



# Chances and Challenges of R&D Management in 21st Century

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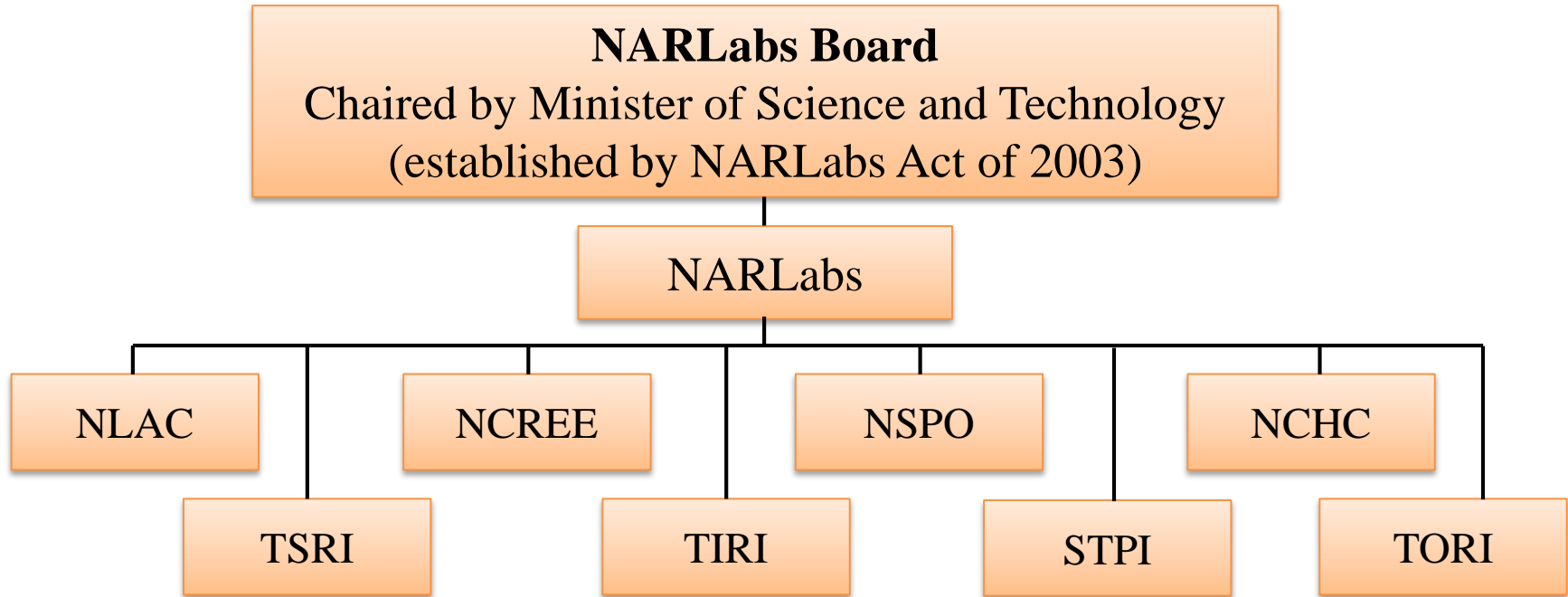
2019/03/25

## **Outline**

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- **NARLabs Organization**
- **Exponential Technologies Manifest Uncertainties in R&D**
- **The Challenges of Open Innovation**
  - Sharing
  - Intangible Assets
  - Flexibility
- **Conclusions**

# NARLabs Organization



➤ **Human Resource: 1,389** employees

➤ Education levels

Ph.D	M.D.	Others
334 (24%)	683 (49.2%)	372 (26.7%)

➤ HR Profiles

R&D Staff	Technician	Engineer	Administrator
596 (42.9%)	232 (16.7%)	325 (23.4%)	236 (17%)

➤ **Financial information: USD \$273 M**

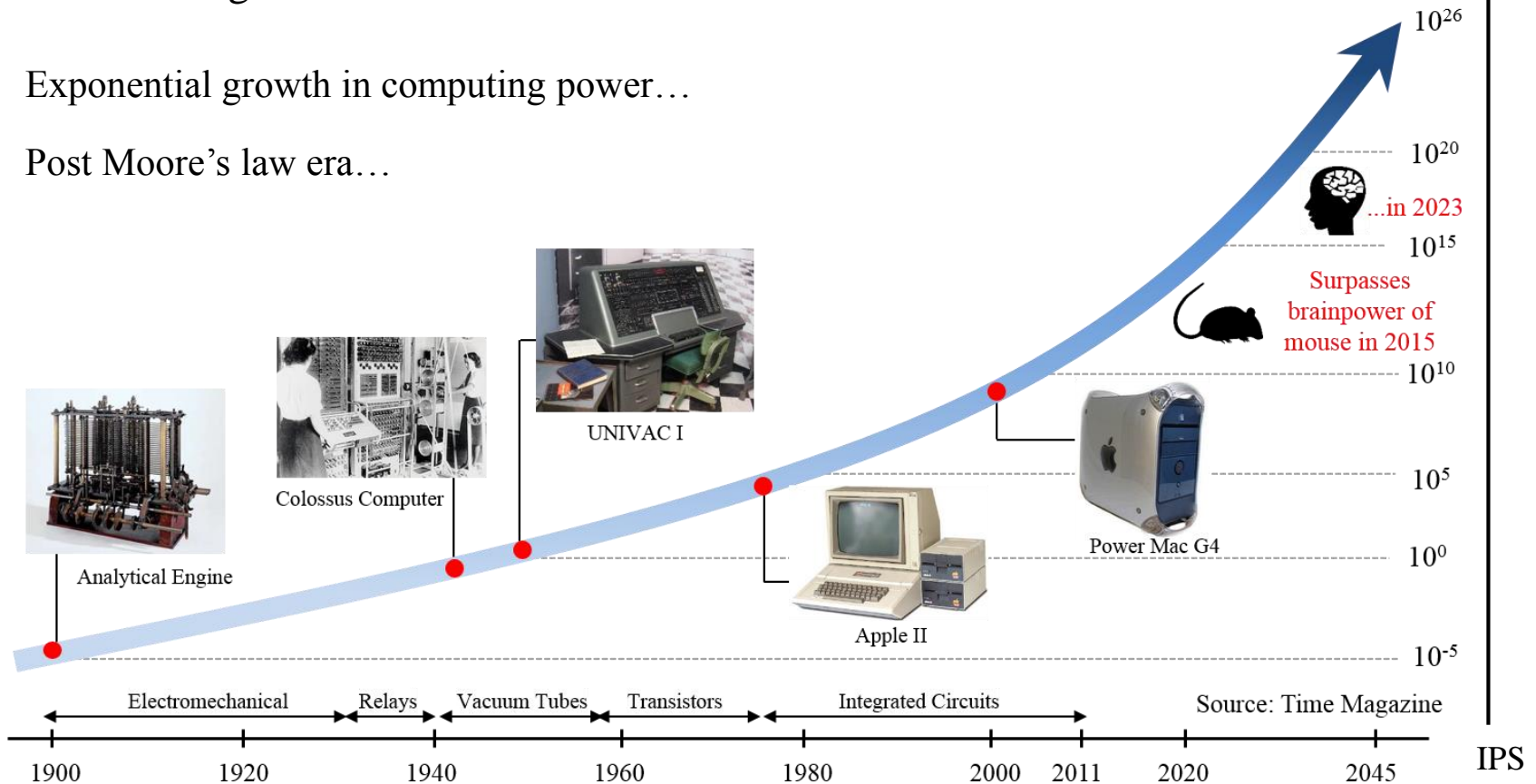
Funds	Number (USD)	Ratio (%)
Grants	211.2 M	77%
Government agency	41.2 M	15%
Private sector	21.4 M	8%

# Exponential Advances in Technologies **NAR Labs** Manifest Uncertainties in R&D

- Development trend of science and technology grows in exponential rate, and technological breakthroughs are accelerating..
- Three disruptive technologies. (1) Mobile internet, (2) Automation of knowledge work, (3) Internet of things.

1 Exponential growth in computing power...

2 Post Moore's law era...



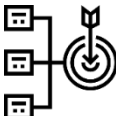


# 21<sup>st</sup> Century R&D Management: Open Innovation

Due to the technological exponentials, global demographic shift, and the phenomenon of climate change, open innovation was most frequently mentioned solution model in 21<sup>st</sup> century R&D management.

- Use outside knowledge and expertise to support technology innovation.
- Reduce the development/innovation gaps.

Ref : Mariann Jelinek et al, 21st-Century R&D, Research-Technology Management, 55, 16-26, 2012.

	Challenge	Chance		Response by NARLabs
<p><b>Sharing</b></p> 	Going it alone is out-of-date	Close relationship with academic and research communities	↔	<div style="border: 2px solid blue; padding: 10px;"> <p>1. Technology Platform 2. Alliance/Collaboration</p> </div>
<p><b>Intangible Assets</b></p> 	Give full play to intangible assets	Multidisciplinary talents and core competencies	↔	<div style="border: 2px solid red; padding: 10px;"> <p>Talent Flow/ Fostering &amp; Social Network</p> </div>
<p><b>Flexibility</b></p> 	Fear of volatility & uncertainty	Matrix management and rapid-responding mechanism	↔	<div style="border: 2px solid green; padding: 10px;"> <p>Flexible Organization Structure</p> </div>

# Resource Sharing : Technology Platform



University



Research institute



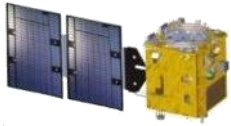
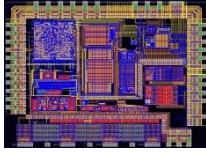




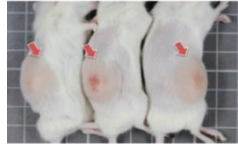

Private sector



Hospital

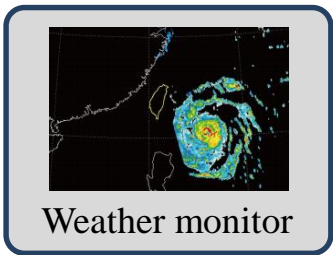
Platform Establishment  
(Linked with academic research resources and industry application)

**NARLabs**  
(Semiconductor, Instrument, Computing, Earthquake, Animal, Space, Policy, Ocean)

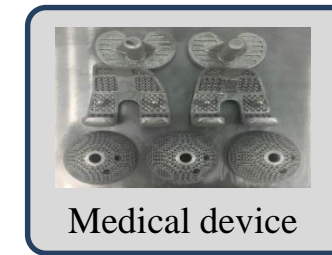
 FORMOSAT-7R	 IC Design/Fabrications	 HPC & Cloud	 Medical Test
 ROV	 3D Printing	 ASID mice	 Machine operation

Platform Sharing

Commercial product · Interdisciplinary application



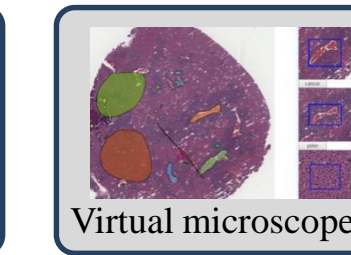
Weather monitor



Medical device

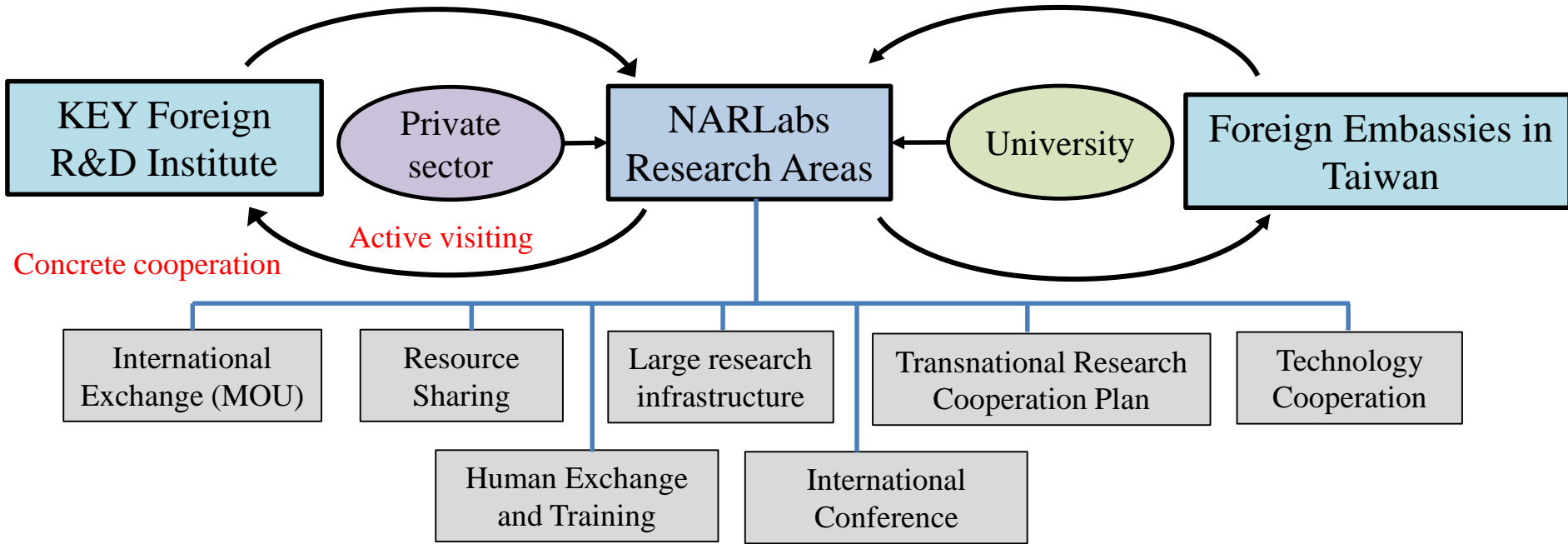


MorSensor



Virtual microscope

# Resource Sharing : Global R&D Alliance/Collaboration

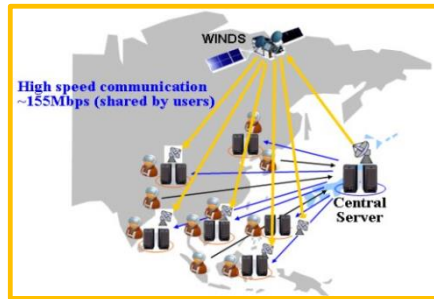


Asian STI Think Tanks Network

Sentinel Asia (PRAGMA)

New Southbound S&T Cooperation

National Contact Point (Horizon 2020)





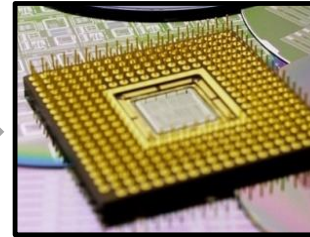
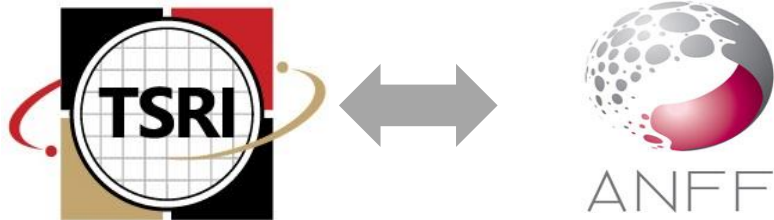
# Resource Sharing : Global R&D Alliance/Collaboration

KEY Foreign R&D institute

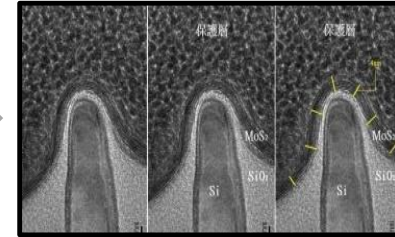
Technology Platform

Development

Semiconductor & Instrument

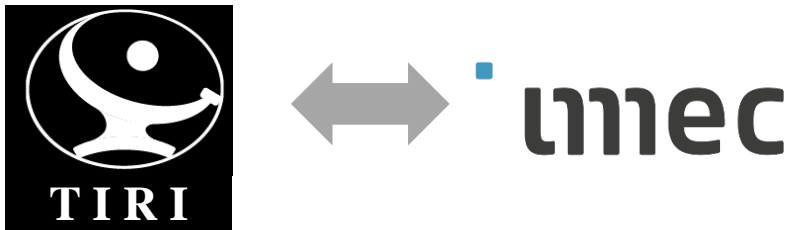


IC/System



Fabrication innovation

Advance imaging & Optics application

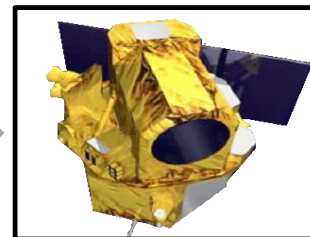
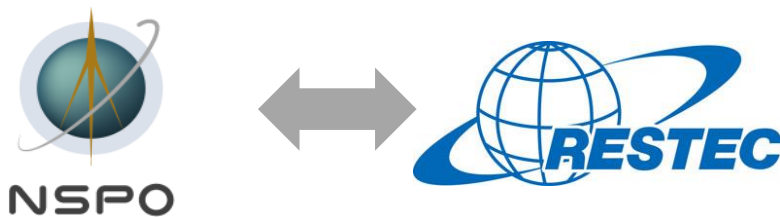


Optical system



Hyperspectral technology

Image Processing Technology



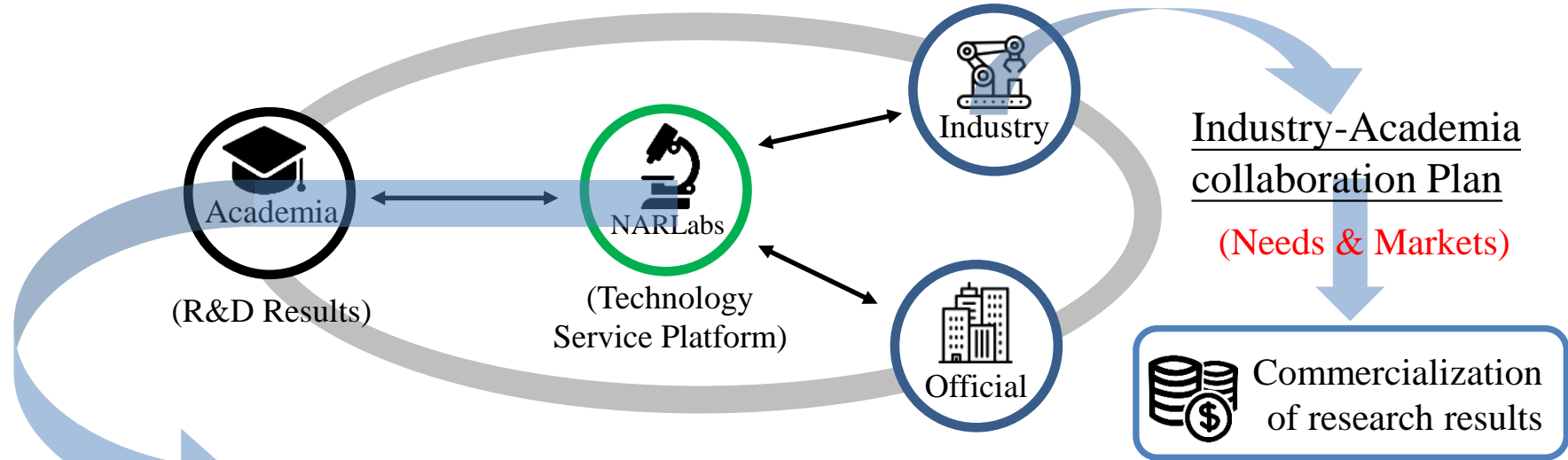
FORMOSAT-2



Environment monitor



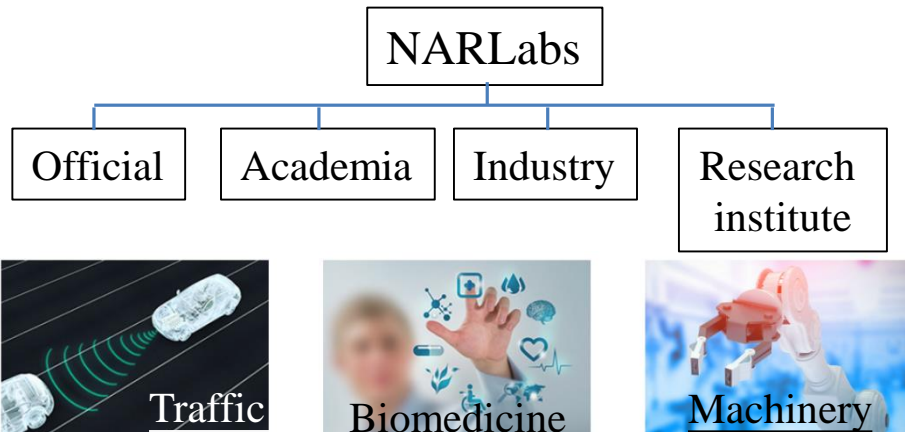
# Resource Sharing : Domestic R&D Alliance/collaboration



1. Technical development and industrial application, 2. Accelerate domestic industry development

## AI Industry & Academia Alliance

## Taiwan CAR Lab



- NARLabs
- ARTC
- NCKU
- ACER
- CHT
- CECI
- 7starlake

# Intangible Assets : Talent Flow & Social Network

Talent flow: (1) cultivation of top performer, (2) exchange of knowledge & technology, (3) establishment of partnerships.



Transnational  
Innovation Platform



Overseas  
Training




International  
Conference

Target: Employee, Students

Employee

Employee, Students, Experts



Taiwan & USA & JAPAN

Stanford-Taiwan  
Biomedical Fellowship  
Program, STB

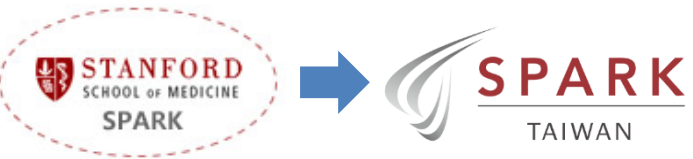


Nanyang Technological University  
(Optical Application)



2018 International Symposium on  
Food Safety Policy and Technology  
食品安全政策與食安科技國際研討會  
October 11-12, 2018, Taipei, Taiwan

Food Safety Policy and Technology



STANFORD  
SCHOOL of MEDICINE  
SPARK

SPARK  
TAIWAN



National Center for  
Supercomputing Applications



2018  
綠能科技國際研討會  
2018 Taiwan International Conference  
on Green Energy Technology  
綠能·智能·幸福

2018年10月8日 (星期一)  
香格里拉台南遠東國際大飯店  
Shangri-La Hotel Tainan, Taiwan

Green Energy Technology

# Intangible Assets : Talent Flow & Social Network



Training Course



Competition

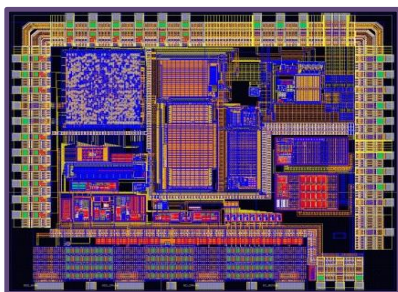


Popular Science

Target: Employee, Engineers,  
Students, Experts

Employee, Students

General public



IC/System design



Introducing and Demonstrating  
Earthquake Engineering Research  
in Schools (IDEERS)



Open House



Fab machine operation  
(etching machine)



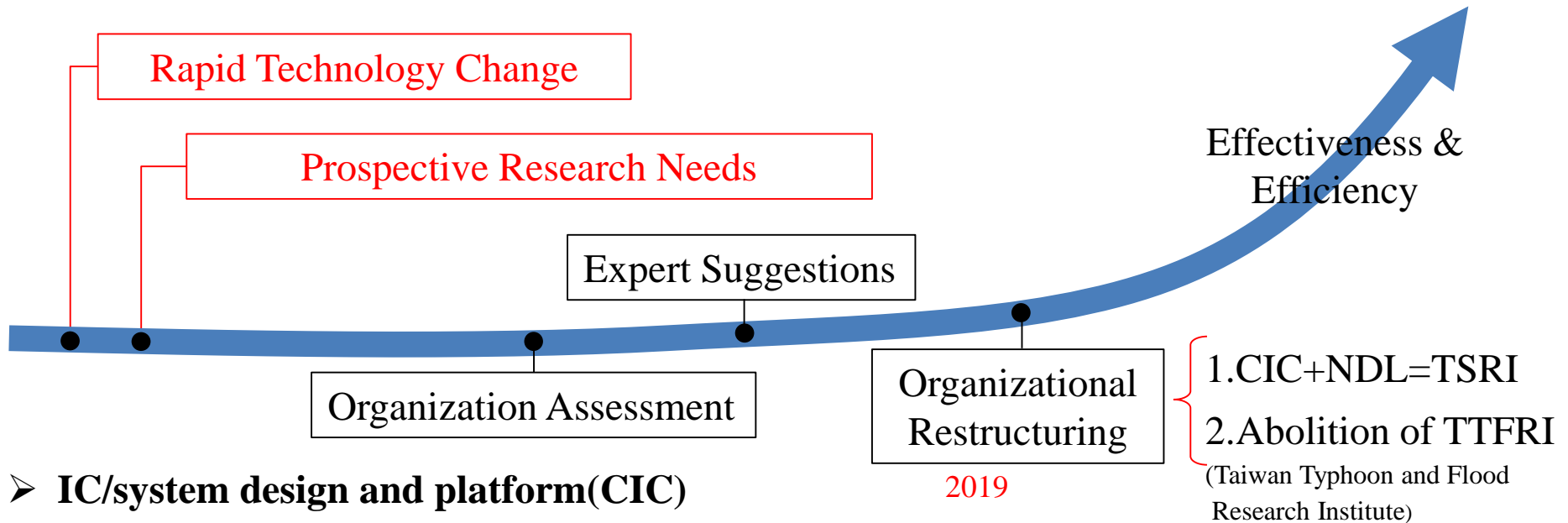
ASME Taiwan SPDC



IC60 – I See the Future



# Flexibility: Flexible Organization Structure

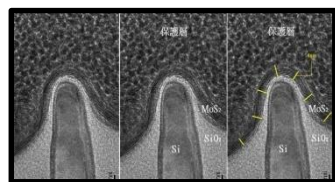


## ➤ IC/system design and platform(CIC)

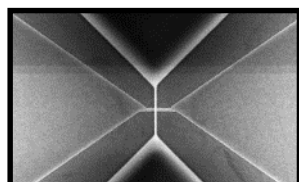
2019



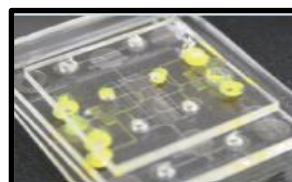
## Development of structure and material · Integration of device and circuit(NDL)



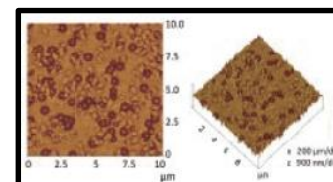
High speed transistor



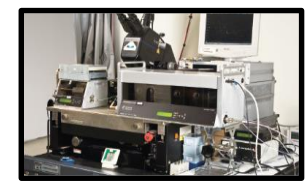
Low-power device



MEMS technology



Detection analysis



Circuit measurement

# Conclusions

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- Open innovation is a key factor in 21st century R&D management, and NARLabs have sufficient abilities to face the chances and challenges of open innovation.
- NARLabs established technology platforms to link with universities, private sectors and other research centers to develop the commercial products and interdisciplinary researches.
- Through resource sharing (knowledge, technology, equipment, etc), NARLabs can establish the global R&D alliance/collaboration with top research institutes.
- Talent flow is a way to cultivate top manpower, and it also is a key factor to promote knowledge and technology exchange.
- In response to rapid technological change and the need for national forward-looking research, NARLabs is flexible in organization restructure.
- NARLabs will spare no efforts in reaching the goal of “**Global Excellence, Local Impact**” to boost Taiwan’s international competitiveness.



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**Thank you for  
your attention**