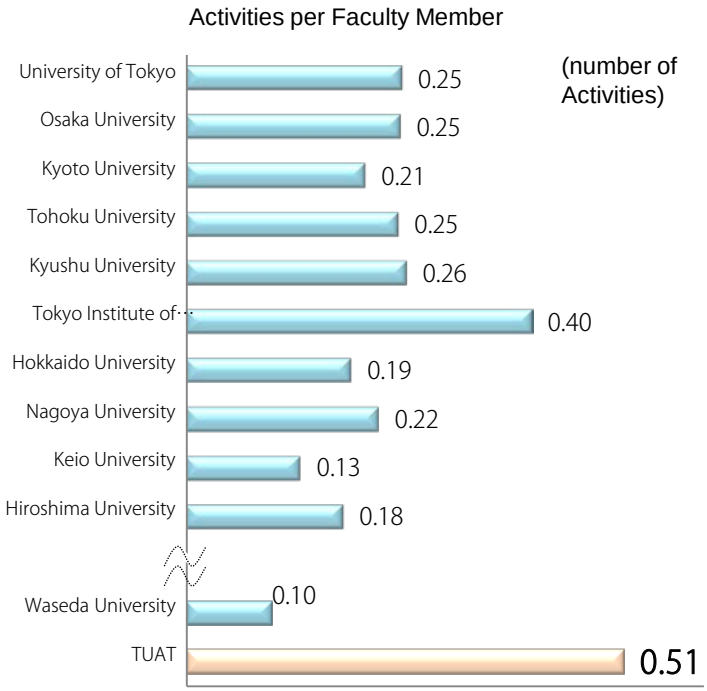
❖Top ranked universities for collaborative research with private companies in 2012 (in terms of research funds)

Rank	Name of University	Funding (in thousands of yen)	Number of Faculty
1	Kyoto University	3,937,614	3,856
2	University of Tokyo	3,867,943	4,827
3	Osaka University	2,406,742	3,323
4	Tohoku University	2,290,884	2,885
5	Keio University	1,533,854	2,598
6	Kyushu University	1,327,275	2,099
7	Tokyo Institute of Technology	1,190,930	1,134
8	Nagoya University	1,071,538	1,754
9	Nagoya Institute of Technology	860,838	353
10	Hokkaido University	773,380	2,104
17	TUAT	378,923	416
18	Shinshu University	357,867	1,150
19	Mie University	336,746	852
20	Kumamoto University	316,246	1,025



❖Top ranked universities for collaborative research with private companies in 2012 (in terms of research activities)

Rank	Name of University	No. of Research Activities	Number of Faculty
1	University of Tokyo	1,207	4,827
2	Osaka University	825	3,323
3	Kyoto University	800	3,856
4	Tohoku University	709	2,885
5	Kyushu University	536	2,099
6	Tokyo Institute of Technology	454	1,134
7	Hokkaido University	402	2,104
8	Nagoya University	391	1,754
9	Keio University	344	2,598
10	Hiroshima University	318	1,748
19	Waseda University	213	2,153
20	TUAT	211	416



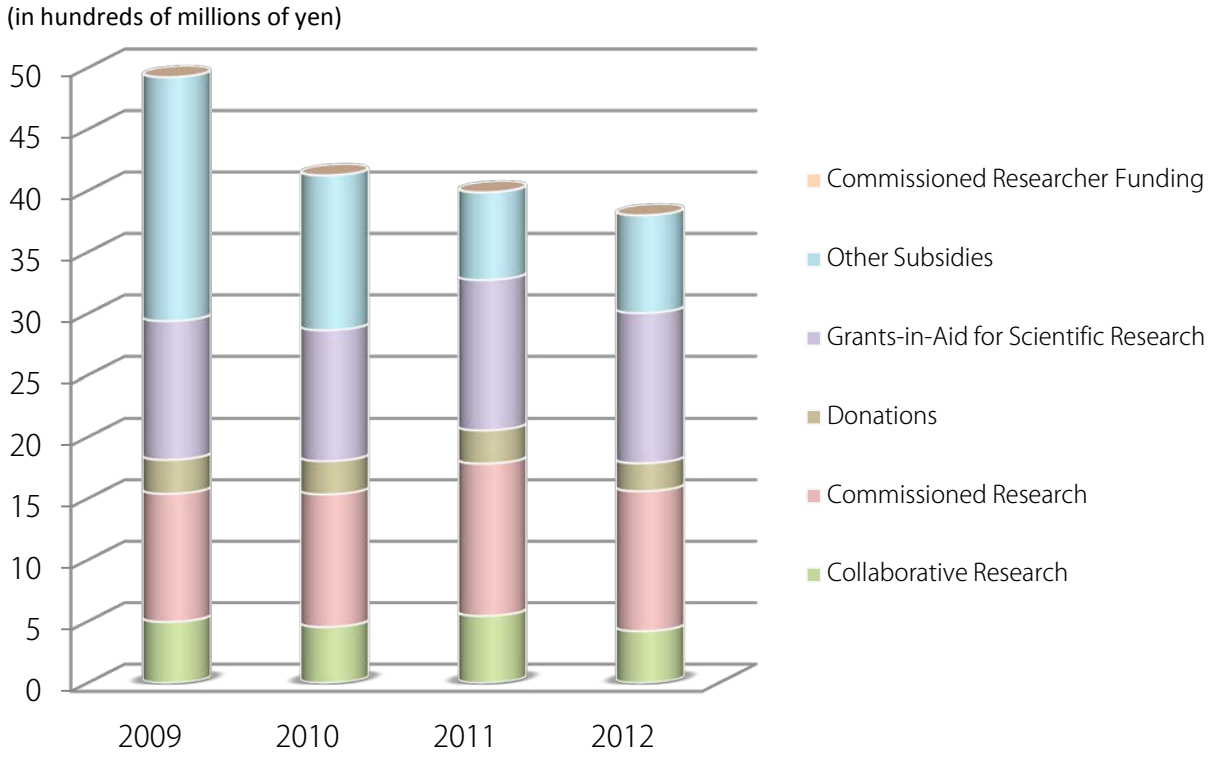
・Calculations based on “Status of Industry-Academia Collaboration and Similar Activities at Universities and Other Institutions in 2012” (November 2013) published on the MEXT website
・Number of faculty data from operations reports for 2012 and other documentation from each university.

9. TUAT External Research Funding by Year

(in thousands of yen)

	Collaborative Research	Commissioned Research	Donations	Grants-in-Aid for Scientific Research	Other Subsidies	Commissioned Researcher Funding	Total
2009	498,425	1,042,261	276,624	1,123,995	1,984,871	271	4,926,447
2010	456,918	1,079,156	270,303	1,060,504	1,259,671	541	4,127,093
2011	546,671	1,239,603	270,564	1,218,209	713,319	992	3,989,358
2012	422,900	1,055,926	227,385	1,217,130	795,598	271	3,719,210

- Includes indirect costs and general management costs
-Cost free collaborative research with universities and other institutions not included with the number of collaborative research activities on page 14
- Grants-in-Aid for Scientific Research amounts reflect the amount transferred after grant issuance was decided upon.
- Commissioned research includes commissioned projects accepted by the Research Support Office.



10. TUAT External Research Funding by Funding Type

Collaborative Research

Year	Amount (in thousands of yen)	Number of Activities
2009	498,425	244
2010	456,918	252
2011	546,671	228
2012	422,900	233

Commissioned Research

Year	Amount (in thousands of yen)	Number of Activities
2009	1,042,261	174
2010	1,079,156	167
2011	1,239,603	174
2012	1,055,926	201

Donations

Year	Amount (in thousands of yen)	Number of Donations
2009	276,624	237
2010	270,303	248
2011	270,564	229
2012	227,385	189

Grants-in-Aid for Scientific Research

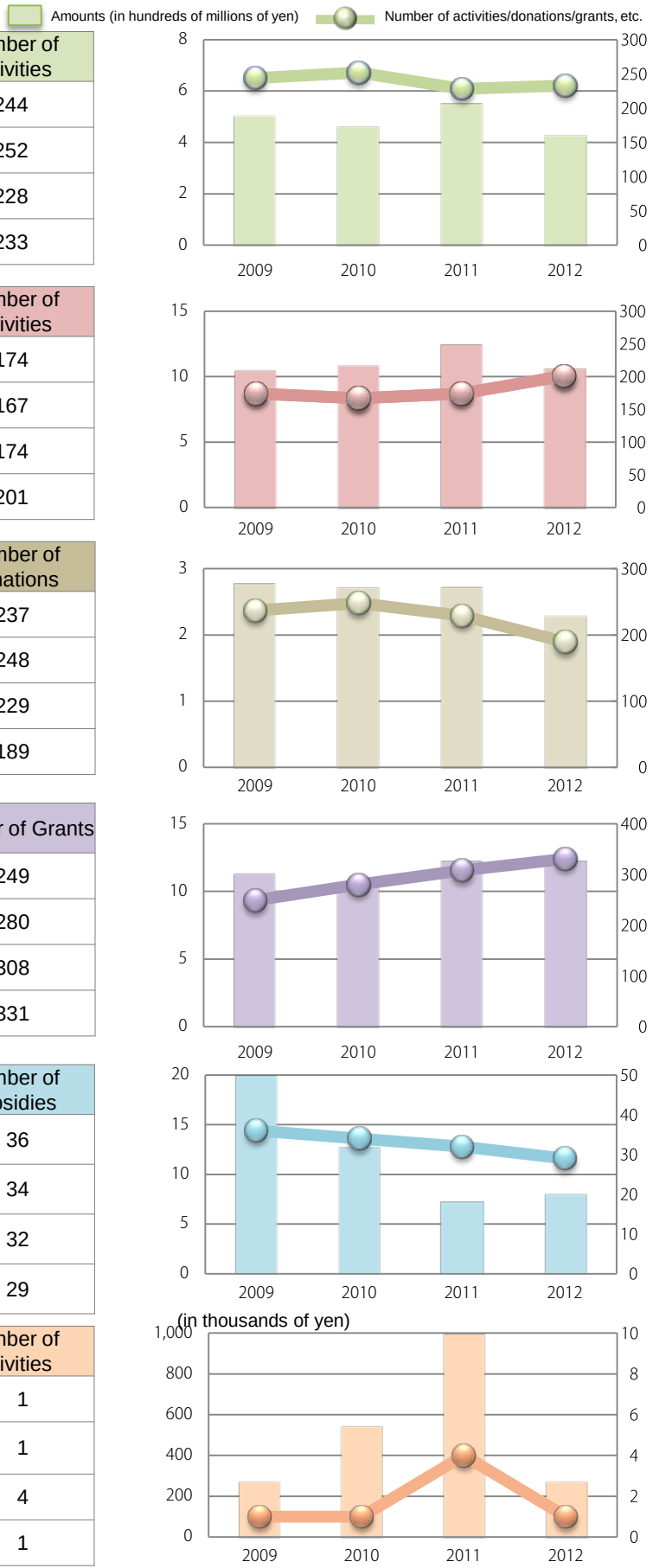
Year	Amount (in thousands of yen)	Number of Grants
2009	1,123,995	249
2010	1,060,504	280
2011	1,218,209	308
2012	1,217,130	331

Other Subsidies

Year	Amount (in thousands of yen)	Number of Subsidies
2009	1,984,871	36
2010	1,259,671	34
2011	713,319	32
2012	795,598	29

Commissioned Researcher Funding

Year	Amount (in thousands of yen)	Number of Activities
2009	271	1
2010	541	1
2011	992	4
2012	271	1



11. TUAT Patent Results

❖Number of Invention Disclosures

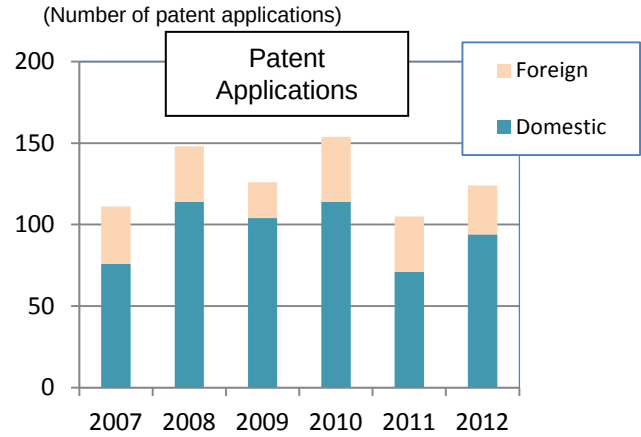
Year	2007	2008	2009	2010	2011	2012
Number of Disclosures	153	168	158	131	107	128

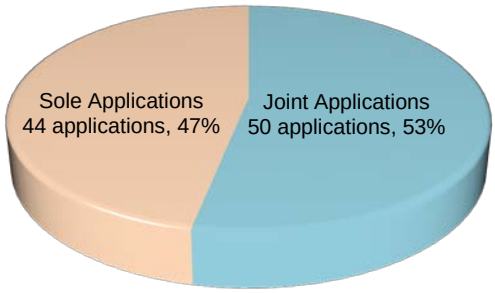
❖Patent Application Results

Although TUAT is actively working toward the creation of university-owned intellectual property, it is necessary to select high-quality, valuable inventions and apply for their patents in order to acquire competitive external funding. As a result, this university established an invention review committee which has been conducting reviews of inventions since February 2006, examining inventions for novelty, inventiveness, and economic potential. By planning to increase university invention rights, it is expected that there will be more opportunities for patent utilization in the future. Furthermore, TUAT is applying for patents based on collaborative research results. Last year, 50% of domestic applications and 33% of foreign applications were joint applications.

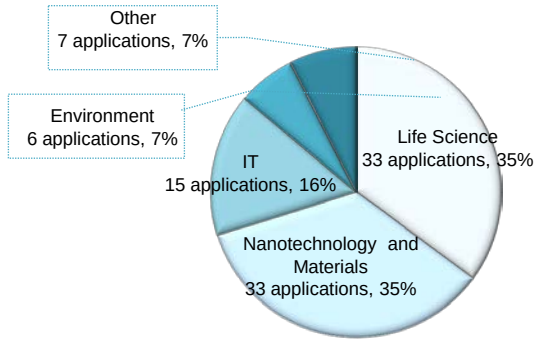
Year	Number of domestic patent applications	Number of foreign patent applications
2007	76	35
2008	114	34
2009	104	22
2010	114	40
2011	71	34
2012	94	30

Number of Patent Application by Year

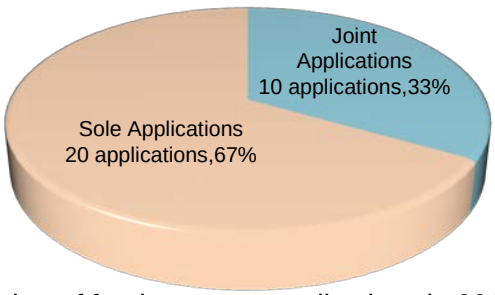




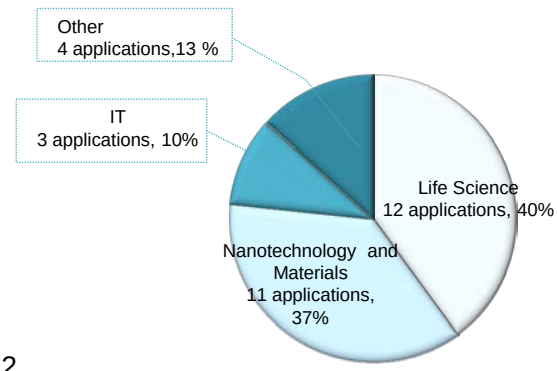
Number of domestic patent applications in 2012 (total of 94 applications)



Domestic patent applications by field



Number of foreign patent applications in 2012 (total of 30 applications) (includes countries where the PCT application is in the national phase)

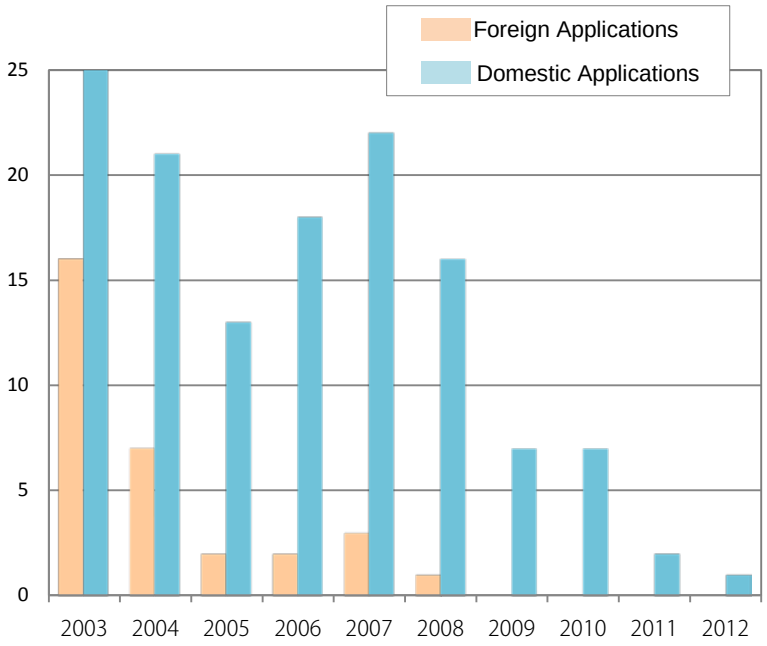


Foreign patent applications by field

12. Patent Application and Technology Transfer Results for TUAT-TLO Co. Ltd.

❖Patent Application Results

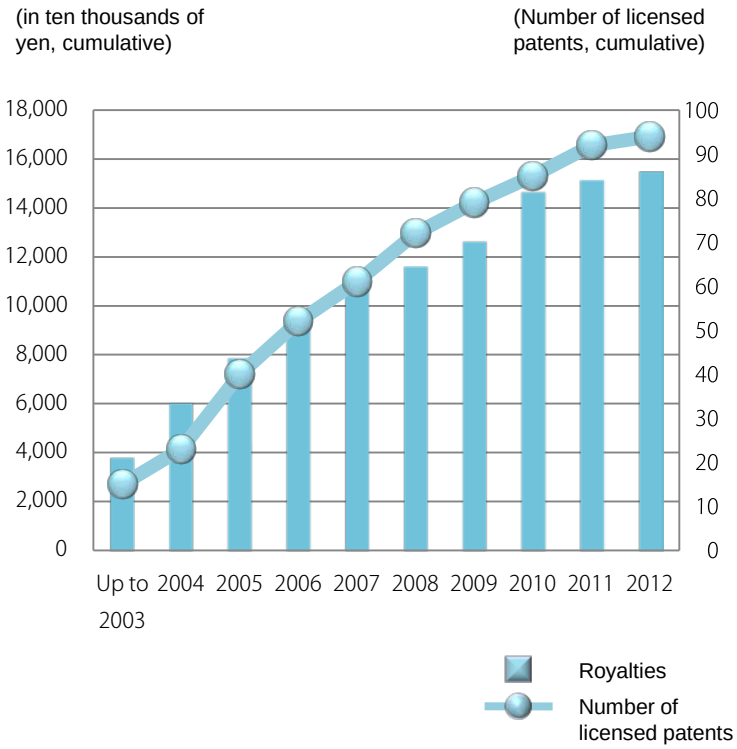
Year	Domestic Applications	Foreign Applications	Total
2003	25	16	41
2004	21	7	28
2005	13	2	15
2006	18	2	20
2007	22	3	25
2008	16	1	17
2009	7	0	7
2010	7	0	7
2011	2	0	2
2012	1	0	1
Total	131	32	163



❖Technology Transfer (licensing) Results

Year	Royalties* (in ten thousands of yen)		Number of licensed patents	
	By Year	Cumulative	By Year	Cumulative
Up to 2003	2,178	3,794	9	15
2004	2,236	6,030	8	23
2005	1,801	7,831	17	40
2006	1,701	9,532	12	52
2007	1,053	10,585	9	61
2008	992	11,577	11	72
2009	997	12,574	7	79
2010	2,059	14,633	6	85
2011	455	15,088	7	92
2012	357	15,445	2	94

* Amounts include consumption tax



TUAT-TLO Co., Ltd. Contact Information

・Homepage: http://www.tuat-tlo.com
・TEL: 042-388-7254 ・FAX: 042-388-7255 ・E-mail: office@tuat-tlo.com

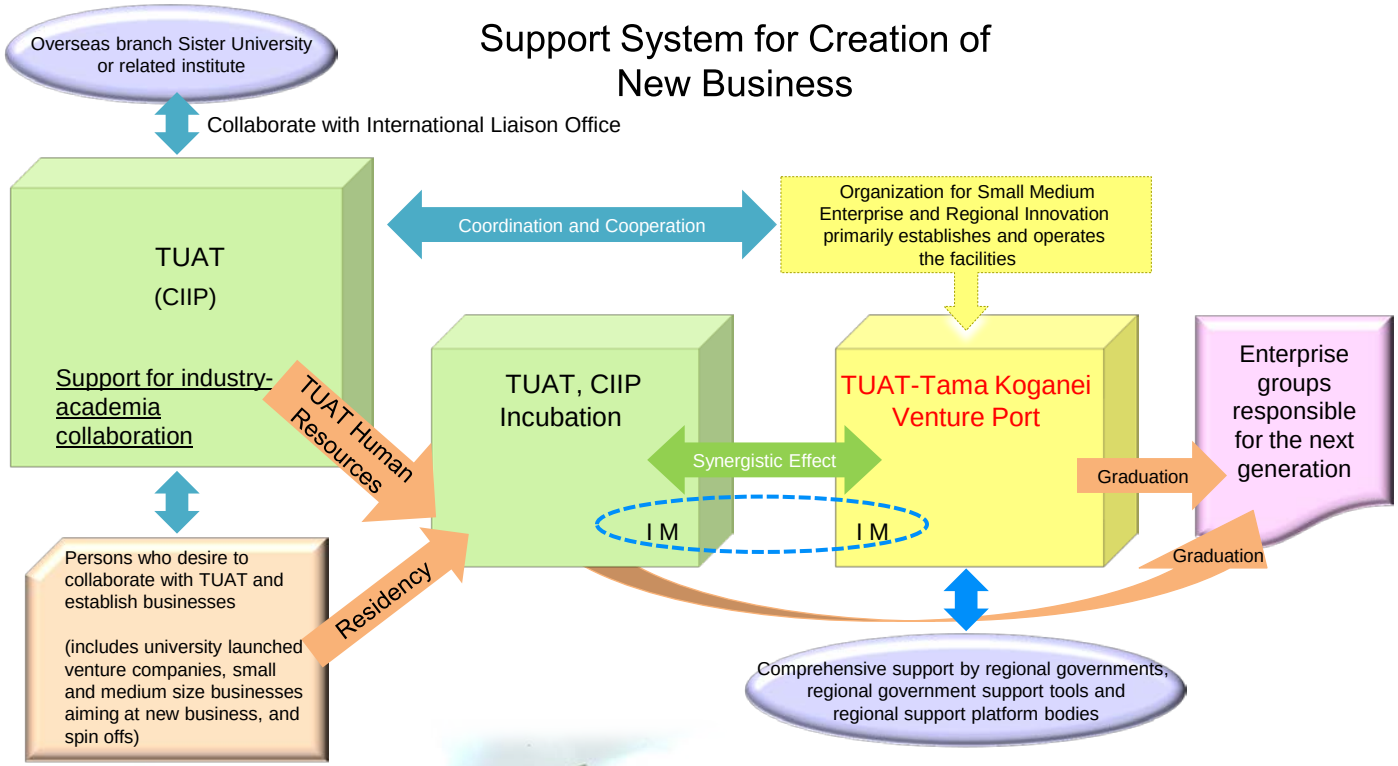
13. Incubation and Pre-incubation Projects

❖TUAT Business Incubation

The Venture Business Laboratory and incubation facility have been established as part of the Center for Innovation and Intellectual Property to provide education and support for university venture businesses. The TUAT incubation facility provides workspace, technology support, guidance and advice regarding patents, management, financial affairs, legal matters, and other forms of support for people starting a business based on research results of TUAT faculty or students, and for venture businesses in their early stage of development. In principle, residence is allowed for three years (eight years maximum), utilizing the space for research and development or business purposes. An appropriate support system has been established for use of a broad network of experts from inside and outside of the university as well as human resources from overseas universities that offer support. In recent years, more and more university venture businesses have been created that have utilized university research seeds. 35 businesses have been launched as of May 2013. There are currently four pre-venture projects under way at the facility. Last year, the project of VBL graduate Shun Nakamura was started as a business. In order to bring about the commercial realization and speed up the business launch of Professor Chiba's VBL project titled "Diffusion Type Desalinization Interface for High-Performance Liquid Chromatography/Mass Spectrometry Analysis Equipment," he competed for two large competitive funds last year by which the project was selected. The first fund is the JST A-Step (feasibility study stage) and the second fund is the MEXT Project for Creating Startups from Advanced Research and Technology for 2012. This year two new projects were added designed to be launched into businesses by Professor Matsuda (Graduate School of Agriculture) and Professor Takiyama (Graduate School of Engineering). For business incubation, support is provided for presentations and creating written applications for public funding and other purposes. We want to continue supporting the creation of many excellent university venture businesses this year which create new value, will be accepted by society, and can operate on a global scale.

❖TUAT-Tama Koganei Venture Port for Entrepreneurial Training

In cooperation with the Tokyo Metropolitan Government and Koganei City, TUAT had already established the TUAT-Tama Koganei Venture Port over five years ago in October 2008 as part of the university collaborative style entrepreneurial training facility establishment program conducted by the Organization for Small Medium Enterprise and Regional Innovation. Management of the facility is handled by the organization with a CIM (Chief Incubation Manager) in charge dispatched from the organization and a TUAT IM (Incubation Manager) in residence. Collaborative research with TUAT research laboratories is promoted for the strengthening of venture businesses. The TUAT-Tama Koganei Venture Port collaborates with the Tokyo Metropolitan Government, Koganei City, and assistance organizations such as local financial institutions, provides various types of support tools and information, and offers comprehensive support in collaboration with the university.



14. TUAT Incubation Businesses and VBL Research Projects

	Business Name or Research Group	Established	Description	Representative	Adviser
2007	PaGE Science Co.,Ltd.	July 2007	Development of technology and information base necessary for evaluating purification effectiveness, by microbe quantity and type, of bioremediation of soil polluted by contaminants such as organochlorinated compounds and benzene.	Noriyoshi Tamura	Masahumi Yohda
2009	**Napa Jenomics** Co., Ltd.	July 2005	Development project aimed at the practical use of nucleic acid delivery technology	Hironori Ando	Kazuhiro Chiba
2009	Bioengineering Laboratories, Llc.	March 2009	Project related to the research, development, manufacturing, marketing, and patent licensing of bioengineering technology	Katsuhiro Kojima	Wakako Tsugawa
2012	ILABO Co., Ltd.	December 2011	Handwriting recognition engine project	Masanobu Horiguchi	Masaki Nakagawa

	Research Project Name	R&D Adviser
VBL Faculty Projects	Revitalization of the Regional Community and Creation of an Environment Area Platform	Hideo Kameyama
	Development of a Micro Crystallizer	Hiroshi Takiyama
	Development of a New Interface for the Realization of High-sensitive Mass Spectrometry	Kazuhiro Chiba
	Development of a Next-generation Motion Analysis System for the Early Detection of Cranial Nerve Dysfunction in Newborns	Hiroshi Matsuda

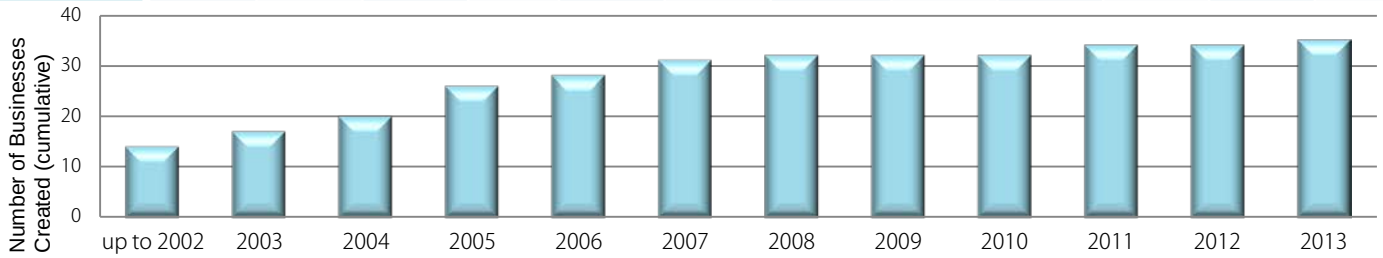
(information as of July 1, 2013)

TUAT incubation facility

15. List of venture businesses which TUAT faculty were involved in creating

No.	Established	Name of Business	Faculty Member
1	December 1994	Biopharm of Japan, Corporation	Akira Endo
2	May 1997	Zelkova YK (now SanritsuZelkova Kensa Center KK)	Takashi Nakamura
3	April 1999	Aluminum Hyomen Gijutsu Kenkyusho, K.K.	Hideo Kameyama
4	November 1999	Cluster Ion Beam Technology Co., Ltd.	Hiroaki Usui
5	August 2000	Rodel Particle Co., Ltd.	Mamoru Iso
6	April 2001	Sekisou Kanagata Co., Ltd.	Masanori Kunieda
7	August 2001	Alcat, Co., Ltd.	Hideo Kameyama
8	November 2001	Nitta Shanghai Co ., Ltd	Mamoru Iso
9	January 2002	K & W Limited	Katsuhiko Naoi
10	February 2002	Nano Solution Inc.	Nobuhiro Takahashi
11	March 2002	Super Technology Innovators Co. Ltd.	Takashi Kurokawa
12	April 2002	Noveltec Inc.	Hiroshi Matsuda
13	April 2002	EnBio Ltd.	Tadashi Matsunaga
14	December 2002	Quantum14 KK	Nobuyoshi Koshida
15	May 2003	Ultizyme International Ltd.	Koji Sode
16	October 2003	Scribal Ltd.	Masaki Nakagawa
17	December 2003	Future Advanced Technology Research Laboratory., Ltd.	Tomo Ueno
18	January 2004	PropGene Inc.	Tadashi Matsunaga
19	October 2004	Alumite Catalyst Technologies Ltd.	Hideo Kameyama
20	December 2004	Fuji OptoTech Ltd.	Yukitoshi Otani
21	February 2005	TMS Co., Ltd.	Keiji Hasumi
22	April 2005	Jitsubo Co., Ltd.	Kazuhiro Chiba
23	June 2005	Greening Laboratory Co., Ltd..	Masaaki Hosomi
24	July 2005	NapaJen Pharma, Inc.	Kazuhiro Chiba
25	September 2005	Japan Animal Referral Medical Center	Yoshihisa Yamane
26	October 2005	Procyon Co., Ltd.	Toshiroh Iwasaki
27	January 2006	Silicone Plus Corporation	Yoshiyuki Watanabe
28	October 2006	Sameken Co., Ltd.	Toshiyuki Sameshima
29	April 2007	Dai Nippon Keisanki Oyo Giken Sangyo KK	Kazuhiko Ohmachi
30	July 2007	PaGE Science Co.,Ltd.	Masahumi Yohda
31	November 2007	Pharme Co., Ltd.	Chisato Miyaura
32	March 2009	Bioengineering Laboratories, Llc.	Wakako Tsugawa
33	May 2011	OK Robotics Ltd.	Shigeki Toyama
34	December 2011	ILABO Co., Ltd.	Masaki Nakagawa
35	May 2013	CorLab Inc.	Shun Nakamura

Year	Up to 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Businesses Created (cumulative)	14	17	20	26	28	31	32	32	32	34	34	35



16. Competitive Funding Received in 2012

	Name of Competitive Fund	Number	Amount (in thousands of yen)	Organization	Type
	Grants-in-Aid for Scientific Research	331	1,217,130	MEXT, Japan Society for the Promotion of Science	Subsidy
(1)	Research Program for Risk Assessment Study on Food Safety	1	4,400	Cabinet Office, Government of Japan	Commissioned Research
(2)	Funding Program for World-Leading Innovative R&D on Science and Technology	1	24,500	Cabinet Office, Government of Japan MEXT	
(3)	Strategic Information and Communications R&D Promotion Programme (SCOPE)	1	2,831	Ministry of Internal Affairs and Communications	
(4)	JST Strategic Basic Research Programs	19	300,710	MEXT	
(5)	Adaptable and Seamless Technology transfer Program through target driven R&D (A-STEP)	40	119,166	MEXT	
(6)	Strategic International Collaborative Research Program (SICORP)	1	7,696	MEXT	
(7)	Support Program for Leading Research Discoveries for Medical Supplies and Medical Equipment (formerly Program for Promoting Basic Research in the Field of Health and Medical Care)	2	10,000	Ministry of Health, Labour and Welfare	
(8)	Promotion of Basic Research to Generate Innovation	1	35,246	Ministry of Agriculture, Forestry and Fisheries	
(9)	Research and Development Projects for Application in Promoting New Policy of Agriculture Forestry and Fisheries	2	23,055	Ministry of Agriculture, Forestry and Fisheries	
(10)	Strategic Development of Energy Conservation Technology Projects	1	112,775	Ministry of Economy, Trade and Industry	
(11)	Basic Research Promotion System in the Transport Field	1	1,800	Ministry of Land, Infrastructure, Transport and Tourism	
(12)	Environment Research and Technology Development Fund	7	126,197	Ministry of the Environment	
(13)	Health Labour Sciences Research Grant	12	42,300	Ministry of Health, Labour and Welfare	Subsidy
(14)	Environment Research and Technology Development Fund (subsidy)	3	28,185	Ministry of the Environment	
(15)	Industrial Technology Research Grant Program	3	10,803	New Energy and Industrial Technology Development Organization (NEDO)	
(16)	Program for Advanced Industrial Technology Creation	2	24,570	New Energy and Industrial Technology Development Organization (NEDO)	
(17)	Program for the Development of Optimization Technology for the Construction and Use of Barns and Livestock Technology	1	6,750	Japan Livestock Technology Association	
(18)	Funding Program for Next Generation World-Leading Researchers (NEXT Program)	2	69,615	Japan Society for the Promotion of Science	
(19)	Asian Standard Certification Promotion Program	1	1,000	Ministry of Economy, Trade and Industry	
(20)	Project for Developing Innovation Systems	1	56,040	JKA	

Grants-in-Aid for Scientific Research includes Grant-in-Aid for JSPS Fellows.

17. Research Seeds List Information

http://www.tuat.ac.jp/~seeds/

❖The University Research Administration Center has published the Guide to Innovative Research Projects (research seeds list) which lists research results of TUAT faculty and other parties.

❖The Japanese version of the Guide to Innovative Research Projects which appears on the TUAT website allows users to perform searches by research category, keyword, or researcher name.

❖If you are interested in any of the research seeds, please contact the University Research Administration Center.

❖For those of you who would like a list of seeds in English or simplified Chinese, please contact the University Research Administration Center (Industry-Academia Collaboration Promotion Team).

Note: Theme information slightly differs from the Guide to Innovate Research Projects (TUAT Research Seeds List) mentioned above.

Research Categories	No.of Projects
Life Sciences	39
Information and Communication Technology	21
Environmental Sciences	12
Nanotechnology and Materials	16
Energy	6
Advanced Manufacturing Technology	21
Others	8
Total	123

Data as of April 1, 2013

18. University Research Administration Center Information

http://tuat-urac.jp/

Description of Activities

❖ Collaborative Research and Commissioned Research lead to industry-academia collaboration.

❖ Intellectual Property : Handling of intellectual property rights acquisition and maintenance of TUAT patents and other intellectual property.

❖ Technical consultations and academic guidance: Providing assistance for solving technology related issues.

❖ Business Incubation: Development of venture businesses using TUAT technology seeds.

❖ Technology Transfer Activities: Licensing of TUAT research results

(Related Organization: TUAT-TLO Co., Ltd.)

Contact List

University Research Administration Center	TEL	FAX	E-mail Address
Office	042-388-7175	042-388-7280	zimcrc@cc.tuat.ac.jp
Advanced Research Promotion Team	042-388-7273	042-388-7286	urac@ml.tuat.ac.jp
Industry-Academia Collaboration Promotion Team	042-388-7283	042-388-7553	suishin@ml.tuat.ac.jp
General Research Support Team	042-388-7008	042-388-7280	kenkyu2@ml.tuat.ac.jp
TUAT-TLO Co., Ltd.	**TEL**	**FAX**	**E-mail Address**
Office	042-388-7254	042-388-7255	office@tuat-tlo.com

Getting to TUAT via Public Transportation

Fuchu Campus

○From Kokubunji Station (JR Chuo Main Line)

Take the Keio bus (Fuchu Station via Meisei Gakuen, Tera No91) from bus terminal no. 2 near the Kokubunji Station south exit and get off at the Harumicho bus stop. Ride duration: Approx. 10 minutes

○From Fuchu Station (Keio Line)

Take the Keio bus (Kokubunji Station south exit via Meisei Gakuen, Tera No91) from bus terminal no. 2 near the Fuchu Station north exit and get off at the Harumicho bus stop. Ride duration: Approx. 7 minutes

○From Kita-Fuchu Station (JR Musashino Line)

The campus is a 12 minute walk from the station.

Koganei Campus

○From the South Exit of Higashi-Koganei Station (JR Chuo Main Line)

The campus is a 10 minute walk from the south exit of the Station

○From the South Exit of Musashi-Koganei Station (JR Chuo Main Line)

The campus is a 20 minute walk from the south exit of the Station