Overview of Nanotechnology in Korea

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Nanotech. Milestones in Korea

- 10 years Nanotechnology Master Plan (July, 01)
- R&D of Nanotechnology
  - Ultra fine structure Program: 1st NT project in Korea (96)
  - Creative Research Inititives (97) and NRLs (99)
  - Frontier Research Programs
  - ► Tera-level nanodevices (July, 00), Nanostructured materials (July, 02), Nanomechatronics (July, 02)
  - Nanocore, Nanobasic, and Nanoexplorative technologies (Oct., 02)
  - NT fusion technologies (July, 03)
  - 2 NCRC: Nanoelectronics (Dec. 03) and Nanobio (Dec. 04)
- Infrastructure for Nanotechnology
  - National Nanotechnology Centers for Industry (July, 01)
  - Nano Information Center (Jan., 02)
  - Nanobusiness Alliance (02)
  - National NanoFab. Center (Sept., 02)
  - Application Specific NanoFab. Center (May, 03)
  - Nanotechnology Information Cooperation Network (July,03)
  - Nanotechnology Research Society (Jan., 04)
  - 2 National Nanotechnology Cluster Centers (Mar. 04)
- Nanotech. Development Promotion Bill (Dec., 02) and Act (June, 03)

10 Years Master Plan for Nanotech. Development in Korea

Objectives

- Establishment of nanotechnology infrastructure within 5 years and entry into the world top 5 nations in this field by 2010
  - Planning to obtain at least 10 cutting-edge nanotechnologies
  - Producing 13,000 nanotechnology experts by 2010
- Setting-up of 3 grand goals for the realization
  - Research & Development : Selection and concentration
  - Manpower: Short and long term plan to meet the demand for universities, government labs and industries
  - Facilities: Construction of public fabrication facilities for universities, government labs and industries

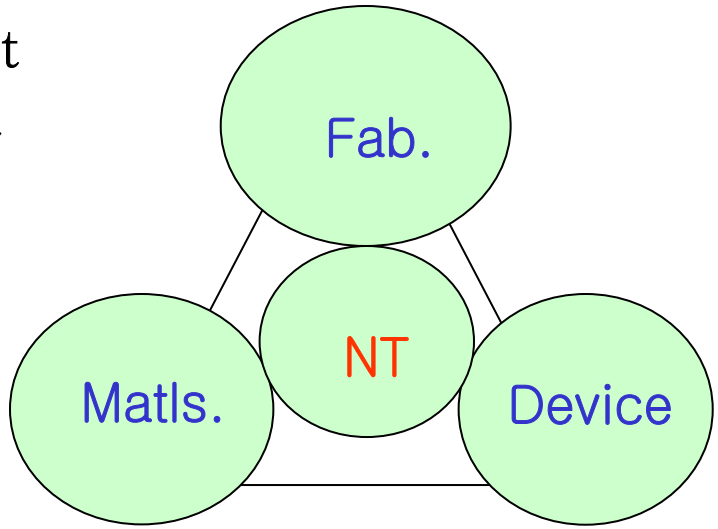
● This plan is now under revision by about 70 nano-experts and new version will come out by December 2005.

Tera Level Nano Devices

Frontier Research Program for NT

❑ Definition and Goal

- Expecting highest technological impact
- Having enough work forces at present
- Leading Korea on NT to world top 5 within next 10 years



❑ 3 Frontier Research Programs

- Center for Nanostructured Materials Technology
- Center for Nanoscale Mechatronics & Manufacturing
- Tera-level Nanodevices Program (TND)

❑ Budget

- About $ 10 M/year for 10 years for each Center

Core Research Program for NT

- Definition and Goal:
  - Leading to big impact on the future technologies
  - Having enough work forces and infrastructures
  - Securing competitiveness by 2010
- Period : 6-9 years
- Budget : Total $8M per Year
  - 5 projects including chemical catalysis

- This program is transferred from KISTEP of MOST to ITEP of MOCIE last year and will be reviewed for the drop or continuation this year.

Basic Research Program for NT

- Definition and Goal:
  - Expecting the expansion of technological impact
  - Having not enough work forces and infrastructure
  - Requiring the consolidation of research capability
- Period : 5 years
- Total Budget : Total $5.6M per Year
  - 9 projects including atom/molecular level manipulation

- This program is transferred from KISTEP of MOST to ITEP of MOCIE last year and will be reviewed for the drop or continuation this year.

Explorative Research Program for NT

- Definition and Goal:
  - Requiring long-term research to seed new fields
  - Fostering creative experts for university
- Period : 3-6 years
- Total Budget : Total $2.4 M per Year
  - 43 Projects ($0.08-0.24 M/project/year)

- This program is transferred from KISTEP to KOSEF this year and will be reviewed for the drop or continuation this year.

NT Fusion Technologies

- Definition and Goal:
  - Any technologies based on the fusion of NT with IT/BT/ET/ST
  - Seeding new fields
- Period : 10 years
- Total Budget : Total $6.4 M per Year
  - 3 NT Projects including super high density optical storage
  - Expand to 31 projects by 2005 including ST/IT and IT/BT

- This program is transferred from KISTEP of MOST to ITEP of MOCIE last year.

Manpower

❑ Foster of Work Force Program at University

- Creation of interdisciplinary program by multi-departments
- Implementation of the program for 3~4 universities as a model in 2003 and afterward, expansion into major universities.

❑ Nurture of Top Quality Scientists

- 50 world top class Ph.D.s
- 100 specialists for nanotechnology research
- Dispatch of the qualified researchers to world top level universities and research centers from 2003

- This has not been well supported and only one program has been established for fostering NT experts as a part of NURI programs. Nevertheless, 18 universities offer BS, MS and Ph.D in NT as of 2004.
  - NURI: New University for Regional Innovation

Facilities

- Foundation of Public Nanofabrication Center
  - Installation of core facilities for domestic and foreign users from universities, industries and government-supported labs
- Establishment of Facilities Network
  - Network of sharing domestic and foreign facilities to resolve the lack of the facilities at the early stage
  - Several MOUs were already made between our and foreign Fab. Centers
- Construction of 9 hectare(30,000-pyoung) Nanotown
  - Research centers and venture startups are located

- Nananotowns are now under consideration and construction by several local governments (Seoul, Chunbook etal.,)

National NanoFab. Center (1)

❑ Main Goals

- To provide centralized facilities that can be shared by NT researchers

► Giving stable and speedy service for nanodevice fabrication

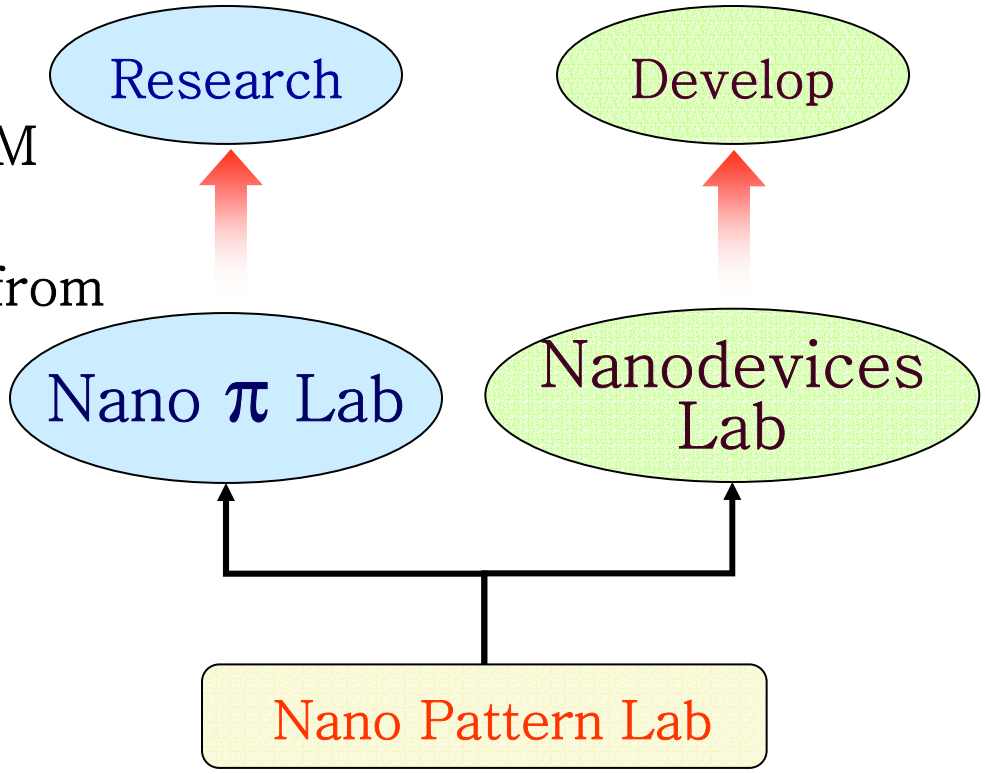
- To educate high level work forces for NT

★ The center is supposed to be self-supporting within 10 years

National NanoFab. Center (2)

- Total Budget : about $250M for 10 years
  - Government : $100M
  - 2 local governments and 8 consortium members : $ 150M
- Location :
  - KAIST located 180km south from Seoul (Dae-duck)
- Operation:
  - KAIST/Consortium members
- Main Facilities
  - Clean room space : 4,300m^2
  - Characterization equipments
  - 10nm scale

✶ It will open to users by March, 2005



Application Specific NanoFab. Center

- Main Goals
  - To provide centralized facilities that can be shared by NT researchers working on nanodevices based on compound semiconductors and other materials
  - To educate high level work forces for NT
- Total Budget : about $144M for 5 years (up to 2007)
  - Government : $42M
  - Gyunggi government and 6 consortium members : $ 102M
- Location : Suwon City located 60km south from Seoul
- Operation : Independent but reporting to Government
- Main Facilities
  - Clean room space : 3,240m^2
  - Characterization equipments
  - 10nm scale

★ The center is supposed to be self-supporting within 10 years and will be open to users by the end of 2005

National NT Cluster Centers

- National fab. centers for the promotion of early NT commercialization
  - Sponsored by Ministry of Commerce, Industry, and Energy
- Two centers nationwide
  - National Center for Nano-processing and Equipment (Chunnam National Univ. and Chunbuk National Univ.)
  - National Center for Nano-materials (Pohang University of Science and Technology)
- Operation
  - 3 designated universities and private sectors
- Total Budget : about $150M for 5 years (up to 2008)
  - Government : $75M
  - Private Sector : $ 75M

National NT Information Center

: operated by KISTI(Korea Institute of Sci. and Tech. Information)

Main Goals

- To establish National Hub for NT Information in Korea

Activities

- To provide essential NT information to government, industry, university and institute,

  ex) World wide NT policy review, academic paper and patent analysis, state-of-the-art and new product news

- To build the basic infrastructure of NT information

  ex) Nano Net(www.nanonet.info), NT information analysis report, Korea NT annual, nano news letter(NanoWeekly)

- To facilitate NT information cooperation and to do network with domestic and foreign Nanotechnology information bodies

  ex) MOU made with 16 domestic and 6 foreign Nanotech Orgs.

Nanotechnology Research Society

: established by Nanotech. Development Promotion Bill

- Members:
  - Composed of nanotech. researcher from academic, national labs and industries
- Purpose:
  - To function as a network to exchange information
  - To promote collaborative research and interchange of researchers
  - To make friendship among NT researchers
  - To implement the role of think tank for NT-related problems
- Activity:
  - Participating as an organizer for Nano-Korea
    : organizing a symposium for NT-related subjects
  - Promoting foreign cooperation as a focal point
  - Educating NT novices to extend NT research

Nanotech. Development Promotion Bill

- Purpose
  - To prepare a solid research basis for NT
  - To encourage the industrialization of R&D results

- Summary
  - To prepare and implement the NT Master Plan
  - To make Technology Road Map for NT
  - To predict demand and supply of work forces for NT and use that prediction for education and training of work forces
  - To expand infrastructures for NT research, including NanoFabs for industries, universities and research institutes
  - To study the NT implications on environmental/societal/ethical problems and provide those results for NT master plan.

Nanotech. Development Promotion Act

- Summary
  - To prepare the NT Master Plan every 5 years
  - To predict demand and supply of work forces for NT every 3 years
  - To report to president every April about NT development action plans and results of preceding year carried out by relevant ministries
  - To evaluate research results every 3 years by relevant Ministers and reflect the evaluation outcomes in the action plan
  - To designate NT specialty institutes for research and organizations for information collection and dissemination
  - To name the non-profit NT organization to nurture

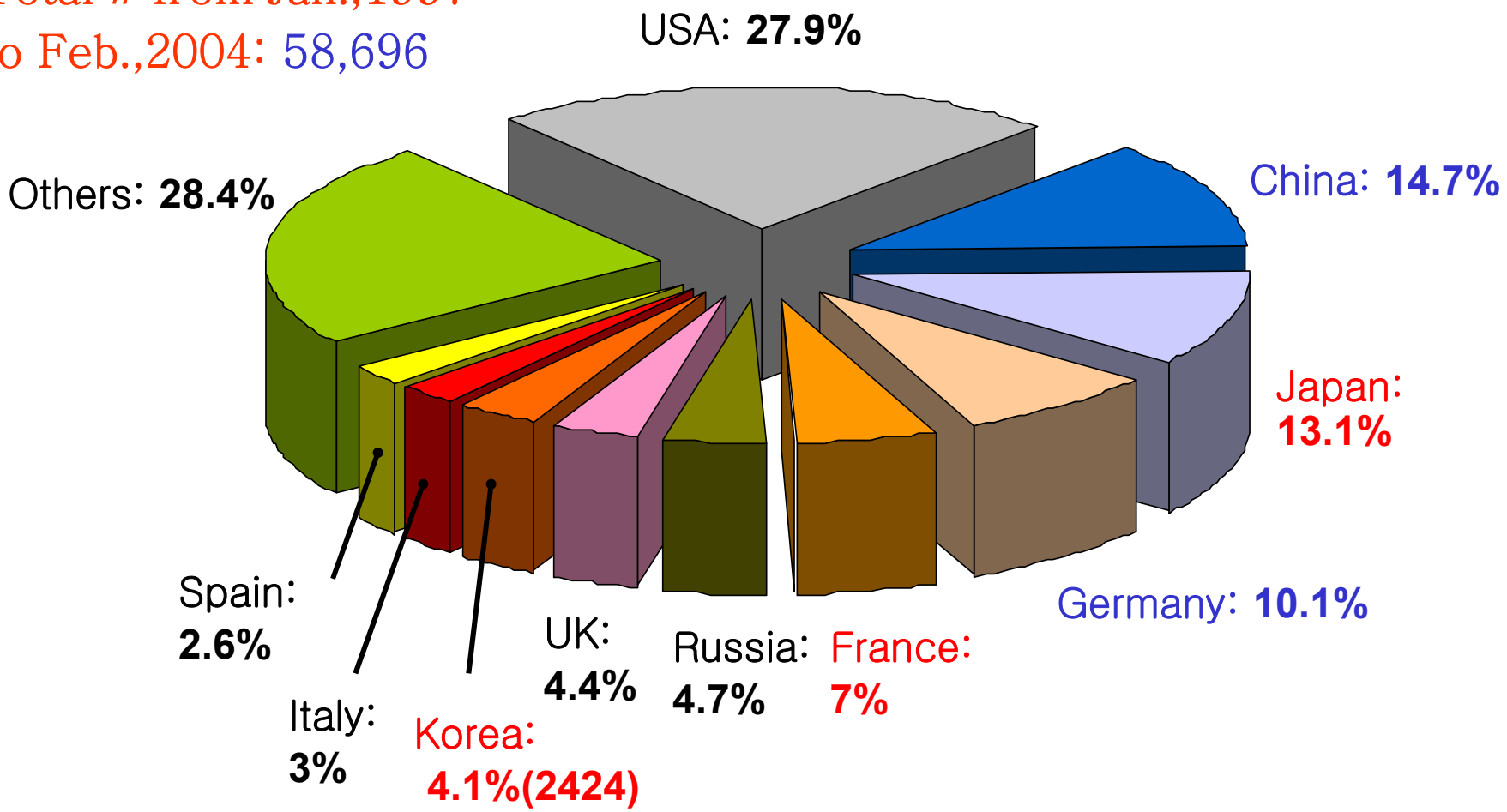
What Happens since 10 Years Master Plan

Classification	2000/2001	2003/2004
Government NT Fund	$28M/$76M	$216M/$250M
# of NT Researcher	-/1015	-/3898
# of NT Paper Publication	221/408	832/-
# of NT Patents	80/100	400/-
# of Univ. to offer NT Degree	None	18

Ratio of # of Publication for Each Country

Source: KISTI (July, 2004)

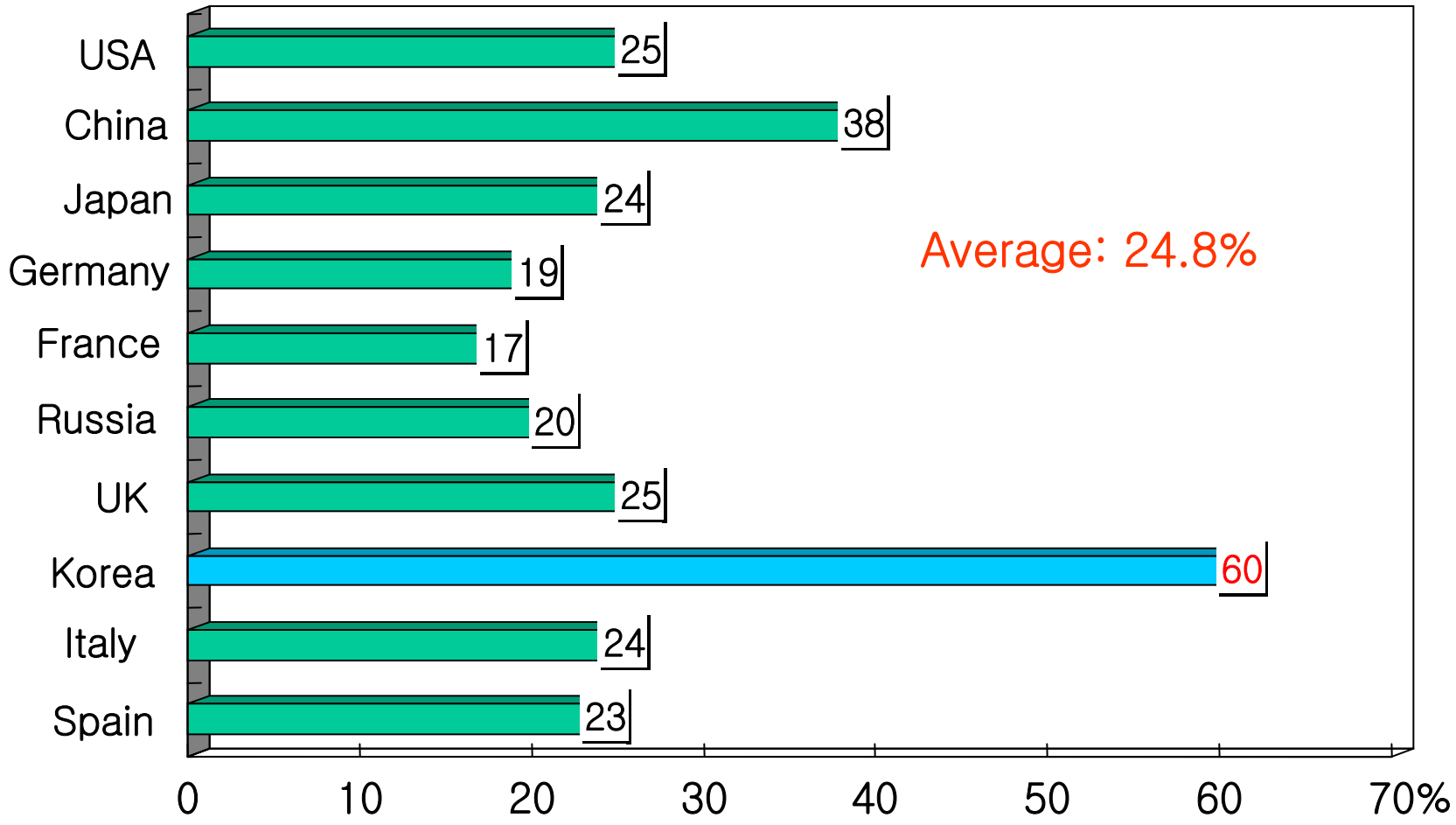
Total # from Jan.,1997 to Feb.,2004: 58,696



Tera Level Nano Devices

Growth Rate of NT Publication for Each Country

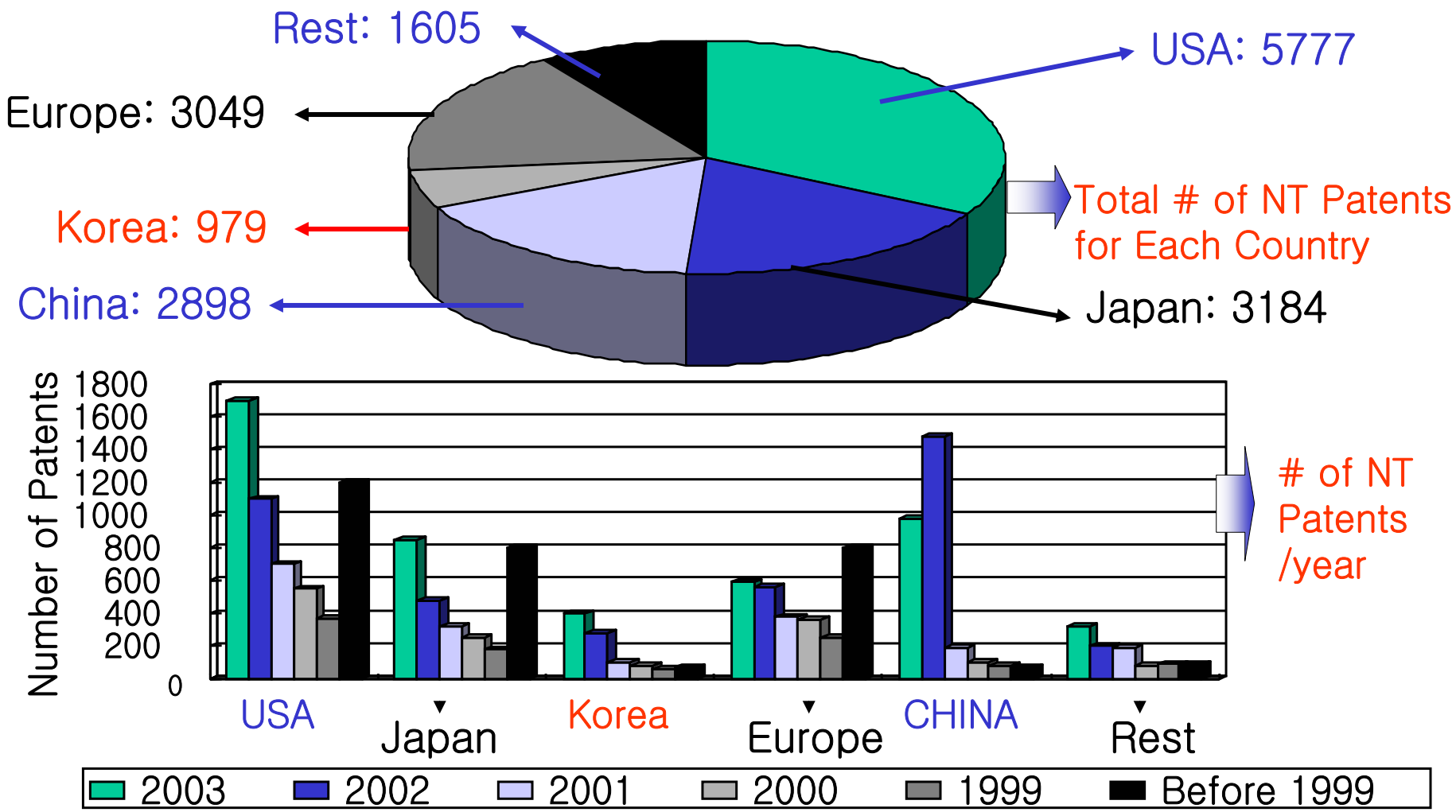
Source: KISTI (July, 2004)



Tera Level Nano Devices

of NT Patents for Each Country during 1990-2003

Source: Nikkei Nano Business, December, 2004



Tera Level Nano Devices