

2019.2.1 JAPAN NANO 2019

## Toward further development of Nanotechnology Platform

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Technology

JST CRDS Specially Appointed Fellow

## Contents of my presentation

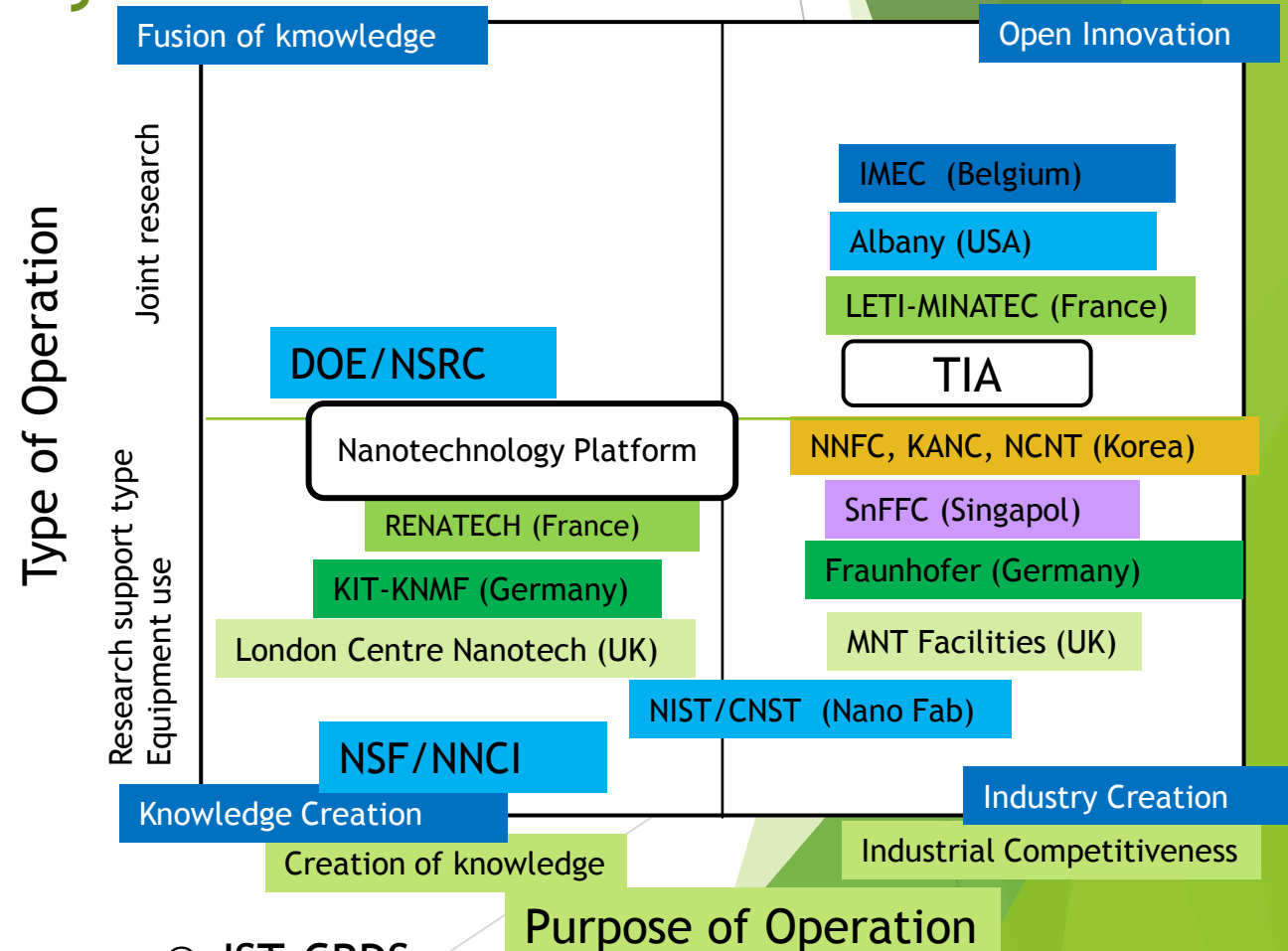
- ▶ In this presentation, I will describe a brief outline of Nanotechnology Platform of MEXT, which established culture of facility-sharing and has produced many outstanding results, and I will raise a problem for further future development.

# Background

- ▶ Advanced microstructure analysis equipment / microfabrication equipment is a research infrastructure that is indispensable for the development of IoT devices aiming at Society 5.0, but as its sophistication advances, prices become too expensive for researchers to purchase with a normal research budget .
- ▶ However, such an equipment was unevenly distributed only to some national research institutes, universities, laboratories, and was not opened to other researchers.
- ▶ Maintaining these devices requires specialized personnel with advanced skills, but universities and research institutes have become difficult to maintain such human resources.
- ▶ The large enterprises who have abandoned their own principles at the time of the open innovation era have stronger desire to utilize advanced nanotechnology equipment maintained by public funds.

# Type of common use : Research base of each country

- ▶ In the United States, South Korea and Taiwan, 10% to 15% of the nano technology state investment amount was systematically used for forming a shared facility network / base, and a network of highly advanced research infrastructure was constructed.
- ▶ In particular, the US NNIN (now NNCI), NCN (NSF) and Korea's six centers are almost complete as a common infrastructure for charging system and international correspondence. In Europe and Taiwan, networks of nanotechnology research infrastructure are formed by country / region unit.
- ▶ In the fulfilling dozens of bases networks in the United States, funds from the Federal Government are funded by about 30% of the total operation cost, taking full advantage of the many years of experience of the shared center.



## Nanotechnology Platform Project of MEXT started in 2012 FY

- ▶ Overseas, a network of nanotechnology infrastructure centers represented by NNIN (now NNCI) in the United States has been developed, and by sharing equipment, companies from all over the world gather and are promoting R&D.
- ▶ In Japan, we can not expect a drastic increase in the country's R & D budget. Recently, we need to take root in new R&D culture by sharing equipment and knowledge.
- ▶ Under the background, the nanotechnology platform business started in 2012 FY.
- ▶ Nanotechnology Platform is a 10-years project, aiming at establishing a nationwide sharing of facilities, by a close collaboration with the institutions with the most advanced research facilities on nanotechnology and know-how on utilization of precedent nano-support and nano-net projects.

Nano-support	Nano-net	Nano-plat
2002-2006	2007-2011	2012-2021

## Purpose of the Project

- ▶ To maximize R&D investment efficiency of industry, academia and government relating to nanotechnology, materials and devices.
- ▶ To promote common use of advanced facilities by diverse users of industry, academia and government, to provide approaches to solving technical problems of industry and research sites, and to promote industrial-academia collaboration and fusion of different fields.

## Fostering a new research culture

- ▶ From ownership to share (cycle of human beings, money, knowledge)
- ▶ From “vertical” (splitting) to “transverse” (fusion)
- ▶ From “close” to “open”
- ▶ From “analog” (independent) to “digital” (networking)
- ▶ From “local” (regional) to “global” (international)
- ▶ From personal viewpoint to user’s viewpoint
- ▶ From investment for own research to investment for solving user’s problems
- ▶ From relying on public funds to diversifying resources (Management sustained with appropriate usage fee accounting)
- ▶ From “flow” supremacy to “stock” emphasis
- ▶ From “traditional” areas by researchers in specific fields to interdisciplinary collaboration to develop “new areas”

## Outline of this project

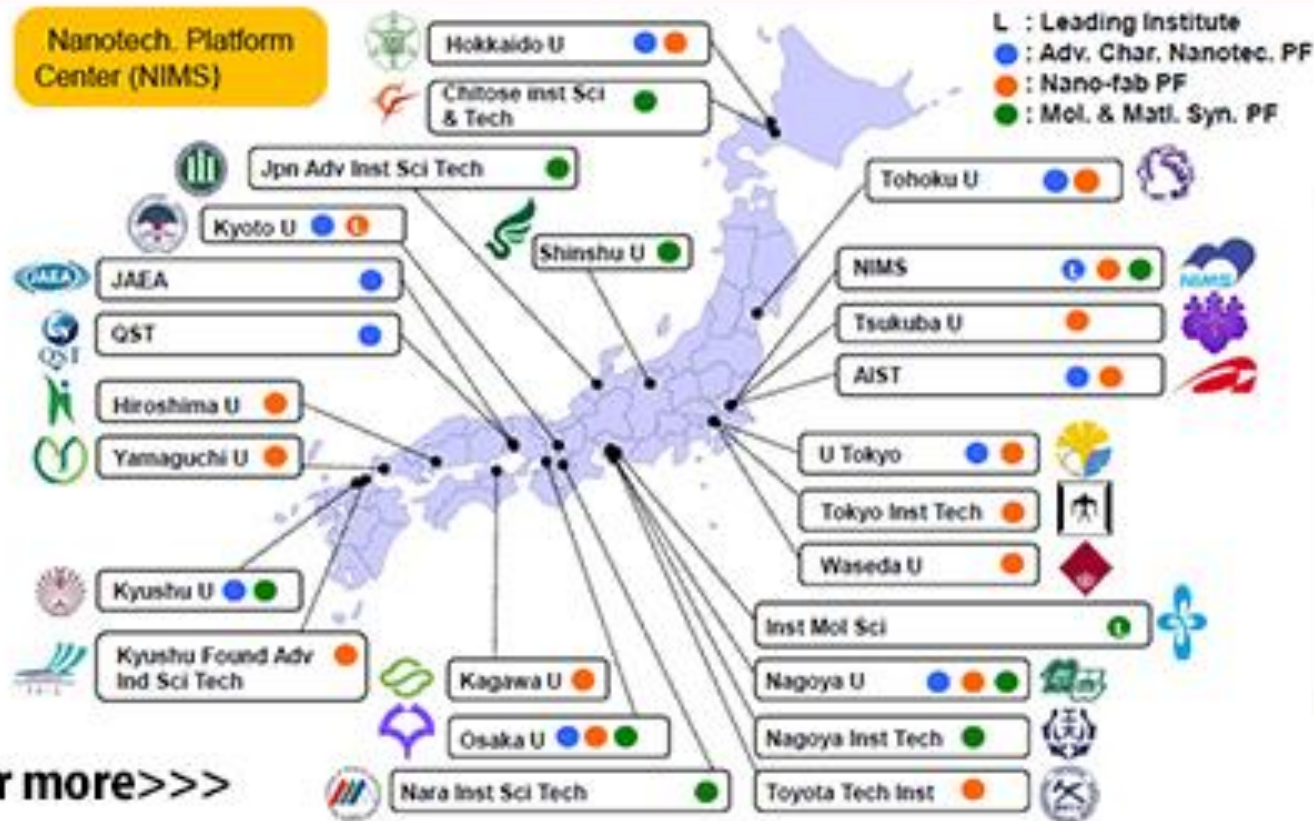
- ▶ By forming three platforms corresponding to (1) advanced characterization nanotechnology, (2) nanofabrication, and (3) molecule & material synthesis, we provide industry, academia and government with cutting-edge measurement and evaluation, processing and material synthesis environments, as well as advanced support technology and knowledge.
- ▶ The annual number of platform use amounts to about 3000.
- ▶ The entire platform is managed by combined budget of the project budget of the MEXT, the fee income from users, and the burden budget by the executing agency.



# Promotion system of nanotechnology platform (25 corporations nationwide, 37 organizations)



## 25 member institutes of Nanotechnology Platform (2012-2021 Fy)



Click for more>>>

**Advanced Characterization Nanotechnology**

Microscopes (TEM, SEM, SPM)  
Synchrotron Radiation

**Nanofabrication**

Nanofab. of semiconductors polymers, nanotubes and etc.

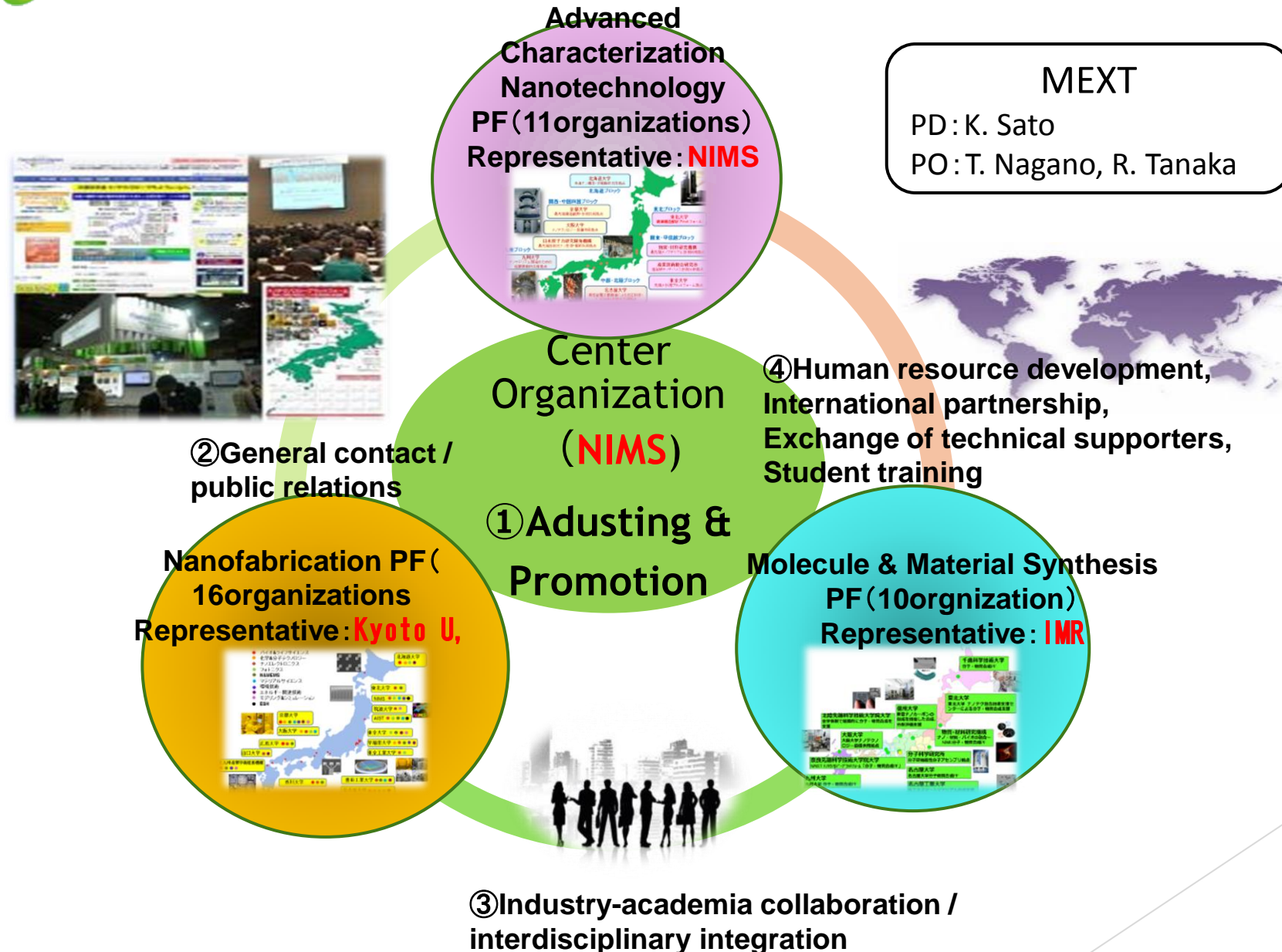
**Molecule & Material Synthesis**

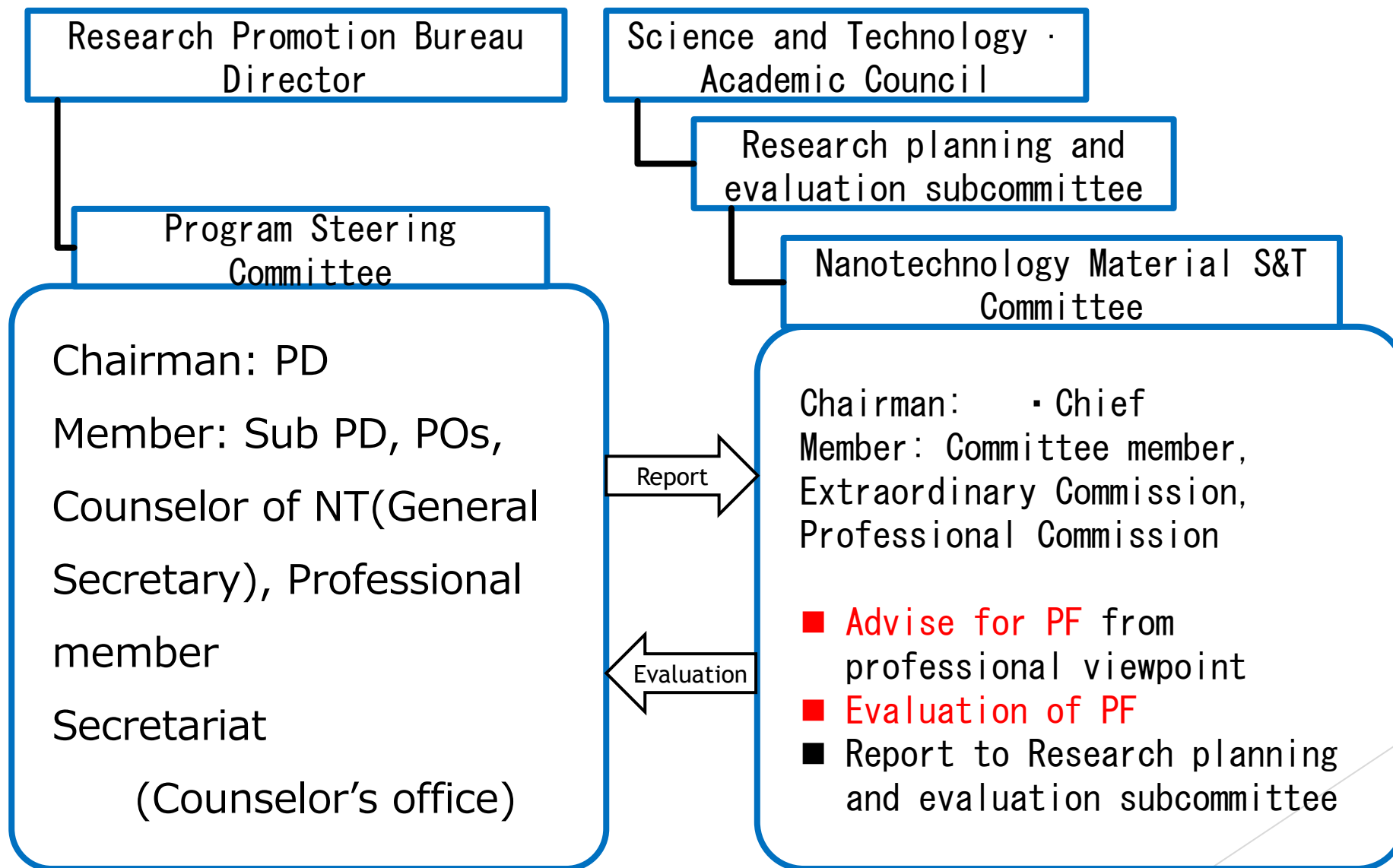
Molecular design & Measurement  
Synthesis of organics

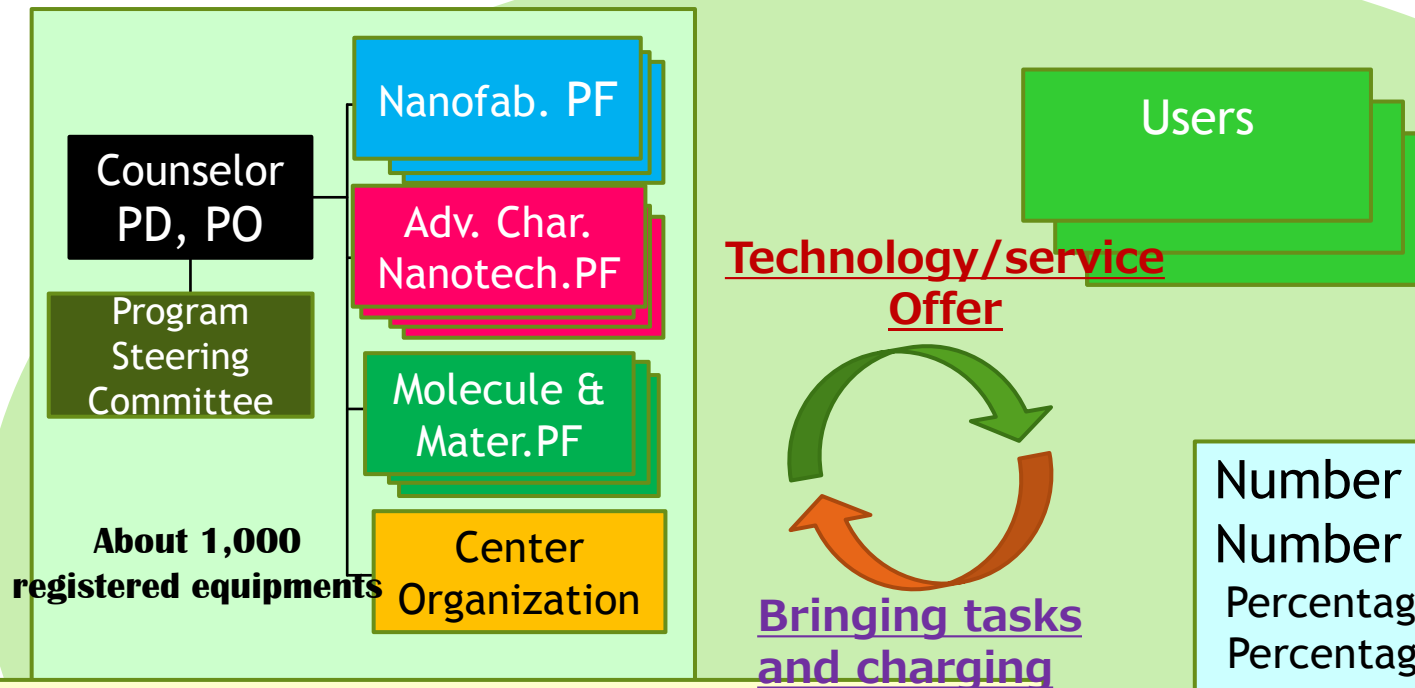
## Construction of Nanotechnology Platform

	Platform	Representing Organization	Implementing Institutions
Organization	Advanced Characterization Nanotechnology	NIMS	Hokkaido U., Tohoku U., NIMS, AIST, U. Tokyo, Nagoya U., Nagoya U., Kyoto U., JAEA, QST, Kyushu U.(11)
	Naofabrication	Kyoto U	Hokkaido U., Tohoku U., U. Tsukuba, NIMS, AIST, U. Tokyo, Tokyo Inst. Tech., Waseda U., Nagoya U., Toyota Inst. Tech., Kyoto U., Osaka U., Hiroshima U., Kagaaw U., Yamaguchi U., FAIS (16)
	Molecule & Material Synthesis	IMS	Chitose Inst.Tech., NIMS, JAIST, Shinshu U. Nagoya U., Nagoya Inst. Tech., IMS, Osaka U., NAIST, Kyushu U. (10)
Center		NIMS	

# Implementation system







### Participating staff of the nanotech platform

- Nanofabrication PF 271
- Adv. Char. Nanotech PF 319
- Mol. & Mat Synthesis PF 251
- Center Organization 27

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Total **868** (including **258 staffs employed by this project**)

In addition to representatives, coordinators, coordination managers, administrative staff, experts, highly specialized technicians, specialized technicians directly correspond to technical services

Number of Use : 13,437 (5 years)

Number of Users : **16,042**

Percentage of new users 53% (averaged)

Percentage of repeaters 47% (averaged)

### User attributes:

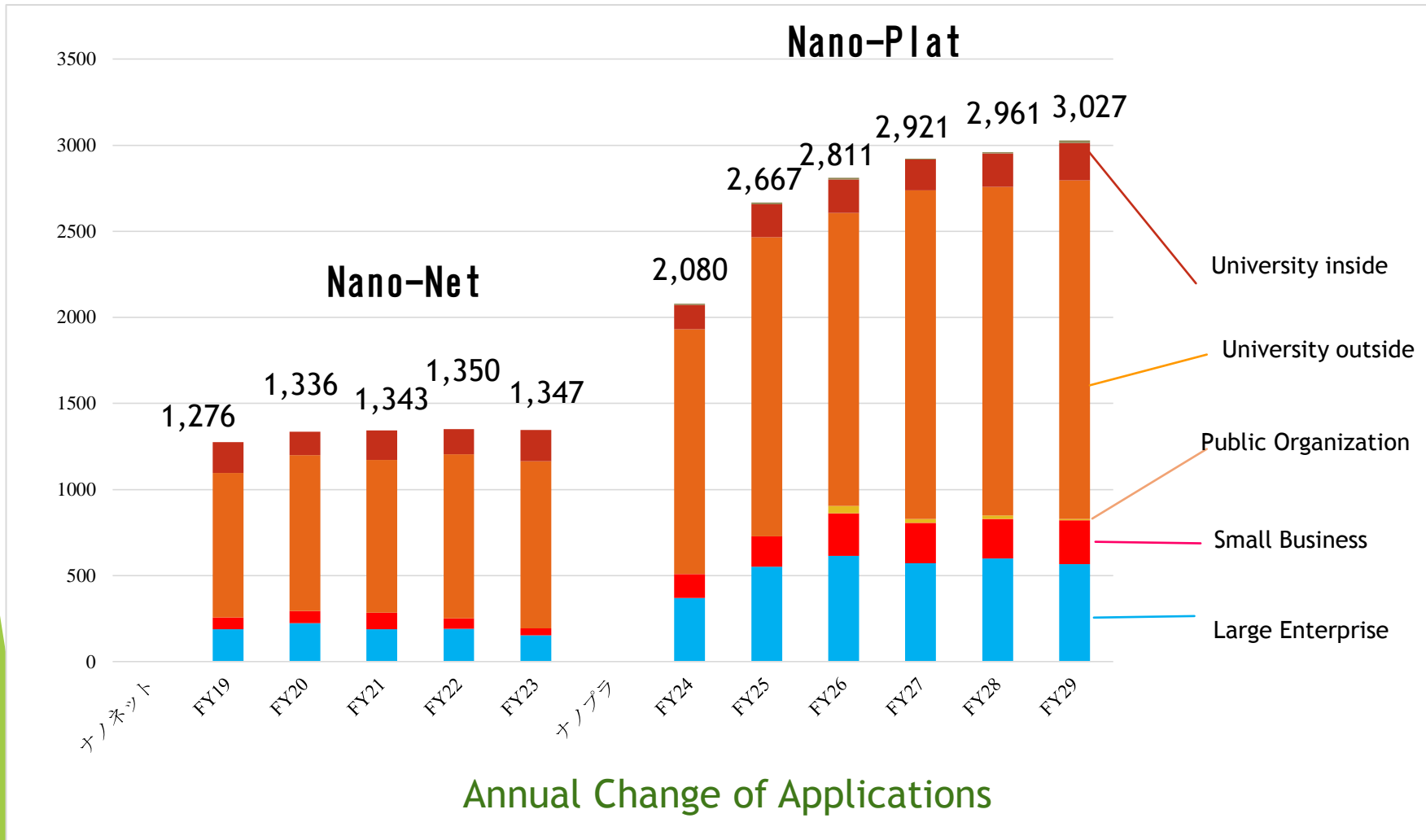
Industry 27% (large enterprise 20%, small business 7%)

University 64% (28% inside the university, 36% outside the university)

Public agency 7%

Other 2%

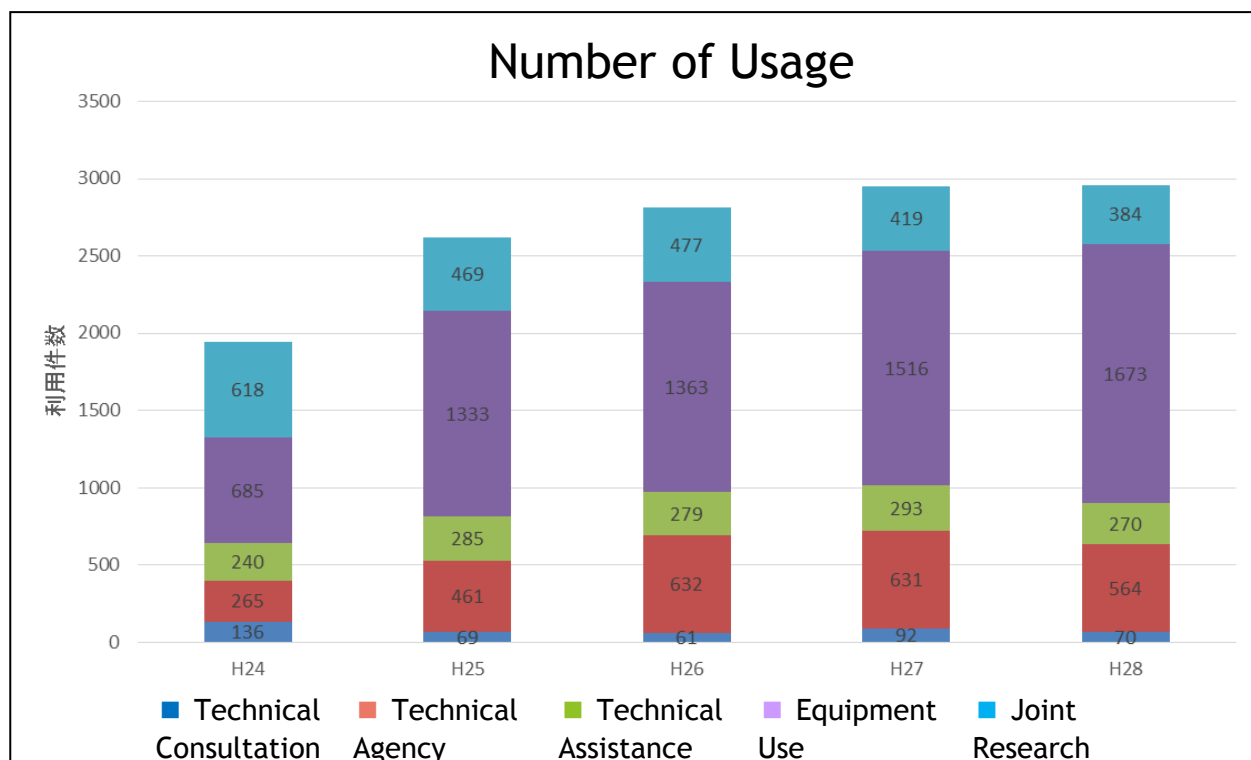
Nanotechnology Platform offers rapid R & D infrastructure functions essential for industry and academia



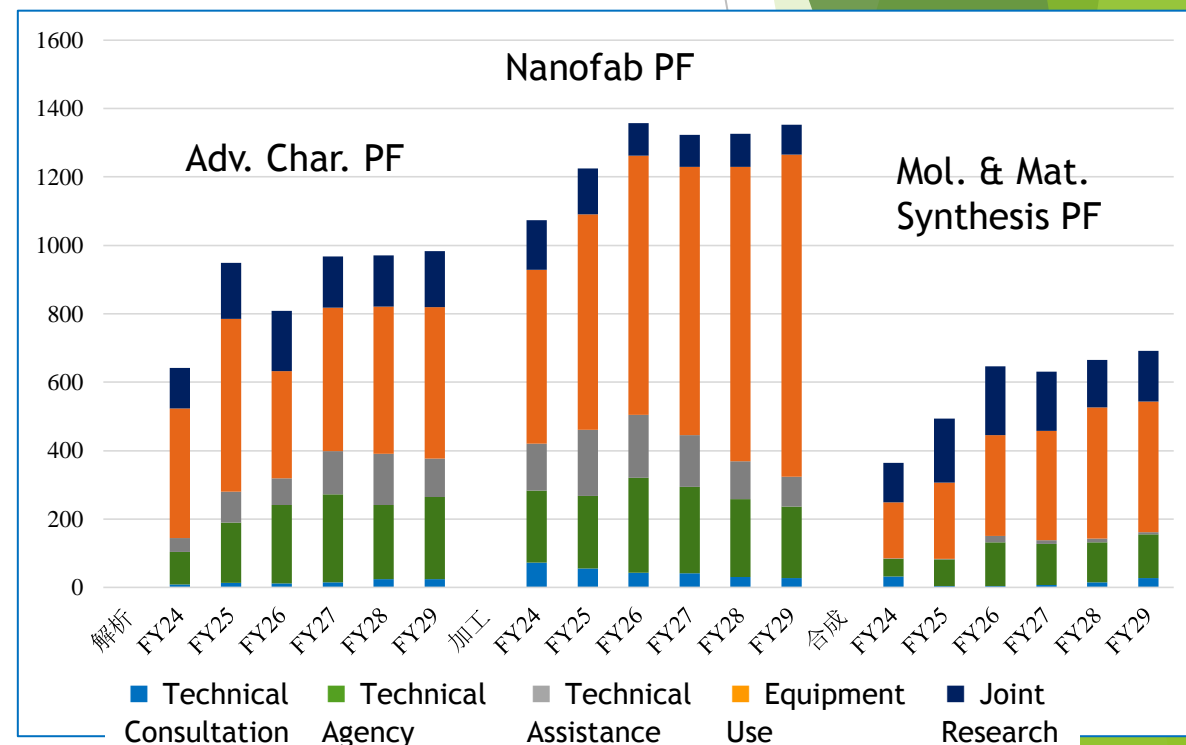
The number of applications was about 1000 annually in the previous nano-net era, but in nano-plat, it reached 3000 in FY2007. Among them, the use of enterprises has reached 27% of the total.

# Usage status by usage type

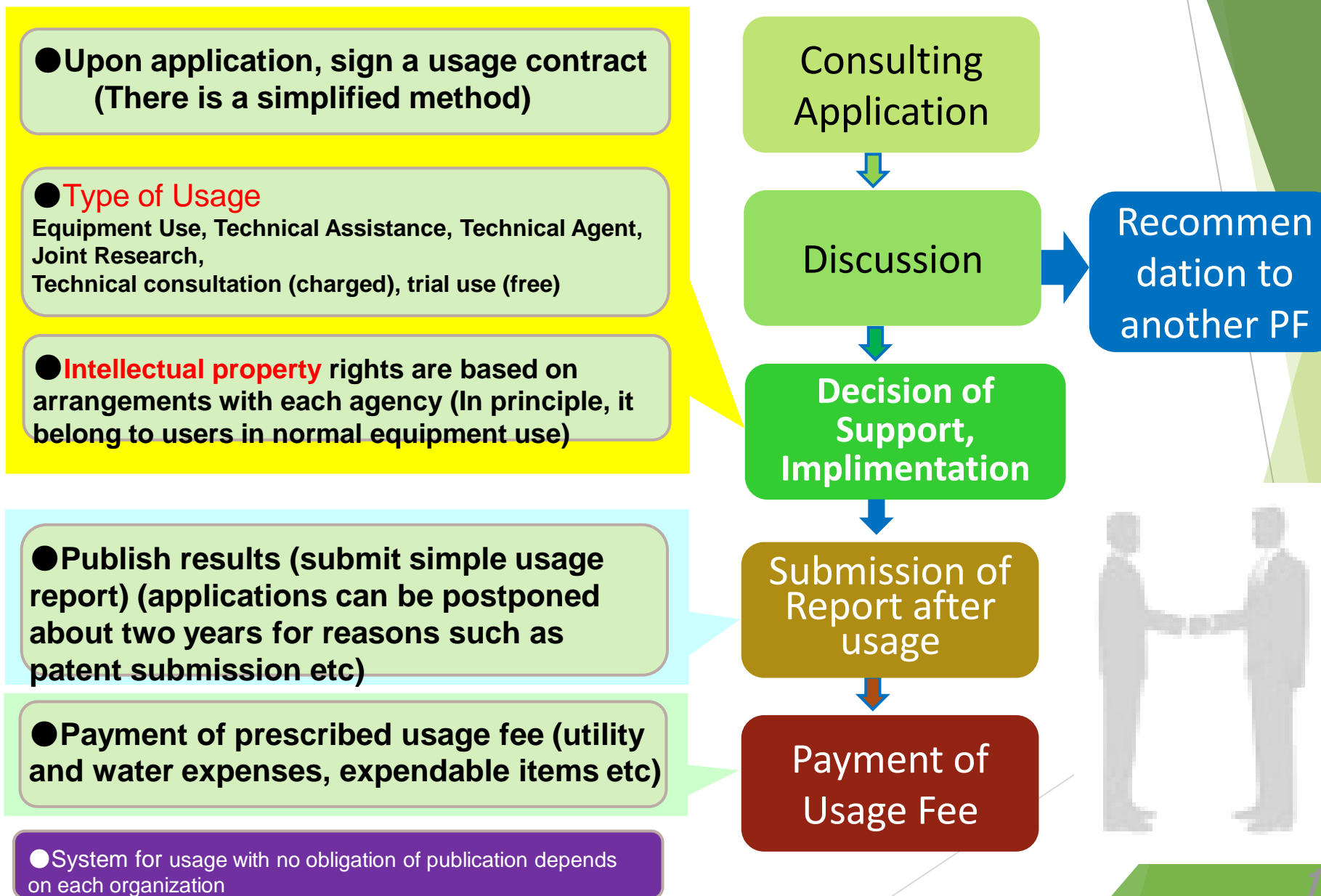
Equipment usage is mainstream,  
but technical agency tends to  
increase



Usage Type is different for  
different PF



# Flow of using Nano-Plat





# General Contact (Center Institution)

## WEBページ(https://nanonet.go.jp)

文部科学省ナノテクノロジープラットフォーム

ページ内検索

検索

ナノテック共用機器検索サイト  
Nanotech Yellow Pages

全国の最先端ナノテック共用研究設備の検索サイト

ナノテクノロジープラットフォーム  
Yellow Pages  
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Life & Green  
Web MAGAZINE  
nanotechJapan Bulletin  
ナノテクノロジープラットフォーム

2018/12/26 Vol.11, No.6発行!!

【最新号記事】  
走査型透過電子顕微鏡観察による $\text{Co}_3\text{O}_4/\text{Ga}_2\text{O}_3$  結晶子の断面観察  
有機系浮遊粒子状物質を捕出するMEMS形センサの開発  
電子線リソグラフィ加工による周期的ナノ構造を利用した有機発光デバイスの高効率化  
大腸菌を用いた新規ペプチドイソキサリナルカロイド誘導化レチクリンの生成

### 最新情報 What's New

秀 平成29年度  
でた利用成果

「秀でた利用成果」6件が決定!!  
受賞課題はこちら

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平成29年度 技術スタッフ表彰が決定!  
文部科学省 ナノテクノロジープラットフォーム

### 最新イベント Events Pick Up

第17回ナノテクノロジー総合シンポジウム  
JAPAN NANO 2019  
2019年2月1日(金)  
東京ビッグサイト会場  
レセプションホール

nano tech 2019  
国際ナノテクノロジー総合展・技術会議  
2019.1.30(木)~2.1(火)  
東京ビッグサイト 東46ホール  
ナノテクノロジープラットフォーム 会場番号:6S-04

AIIST  
ナノテクノロジープラットフォーム  
産業研究・微細構造解析プラットフォーム  
1930年度(第2回)地域活性化  
第50回名古屋駅前イノベーション  
技術シーズ発表会  
2019年2月1日(金) 13:00  
会場:名古屋駅前イノベーション  
センター

2019年 第66回  
応用物理学会  
春季学術講演会  
The 66th JSAE Spring Meeting, 2019  
2019年3月9日(土)~12日(火)  
東京工業大学 岡山キャンパス

日本化学会  
第99春季年会2019  
2019年3月16日(土)~19日(火)  
甲南大学 岡本キャンパス

### 事業総合ポータル NanotechJapan --- さらに詳しく !!

全国25の大学・研究機関の最先端共用設備を自由に利用して、課題を速やかに解決しよう!!

#### 微細構造解析プラットフォーム



#### 微細加工プラットフォーム



#### 分子・物質合成プラットフォーム



#### ダウンロード

- パンフレット/Pamphlet
- リーフレット/Leaflet
- ビデオ/Video

#### 最新情報 What's New --- 詳しくはこちら

秀 平成29年度  
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#### ナノテックニュース

Nanotech News

メールマガジン  
購読者募集中!

NanotechJapan  
Mail Magazine

購読希望の方は  
こちらから  
登録ください

ナノテクノロジーの最新の成果を連載したWebマガジン  
について、購読は無料です。ぜひご登録ください。

#### 最新ニュース News

- 参考機関から
- 政府・公的機関から
- ナノテック情報
- ナノテックニュース

中分類検索結果

機関:> 物質・材料研究機構 中分類:> 電界放出型走査電子顕微鏡



英語名: Field-Emission Scanning Electron Microscope, FESEM. 超高真空環境で鋭い陰極先端に高電界を印加して電子放出させる電子銃を用いた走査電子顕微鏡で、電子線の直径が小さいため高い空間分解能が得られる。

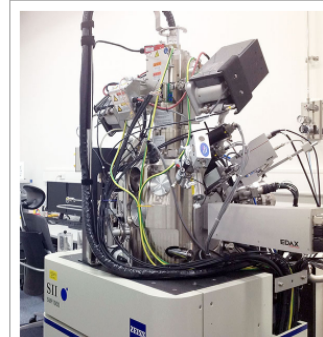
該当する機器 件数: 3件

写真	設備名称	設置機関	研究分野	仕様
	微細組織三次元マルチスケール解析装置	物質・材料研究機構	微細構造解析	エスアイアイ・ナノテクノロジー社製SMF-1000 FIB-SEM-Ar-ionのトリプルガンに装備した電子顕微鏡。FIBとSEMを直交に配置することによって...
	FIB-SEMダブルビーム装置	物質・材料研究機構	微細加工	SIIナノテクノロジー社製: XVision200DB FIB/SEM加速電圧: 1~30kV カーボンデポジションシステム マイクロプロービングシステム...
	観察・評価装置	物質・材料研究機構	微細加工	1 走査電子顕微鏡 (日立ハイテック社製: S-4800) 加速電圧: 0.1~30kV リターディング機能搭載 最大試料寸法: φ61mm...

研究設備詳細情報

※本サイトは、現在試験運用中です。表示される設備の情報等は、テストデータですのでご注意ください。(設置機関への問い合わせフォームも、準備中となっております。)

事業名	ナノテクノロジープラットフォーム
機器ID	A-NM-030
分類	特殊プローブ顕微鏡 > 三次元マルチスケール解析 走査電子顕微鏡 > 電界放出型走査電子顕微鏡 表面分析装置 > エネルギー分散型蛍光X線分光(EDS)
設備名	微細組織三次元マルチスケール解析装置
地域	関東
設置機関	物質・材料研究機構
研究分野	微細構造解析
仕様	エスアイアイ・ナノテクノロジー社製SMF-1000 FIB-SEM-Ar-ionのトリプルガンに装備した電子顕微鏡。FIBとSEMを直交に配置することによってシリアルセクションングによる3D観察を行うことに特化した装置で、高い空間分解能・高いコントラストでの3D再構築観察が可能。SEM像は通常のET検出器のほか、インレンスの二次電子、反射電子検出器を装備し、1kV以下の極低圧観察が可能。そのほか、EBSO,EDS,STEM(BF,ADF)などの多様な検出器による同時測定が可能。



NANO-LINKING INNOVATION

ナノテクジャパンは、文部科学省「ナノテクノロジープラットフォーム」の一環として、全国の産学官が連携して、最先端研究開発及び研究支援能力を分野横断的にかつ最適な組合せで提供できる共有システムを構築し、研究開発者への貢献を目指して活動しております。

キーワード検索

[お問い合わせ]

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文部科学省ナノテクノロジープラットフォーム共有設備利用案内サイトへようこそ！ 研究開発に必要な最先端の装置群を日本全国の研究機関から選べます。

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- 分子・物質合成

プラットフォームから探す

- ▶ 微細構造解析
- ▶ 微細加工
- ▶ 分子・物質合成
- ▶ 蓄電池基盤

研究機関から探す

- ▶ 北海道大学
- ▶ 千歳科学技術大学
- ▶ 東北大学
- ▶ 物質・材料研究機構
- ▶ 産業技術総合研究所
- ▶ 筑波大学
- ▶ 東京大学
- ▶ 早稲田大学
- ▶ 東京工業大学
- ▶ 徳川大学
- ▶ 北陸先端科学技術大学院大学
- ▶ 分子科学研究所
- ▶ 名古屋大学
- ▶ 名古屋工業大学
- ▶ 豊田工業大学
- ▶ 京都大学
- ▶ 奈良先端科学技術大学院大学
- ▶ 大阪大学
- ▶ 日本原子力研究開発機構
- ▶ 量子科学技術研究開発機構
- ▶ 香川大学
- ▶ 広島大学
- ▶ 山口大学
- ▶ 北九州産業学術推進機構
- ▶ 九州大学

関連リンク

エリアから探す

地図をクリックすると、そのエリアで絞り込み検索した共有施設のページが表示されます。

【検索結果もお気軽に！】

ナノテクノロジープラットフォームセンター ☎029-859-2777

設備分類から探す 件数: 32件


NanotechJapan

全国23機関の最先端研究開発施設が連携し、高度な専門サービスを提供

充て込研究設備共有ネットワーク

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微細構造解析 微細加工 分子・物質合成

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Life & Green Web MAGAZINE

NanotechJapan Bulletin

ナノテクノロジープラットフォーム

2018/12/26 Vol.11, No.6 発行

【最新記事】

走査型透過電子顕微鏡観察によるコヒーレント $\alpha$ -Al<sub>2</sub>O<sub>3</sub>/Ga<sub>2</sub>O<sub>3</sub>超格子の断面観察

有機系浮遊粒子状物質を抽出するMEMS型センサの開発

電子線リソグラフィ加工による周期的ナノ構造を利用した有機発光デバイスの高効率化

大規模を用いた新規ベンジルイソキノリンアルカロイド総合成法

イベント案内

第17回ナノテクノロジー総合シンポジウム JAPAN NANO 2019

2019年2月1日(金)

東京ビッグサイト食糧棟 レセプションホール

nano tech 2019

国際ナノテクノロジー総合展・技術会議

2019.1.30(木)~2.1(金)

東京ビッグサイト食糧棟 レセプションホール

第50回名古屋大学イノベーションイシューズ発表会

2019年1月30日(木) 13:00~15:00

名古屋大学 大講義室

# Confirmation of executing agency's awareness at site visit



- ▶ PD and PO accompanying with the officials with Counselor of Nano / Materials of MEXT make site visit to each executing agency to grasp the current situation, and help to solve the problem.
- ▶ Since the project is a long-term project with a period of 10 years, it is not necessarily that there are cases where the responsible persons of the executing agency are replaced and the original intention is not succeeded. At the site visit, we are requesting the inheritance of each institution's original intention and responsibility awareness.

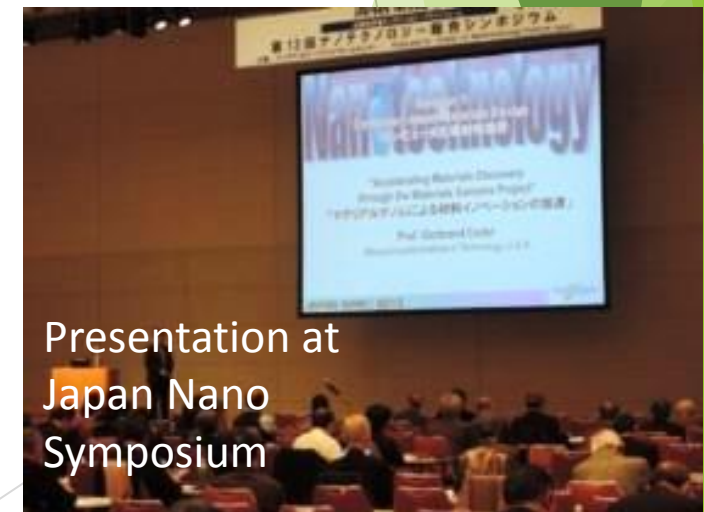
## Public Relations / Promotion of use (Center Organization)

Public relations activities at exhibition  
presentations and academic societies exhibitions

- Publication of Achievements at Japan Nano Symposium (Tokyo Big Site)
- Presentation and Exhibition at Academic Society Meetings such as JCS, JSAP, NBCI, JASIS, Semicon-Japan
- Working with SMEs and Public Examination by Cooperation Manager(until 2017 FY)



Exhibition at Nano Tech  
Booth

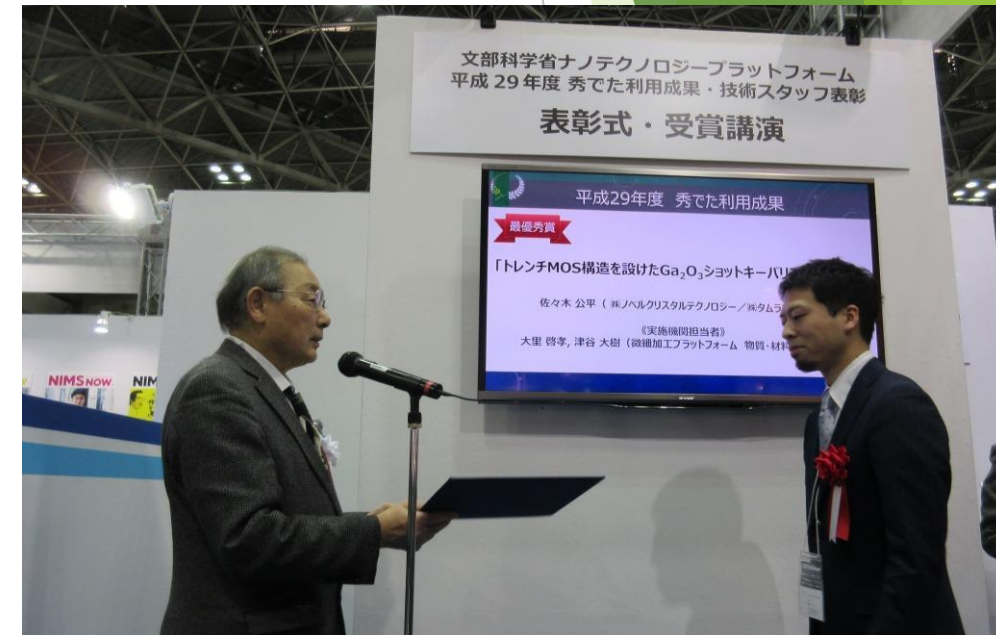


Presentation at  
Japan Nano  
Symposium

## Recognition of Excellent Utilization Achievement

A lot of research results have come out from Nanoplat. At the end of each FY, a commendation by experts will select several "outstanding utilization outcomes" and the best award from among them and will be honored at the Nanotechnology Japan site

- ▶ Best Awards of each FY
- ▶ 2018FY “Development of broadband wavelength swept pulse quantum cascade laser” (User: Hamamatsu Photonics inc., Support: Tohoku Univ.)
- ▶ 2017FY “Ga<sub>2</sub>O<sub>3</sub> Trench MOS-Type Schottky Barrier Diodes” (User: Novel Crystal Technology Inc., Support: NIMS)
- ▶ 2016FY “Nano-scale analysis of self-assembled metallic nanopillars for photoelectrochemical water splitting “ (User: ISSP, Support: Nagoya Univ.)
- ▶ 2015FY “Synthesis and analysis of 3,4-dichloromethylphenidate” (User:NIT, Support: IMS)
- ▶ 2014FY “Vacuum ultraviolet field emission lamp using fluoride thin film” (User: Tokuyama Inc., Support: Nagoya Inst. Tech.)
- ▶ 2013FY “Development of Silicon Electret Microphone” (User: Rion, Support: Tohoku Univ.)



Ceremony of Recognition (2018.2.14)

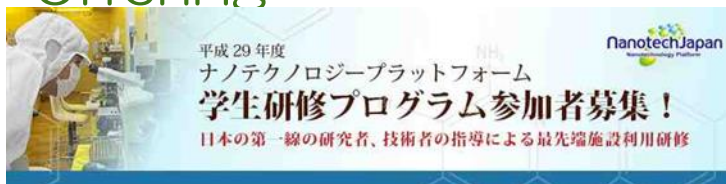
These achievements were evaluated for their contribution to solving social problems

# Human resource development

(Improvement of technical skill of PF technical support person, user, student)

Mutual offering of full training menu from all agencies for technical supporters and users. We offer each exclusive menu for students. New device skill · To acquire advanced knowledge

- ▶ Provision of technical skills training to more than 200 technical assistants employed in Nanoplant
  - Start function assignment system according to mastery skills (Experts, highly specialized technicians, specialized technicians)
- ▶ Define skill standards, review each PF, grant through committee
  - Short-term training opportunities for similar organizations in Europe and the United States
- ▶ Contributing to skill improvement and human resource development of users
- ▶ Provide training programs for students nationwide, accepted by public offering



It is also an important mission of this project to appreciate the "skill of the artist" of the technical staff who is a rich subordinate existence and promote career formation



- ▶ 2017FY Technical Staff Recognition
- ▶ Excellent Technology Award : A. Kumamoto ( Univ. Tokyo )
- ▶ Excellent Technical Support: Y. Kishimura (Microfab PF, Yaomaguchi Univ.), H.Ando & S.Takeuchi (FAIS)
- ▶ Young Staff Encouragement Prize: K.Higuchi Nagoya Uiv. )
- ▶ 2016FY
- ▶ Excellent Technology Award : S.Arai (Nagoya Univ.)
- ▶ Excellent Technical Support: K. Okitsu (Univ. Tokyo)
- ▶ Young Staff Encouragement Prize: Y.Yamamoto (Nagoy Univ.)



## Contribution to promote university system reform

- ▶ Nanotechnology Platform triggered the creation of a shared system in various universities and induced rule reform
- ▶ In particular, the management method of the accounting model and the income / expenditure structure was also used as a reference for other universities and other projects
- ▶ In the Infrastructure Sharing Promotion Project of MEXT, the experience and mechanism of Nanoplant is widely used and developed (→right figure)



80 Research organization from 39 institutes have introduced the new Infrastructure Sharing System of MEXT



# Outline of mid-term evaluation(1)

Mid-term evaluation was performed in 2014 and 2017 FY.  
Here outline of the latter is introduced below.

## (1) Overall situation and evaluation

- ▶ Utilization number and usage fee income are increasing year by year, utilization is fixing and expanding, the number of related papers and the number of patent applications are also increasing year by year. The collaborative system with the representative organizations and executing agencies of each platform (hereinafter referred to as PF) is well functioning, and improvement of convenience is attempted.
- ▶ The number of citations of research papers supported by this project is steadily increasing as a contribution to the improvement of research capabilities of universities and other institutions. Since the top 1% citation and the top 10% paper are also included, it is clear that high quality research is supported.
- ▶ As a result of this project, sharing of facilities and introduction of charging system are advancing, contributing to reform of common system in university. It contributes to effective utilization of research and development budget of the country, improvement of research efficiency, and allows accumulation and succession of experience and knowledge on nanotechnology, materials science and technology
- ▶ The Nanotechnology Platform has engaged in training human resources such as training for improving skills of technical support personnel employed in this project, function name granting system for motivation improvement, technical support person awards.

# Outline of mid-term evaluation(2)

## (2) Situation and evaluation of each PF

### 【Advanced Characterization Nanotechnology PF (Representative: NIMS)】

- ▶ Highly appreciated the point that it has the function of independently developing analysis technology.
- ▶ Evaluate unique measures such as collaboration with analytical company, sharing of technical needs trend by the council, utilization of big data, etc.
- ▶ We expect to respond to new fields in the future. For executing agencies with large research facilities, we expect measures to expand usage

### 【Nanofabrication PF (Representative: Kyoto Univ.)】

- ▶ The number of uses, usage fee income, use from companies, etc. are growing, leading to productization from technical support.
- ▶ Evaluate the system of providing provision of quality guaranteed across the executing agency and the system for using consultation and technical consultation with a coordinator inside the representative organization.
- ▶ As a measure to respond to requests for technical agency and support, we evaluate active attitude towards act, including considering "new substitution model". Looking forward to strengthening efforts to improve the quality of support

### 【Molecule & Material Synthesis PF (Representative: IMS)】

- ▶ It can be seen that there are many citations of research papers and that they provide academically high-quality support. The synthesis support function is valuable and highly appreciated.
- ▶ Molecular and material synthesis is the essence of nanotechnology and we strongly expect leadership of representative organizations to make effective use of this PF.

### 【Center Institutions (NIMS, JST\*)】 \*Ended work as center institution in 2017 FY

- ▶ Strengthening the integral efforts of the entire project by the administrative officials' conference etc., sharing problems, expanding new users, promoting industry-academia-government cooperation promotion managers to develop different fields, efforts of "trial use" project, etc.
- ▶ We plan the outcome presentation meeting and business introduction symposium etc and devoted ourselves to recognition of this project. Efforts such as awards to users and executing agencies and recognition of technical support persons, etc. are evaluated from the viewpoint of securing incentives for both users and supporters.

## Outline of mid-term evaluation(3)

- ▶ Future direction of the platform
  - Predicting the trend of science and technology fields from now on, planning again the strategy that should exist as PF, and reviewing such as replacing some executing agencies and providing technologies from the viewpoint of efficient provision of assistive technology.
  - To further promote the sharing of equipment and to further improve the external sharing ratio, review the lineup of registered equipment.

# Approach to improvement by receiving mid-term evaluation

- (1) Strengthened response to changing needs for corresponding areas IoT, Bio etc.
- (2) Strengthening of careers of staff and review of equipment lineup
- (3) Scheduled to report on strategy planning "Advanced shared facilities / technology platform perspective WG"
- (4) Usage fee calculated from the provisional market price with the required cost execution amount, provided value in mind, PF actual circumstances consideration
- (5) PF will advance internationalization of the environment.
- (6) Activities of the project widely communicating the outcome and results, conduct activities to gain understanding
- (7) Contribution to reform Act as much as possible to promote reform of the system
- (8) Particularly cooperate with NIMS's Information Integrated Materials and Materials Research Base (MI 2I)
- (9) Make note of the three aspects of scientific excellence, promotion of innovation, contribution to the region
- (10) Efforts to further enhance the external sharing ratio of external common promotion equipment

## Breakthrough of bottlenecks in improving quality of support and responding to new support

- ▶ In order to break the situation that is a bottleneck in improving the quality of support and responding to new support requests,
  - ▶ Increase in maintenance costs associated with long-term use of equipment
  - ▶ Replacing outdated equipment to state-of-the-art
  - ▶ Staff 's term of employment with assistance is becoming obvious.
- ▶ I would like to request drastic and continuous policies of the country.
  - ▶ Clear separation on the budget of research expenses and research facilities.

## Future issues : Direction of initiatives

- Growth and leap of the nanotechnology platform for 7 years, next to the nano-net 10 years
  - The ecosystem surrounding PF is evolving → dealing with impeding factors
  - Responding to new services, new technologies and new devices that can fight in the world
    - *Data PF collaboration*
    - *Strengthen responsiveness of bio and IoT areas*
    - *New technology development*
    - *Repair / renewal of aged equipment*
    - *Strengthen international partnership and exchange*
- Promote reform of universities and national universities, Nano-Platform constantly stepping forward, contributing to society as a third mission lineup of university research, education
  - *Promotion of cooperation with other projects and other organizations*
  - *Evaluation of professors / staff who contributed*
  - *Promotion of career development*

Thank you for kind attention