Engineering Research and Development for Technology (ERDT)
Semiconductor Materials & Electronics Track

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ERDT Semiconductor Materials & Electronics Track

- R&D agenda planning strategy:
  - Put the R&D agenda in the context of current industry-led initiatives aimed at enhancing their competitiveness
- What are these initiatives?
  - Advanced Devices and Materials Testing Laboratory (Admatel)
  - Electronic Products Development Center (EPDC)
  - Philippine Microelectronics Center (PMC)
- Craft R&D agenda that supports and enhances these industry-led initiatives

Advanced Devices and Materials Testing Laboratory (ADMATEL)

Objectives

- To make ERDT R&D efforts more aligned with the needs of the industry
  - To identify R&D needs of the industry;
  - To identify measures to make ERDT R&D more responsive to the industry;
  - to establish an R&D framework for the academe, government, and industry to support the industry.

Identifying Available Resources and Stakeholders

DOST-ITDI
Advanced Devices and Materials Testing Laboratory (ADMATEL)

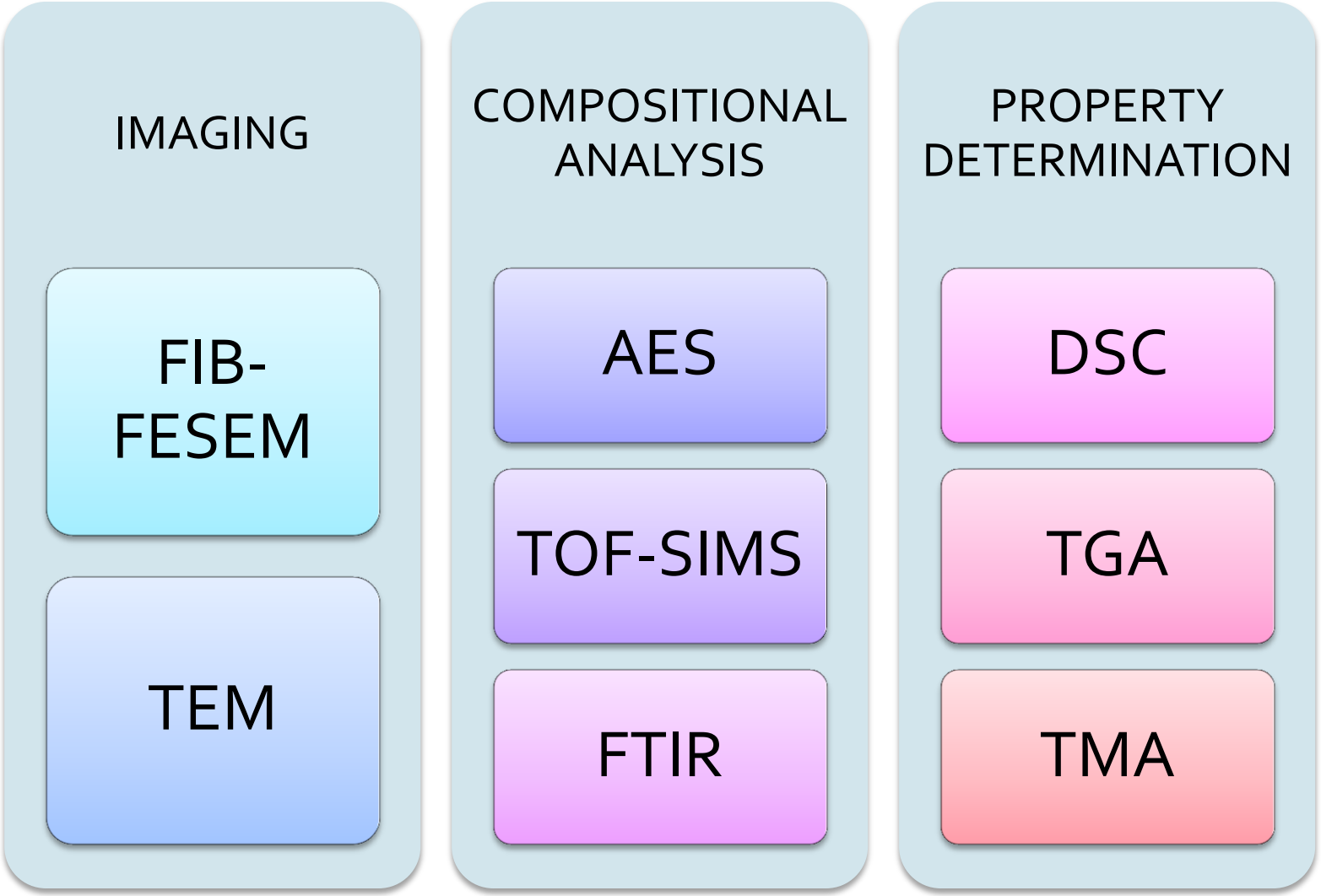
ERDT CONSORTIUM UNIVERSITIES

SEMICONDUCTOR & ELECTRONICS INDUSTRY

What is ADMATEL?

- A DOST-project to establish the Advanced Devices and Materials Testing Laboratory
- Special division of ITDI that shall reinforce and upgrade the failure analysis and materials testing facilities
- Located in DOST Bicutan compound, with a total floor area of 2880 sqm.
- Cost > P300M

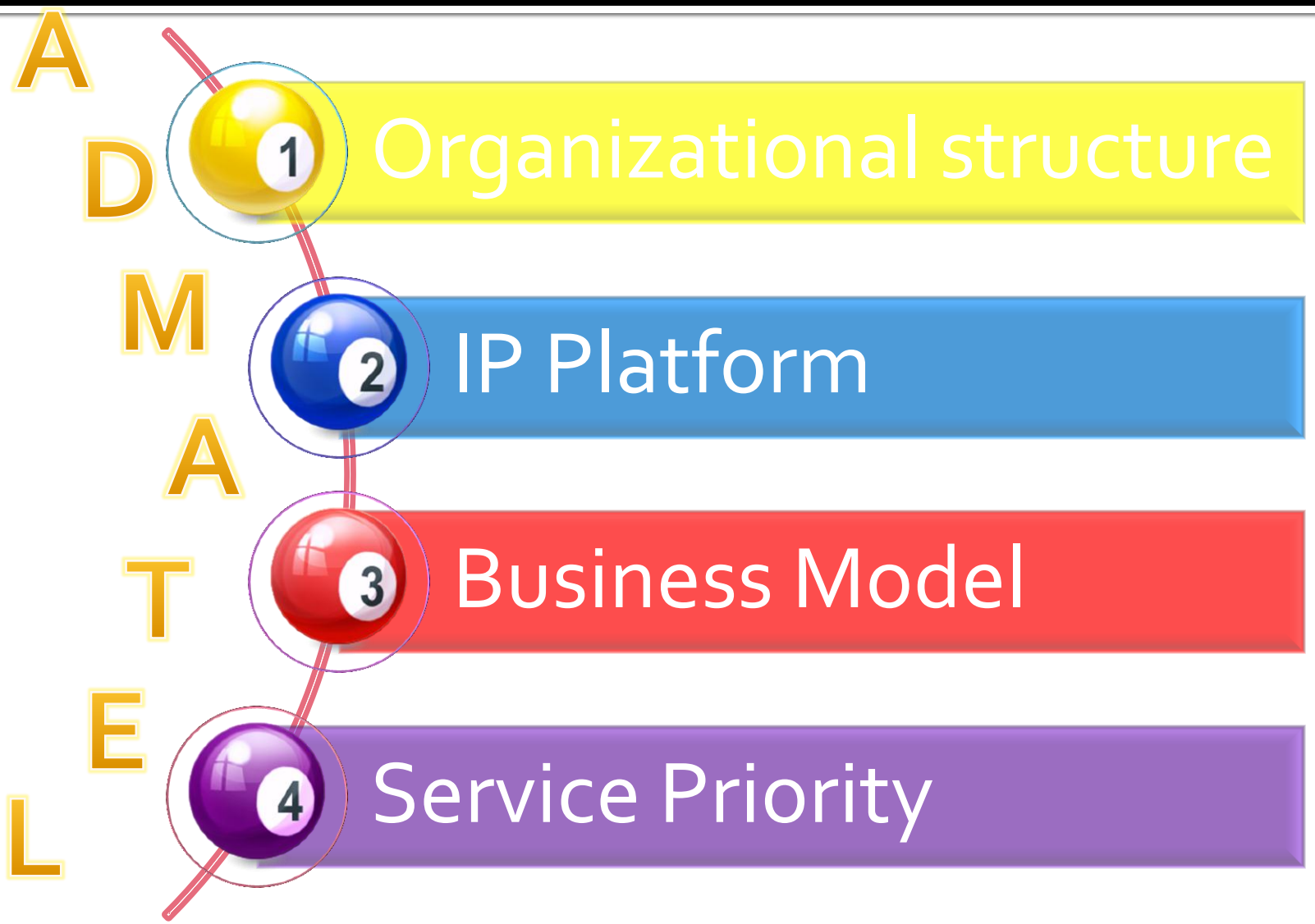
What is ADMATEL?



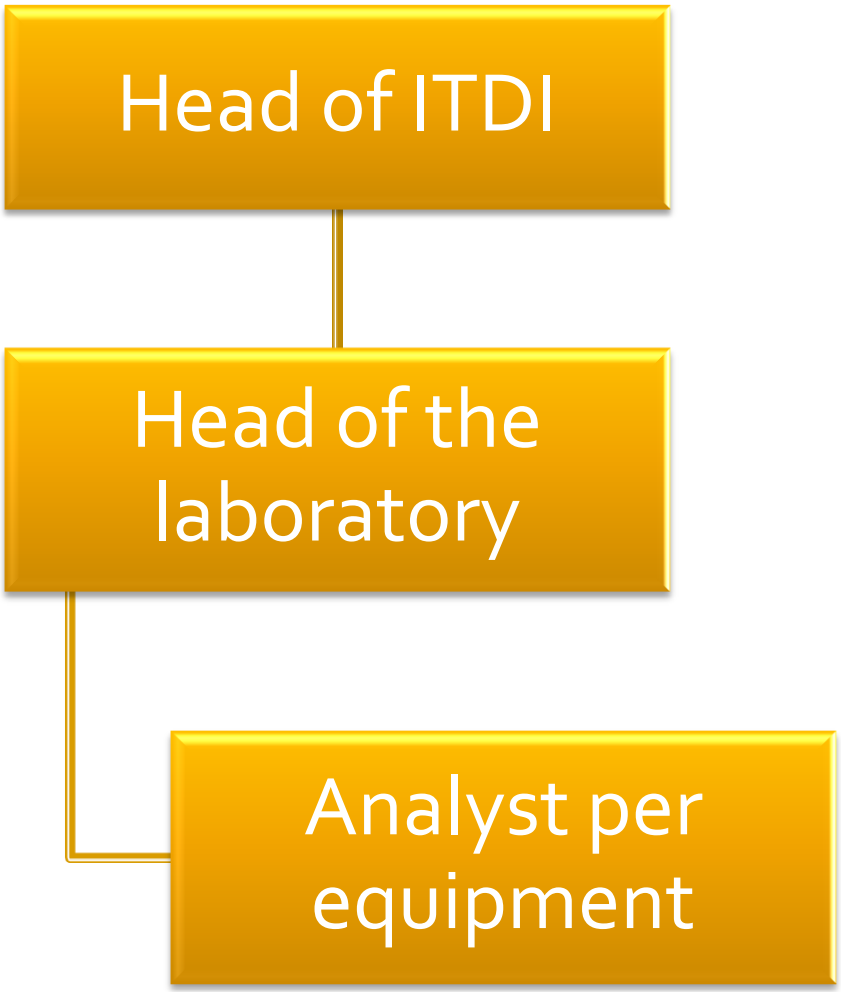
What is ADMATEL?

- The facility also has lecture rooms, offices, conference room, dormitories, and laboratories – Class 100k clean room, standard ESD safety compliance
- Inauguration will be on December 12, 2012
- In-house trainings and industry immersions to enhance capability of staff are ongoing
- Benchmarking was done in Tokyo and Singapore

Concerns raised by RTD participants:



Organizational Chart?



- Will be run by ITDI staff and additional contractual staff to be hired
- Business plan development on-going
- Plan for future privatization

Intellectual Property

- ADMATEL will maintain integrity and will have secrecy agreement with clients
  - How data will be stored?
  - Who has access to data?
  - List of safeguards must be in place

Rates?

- Still to be determined and will be sent to the companies ASAP
- Will still determine if use of the equipment will be on a per hour or per sample basis
- Students rates will be provided
- Will specify payment scheme later but will consider existing terms of companies (e.g. 90 days)
- Sample preparation will have a separate charge

Turn-around Time

- Companies expect their results within one day
- How to address?
  - Focus on testing
  - Will be running 24/7
  - Will hire additional staff (15-20 more, on top of existing 20 personnel)
  - Improve electronic communication (better networking)
  - PEZA requirement
  - Standby generators to ensure continuous power supply

Operations

- The facility will be functional by January 2013, for basic, existing equipment
- For sophisticated equipment, certification of super user should be firstly done (ISO grade of at least 97%)
- Certified people from companies may use the equipment
- Observers may be allowed
  - May sit side-by-side with the operator
  - Watch through the window

Personnel

- Current staff have experience in Material Science and have been doing analysis
- Company immersion (200 hours) on FA, customer complaints, etc.
- Immersion in other companies should also be explored
- No business model yet

ADMATEL and ERDT

- Student and research is only possible for the basic equipment, at least initially
- Access by the academe remains to be addressed
  - ADMATEL must meet tight turn around times and may not be able to accommodate

Synergy with Academe and ERDT?

- Current Situation
  - Companies, especially the multi-nationals, concerned with intellectual property issues when collaborating with academe
    - Multinationals have their own research centers somewhere around the world
    - Doing R&D to solve their problems on materials
    - Question on what relevant opportunities exist for academe in this area
  - Materials research require sophisticated equipment to manufacture
    - Not (yet) available in the university

Synergy with Academe and ERDT?

- Current situation
  - Companies not inclined t wait for 2 year projects.
    - Faster turnaround time is desired, as this results in lower cost
  - Multinational companies have suppliers (Japanese/Korean) which develop their materials.
    - These suppliers have their own research centers, as well.

Synergy with Academe and ERDT?

- Possible modes:
  - Should ask the help of ITSO
    - Do strategic thinking for the academe
    - Help look for future problems
  - Identify new materials for a specific application, i.e. thinking ahead.
  - Concentrate on developing materials that will be sellable to the industry
    - e.g. those of lower cost but can comply with requirements

Synergy with Academe and ERDT?

- Gap between the industry and the academe should be bridged
  - Academe – geared towards generation of new knowledge, publishing papers, presenting in conferences, public domain research
  - Companies – tight turnaround times, IPR concerns

Synergy with Academe and ERDT?

- Academe invited to participate in characterization, analysis, and/or testing
  - Must consider turnaround time
- Establishment of reliability laboratory
- Package design may be done
  - However, must be customer driven
    - Academe should put itself in the shoes of the customer

Potential directions with Academe and ERDT

- Academe could help ADMATEL work efficiently in order for the first time clients to be satisfied
- Reliability center is a promising direction, and may be a priority a few years from now
- Development of new materials that will be marketable and will have sellable patents to semiconductor and electronics industry, with the help of ITSO
- Package design, including material design, for ICs may be one of the directions

Electronic Producsts Development Center (EPDC)

EPDC Background

- Based on a proposal for a "Common Product Development Facility for the Electronics Industry"
  - Submitted by the Electronics Industries Association of the Philippines Inc. (EIAPI)

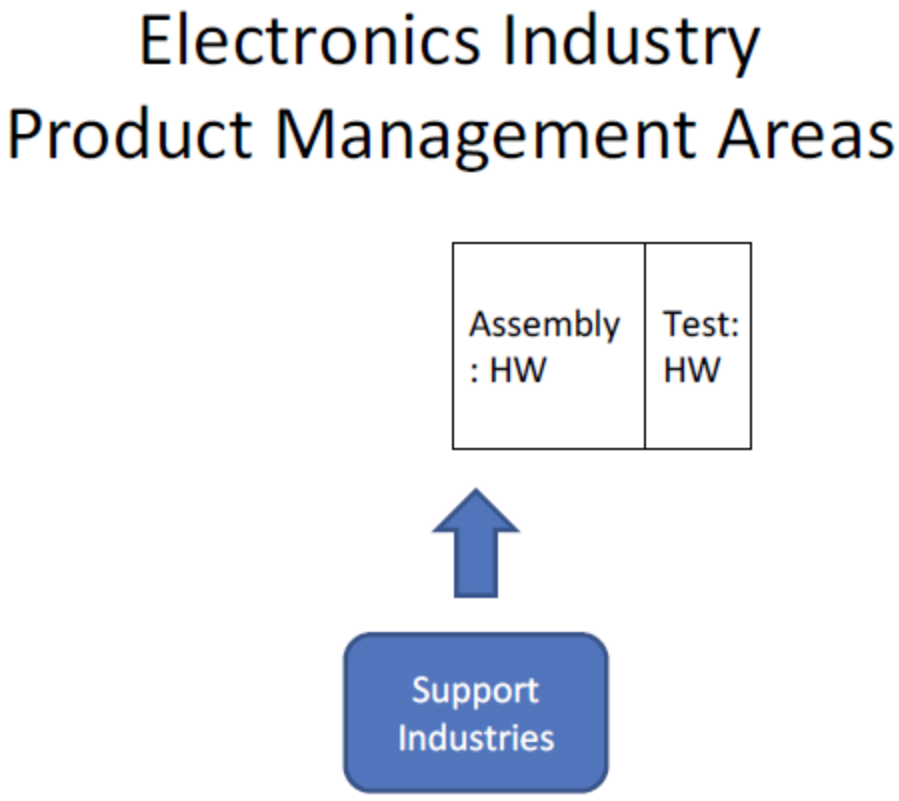
EPDC Background

- At present:
  - Companies find it difficult to access special tools for software and hardware development
    - Difficult to make their own products.
  - Companies have to send their designs and staff to other countries to do tests
  - This process can be long and iterative
    - Product development becomes expensive
  - Without local facilities there is a large barrier to entry for companies in the Philippines to enter or expand into the electronics market both here and abroad
    - Affects both small and large, local and foreign companies

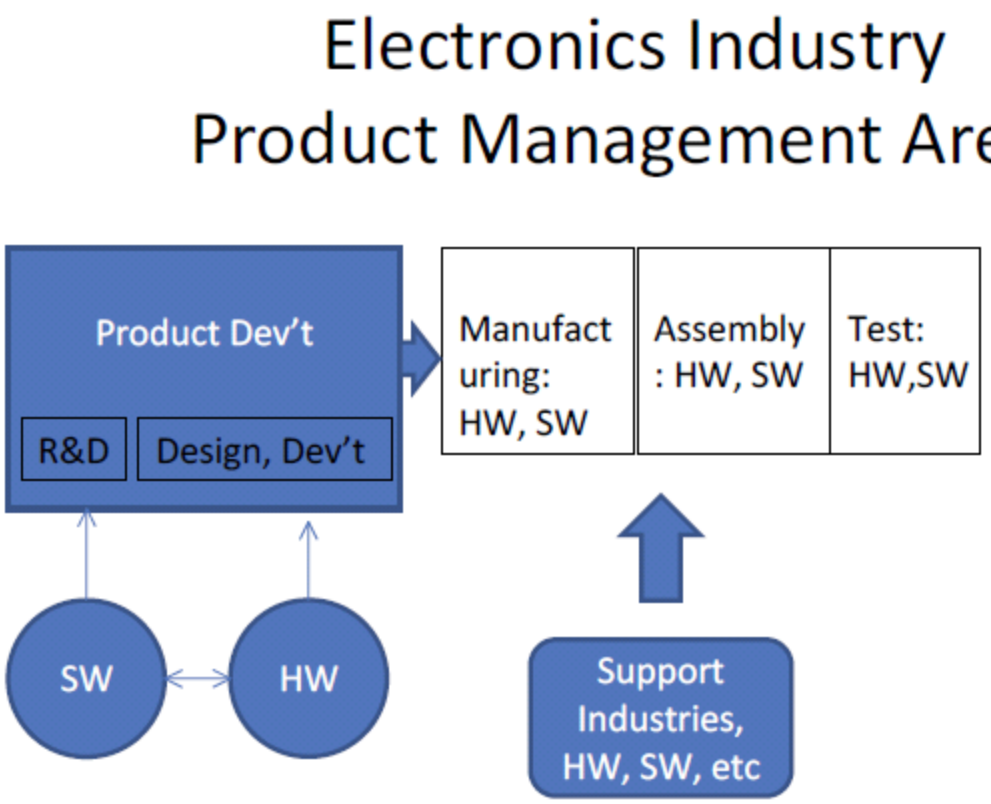
EPDC Background

- EIAPI has requested DOST to provide these facilities
  - Help industry grow not just in assembly services and intermediate outputs
  - Help industry grow in the design and manufacture of electronic components, products and software in the Philippines
- Complete the electronics line from designs to components to finished products and systems
- Enable more companies to design and manufacture their own products for the local and foreign markets
  - Including those requiring multi-disciplinary skills and materials like metals, plastics, etc.

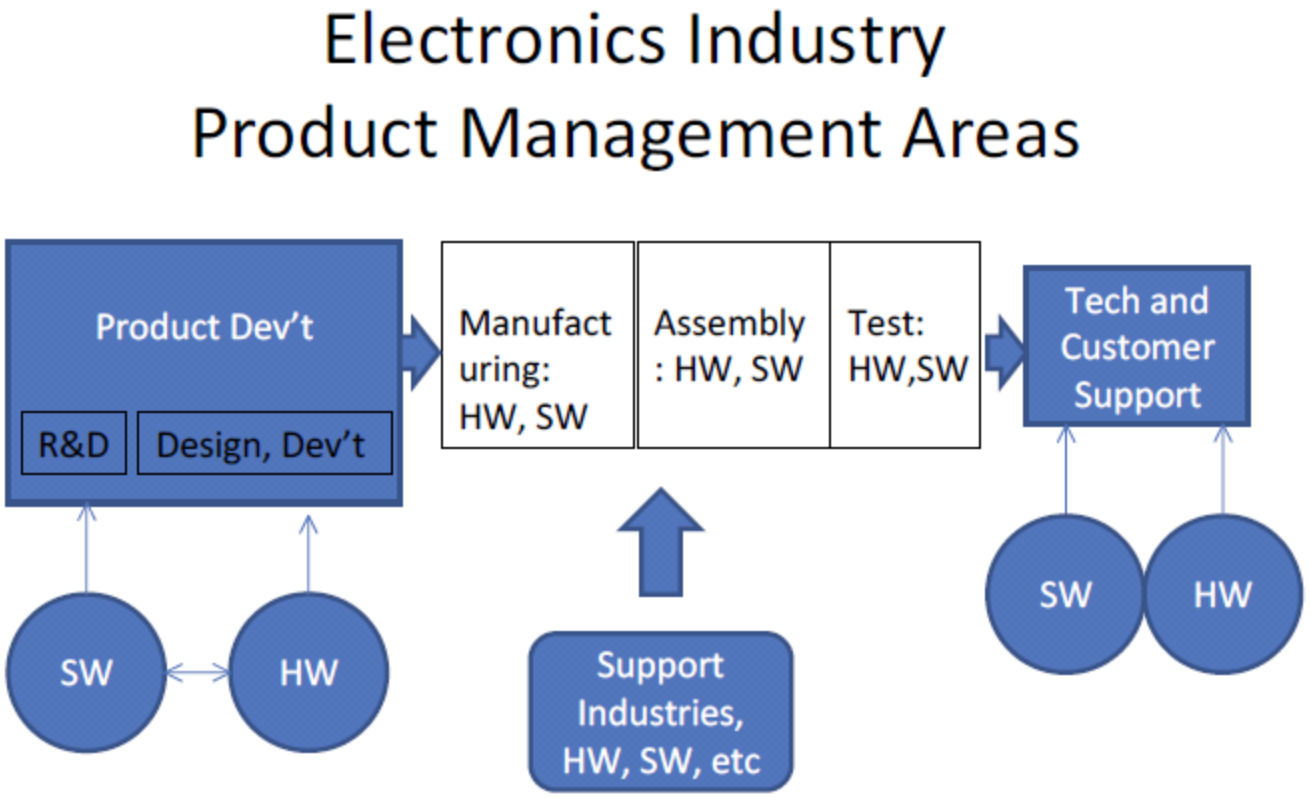
Expand the Electronics Sector in the Philippines



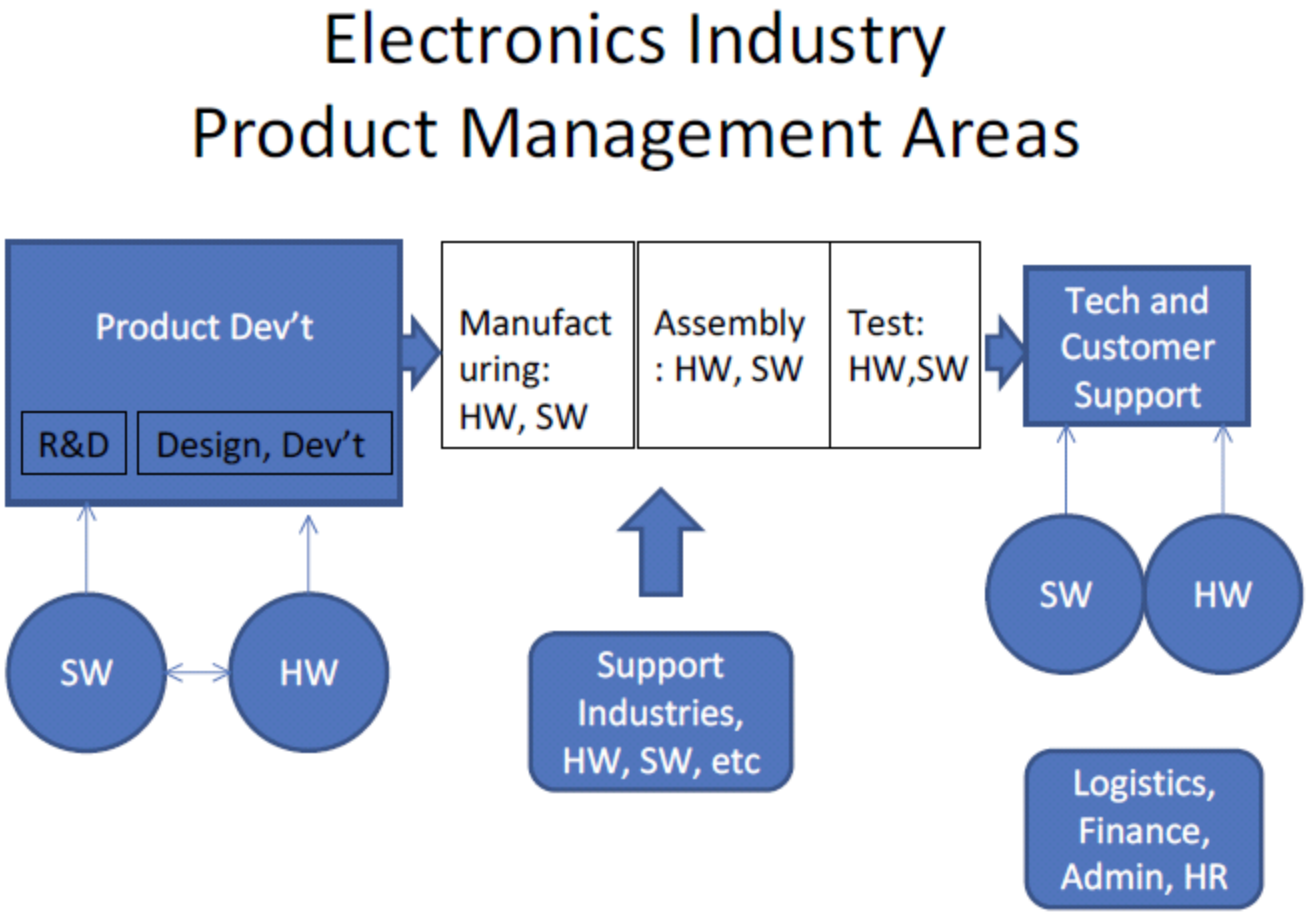
Expand the Electronics Sector in the Philippines



Expand the Electronics Sector in the Philippines



Expand the Electronics Sector in the Philippines



What is the EPDC?

- Philippines to provide engineering talent for product design, development, and R&D, tech and customer support for companies
  - We want to do these IN the Philippines
- CHED, DOST, and DTI to help provide resources
  - For companies to raise engineering talent that meet their needs
  - Managed through a public-private partnership, similar to ITRI
- Resources?
  - Training
  - HW & SW tools/licenses
  - Test facilities
  - Marketing support
  - Small and med enterprise development

Proposed EPDC Resources

- Resources for Product Development
  - Design tools
    - Software development
    - Hardware and embedded systems development
    - 3D development
  - PCB Prototyping
  - Safety tests
  - Interference or Electromagnetic Compatibility (EMC) and EMI tests
  - Reliability tests
  - Test equipment
    - RF equipment
    - Test and measuring equipment and power supplies
    - Anechoic chamber or test cell (for EMC tests, measuring RF fields)
    - Special tools and accessories
  - Funded by DOST PCIEERD: P262M

EPDC: Goals

- Increase number of engineers or companies, doing technologies in the Philippines
- Increase number of joint or cooperative activities among companies/institutes in Philippines and other countries
  - Identify and bring in strategic technology companies we would like to develop and locate in the Philippines
  - Identify and correct the parameters that brought us up/down in the world technology/science index so that we can promote, promote, promote

Synergy with Academe and ERDT

- How can ERDT and the academe support the EPDC?
  - Set a "design for EMI-EMC compliance" and "design for product safety" training and research agenda
    - Help products pass relevant standards
    - When products fail tests, the center may provide guidance on how the product may be improved
      - Trainings or classes in geared towards passing specific standards
    - Problems encountered with the products are seen as good fodder for case studies or research by academe
      - Supporting a more relevant and responsive curriculum
    - Concern again on turnaround time

Synergy with Academe and ERDT

- How can ERDT and the academe support the EPDC?
  - Internships
    - Involve students in stages of product development
    - Provide exposure to tools and equipment

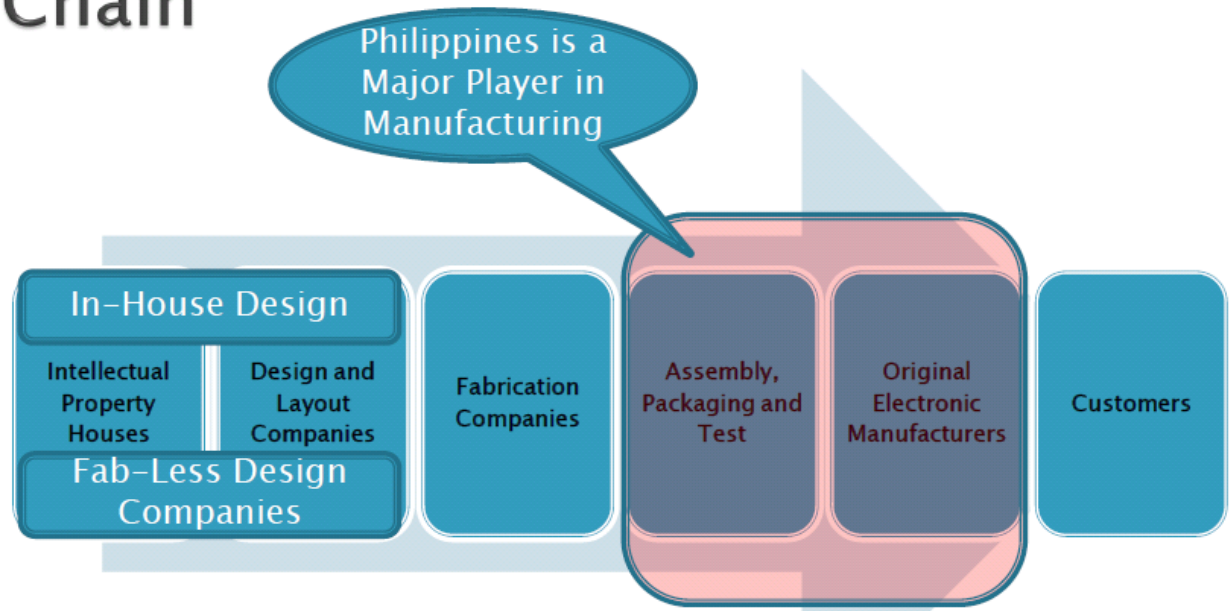
Synergy with Academe and ERDT

- How can ERDT and the academe support the EPDC?
  - Information campaign on relevant standards
    - Raising the standards for local products to improve the quality of exports.
    - May also target local market – raise awareness oon quality of some imports vs. local products

The Philippine Microelectronics Center (PMC)

PMC Background

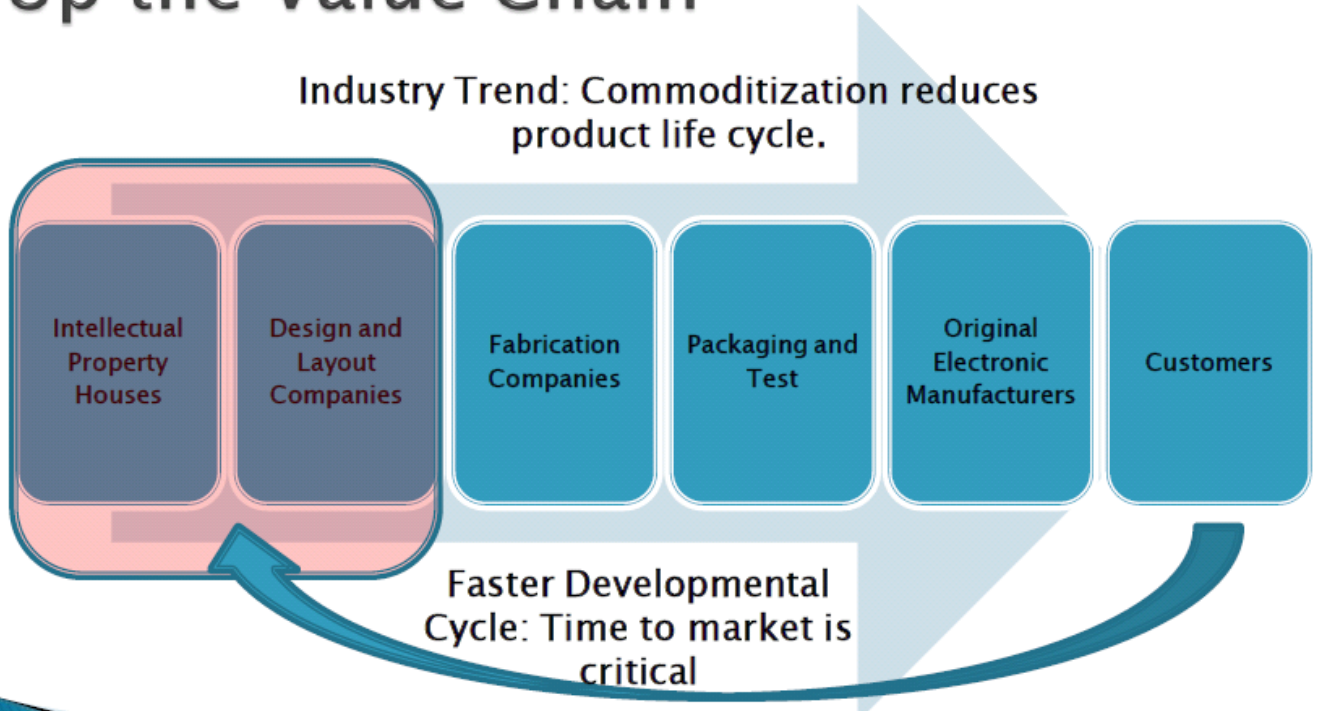
Integrated Circuit Design Supply Chain



For the past 40 years, electronics is a significant portion of our exports.

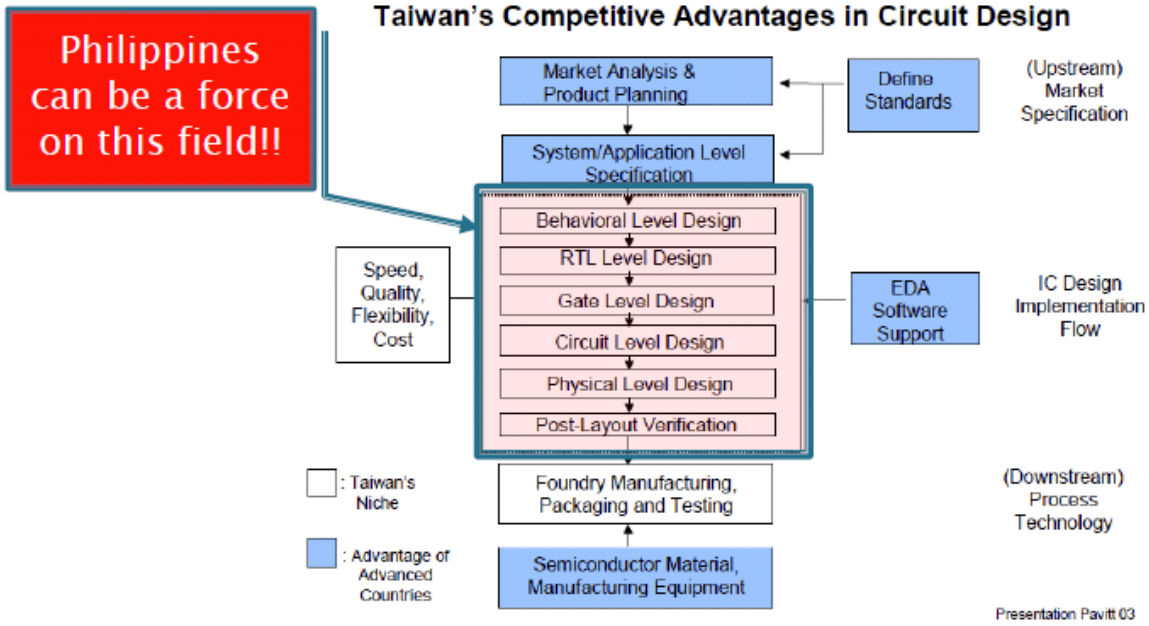
PMC Background

Integrated Circuit Design: Moving Up the Value Chain



PMC Background

IC Design is Moving to Asia!



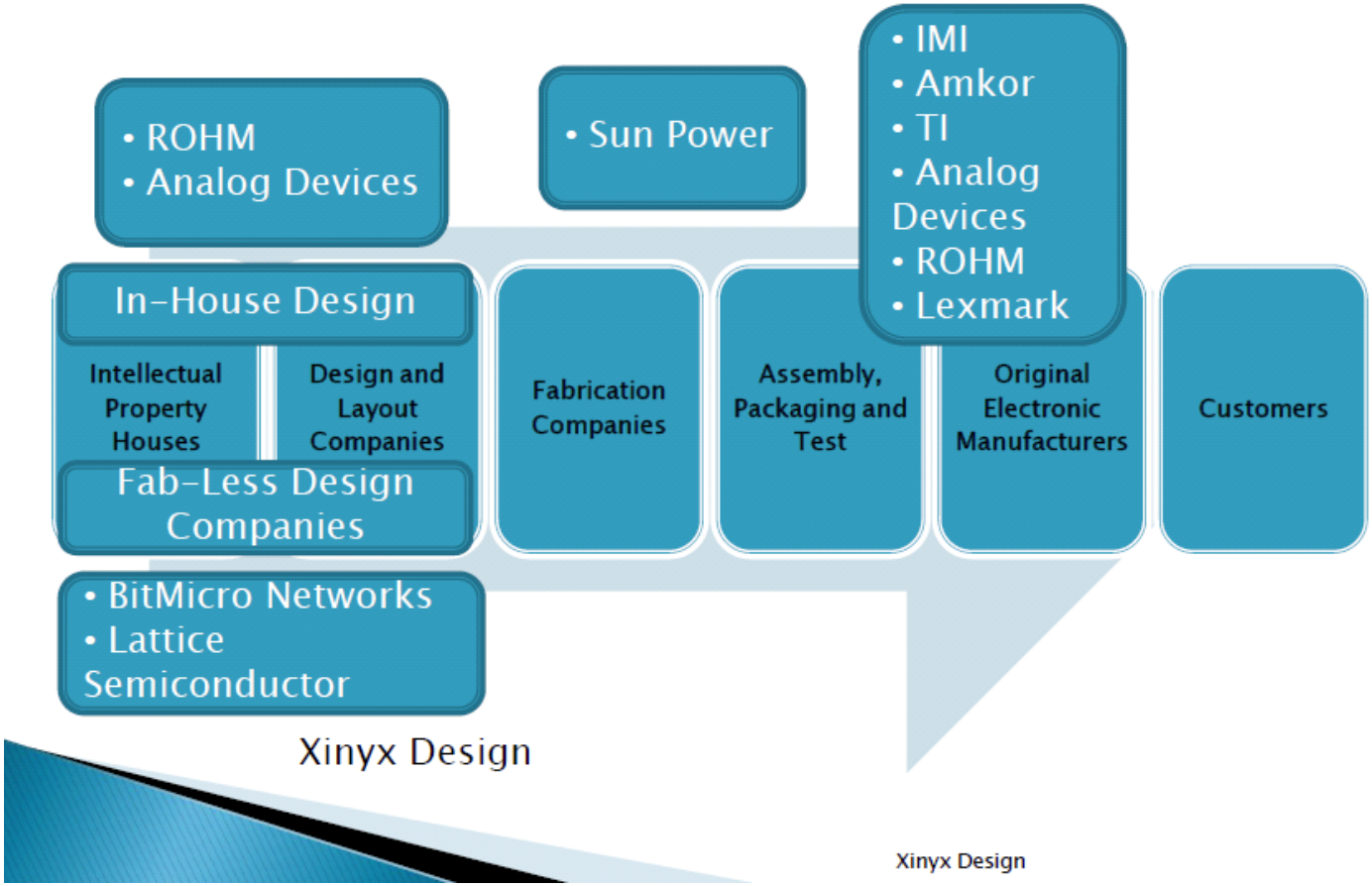
Source: Chang and Tsai, 2002

- Taiwan is the given leader on this field.

Source: Internalisation of Innovation: Why Chip Design is Moving to Asia? By Dieter Ernst, an East-West Center Working Papers

PMC Background

Sampling of Local Industry Players



Xinyx Design

PMC Background

Key Challenges

- Talent retention
  - Not enough pool of experienced engineers
  - Attrition remains to be a problem
  - Very hard to attract talent back
- Talent development
  - Access to tools
  - Absence of supporting infra for retooling of engineers
- Access to technology
  - Cost of acquiring libraries
- Marketing, Marketing, Marketing

PMC Background

What Government Can Do?

- Expand Supply Pipeline of engineering talent
  - Proposed Philippines Micro-electronics Center
- Position Philippines as a destination for IC Design activities

What is the PMC?

Proposed Philippines Micro-electronics Center

- Objective 1: Create Pool of Trained Engineers
- Milestones:
  - Creation of industry relevant training contents and assessment program (up to 2,000 engineers in the next 2-3 years)
  - Deliver training programs to undergraduate and graduate engineers

- Objective 2: A One-stop shop for hiring and training of IC Design engineering talents
- Milestones:
  - Re-tooling trainings for local IC Design companies
  - Database of trained engineers

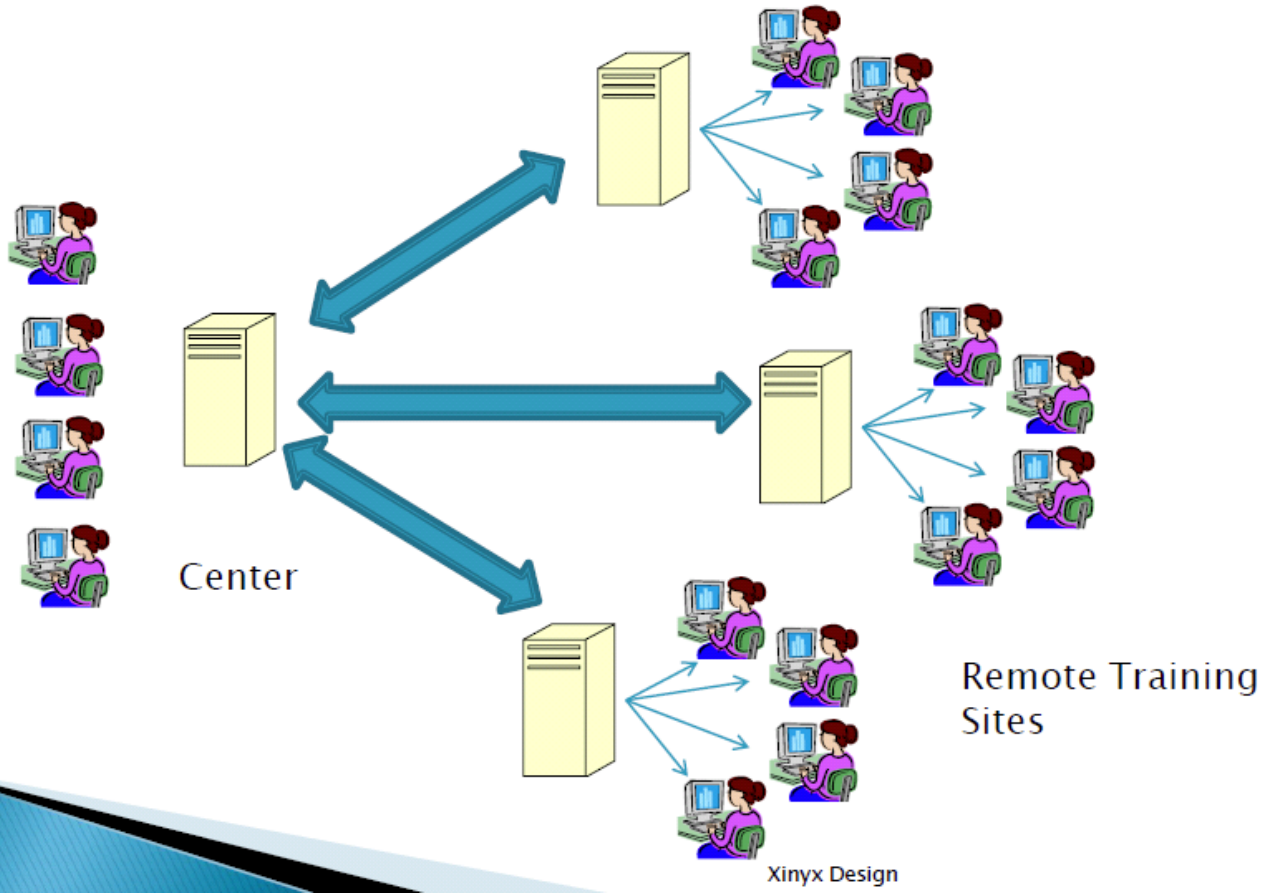
What is the PMC?

Proposed Primary Activities

- Faculty immersions to host companies in the industry
- Exposure of undergraduates to Industry tools and methodology
  - Modularized training content
  - Can be injected into Electives and Laboratory courses
- Short Courses (2-weeks)
  - For engineer re-training
  - Can be tapped by industry players for retooling

What is the PMC?

Operational Model



ERDT R&D Agenda for Semiconductor Materials and Electronics

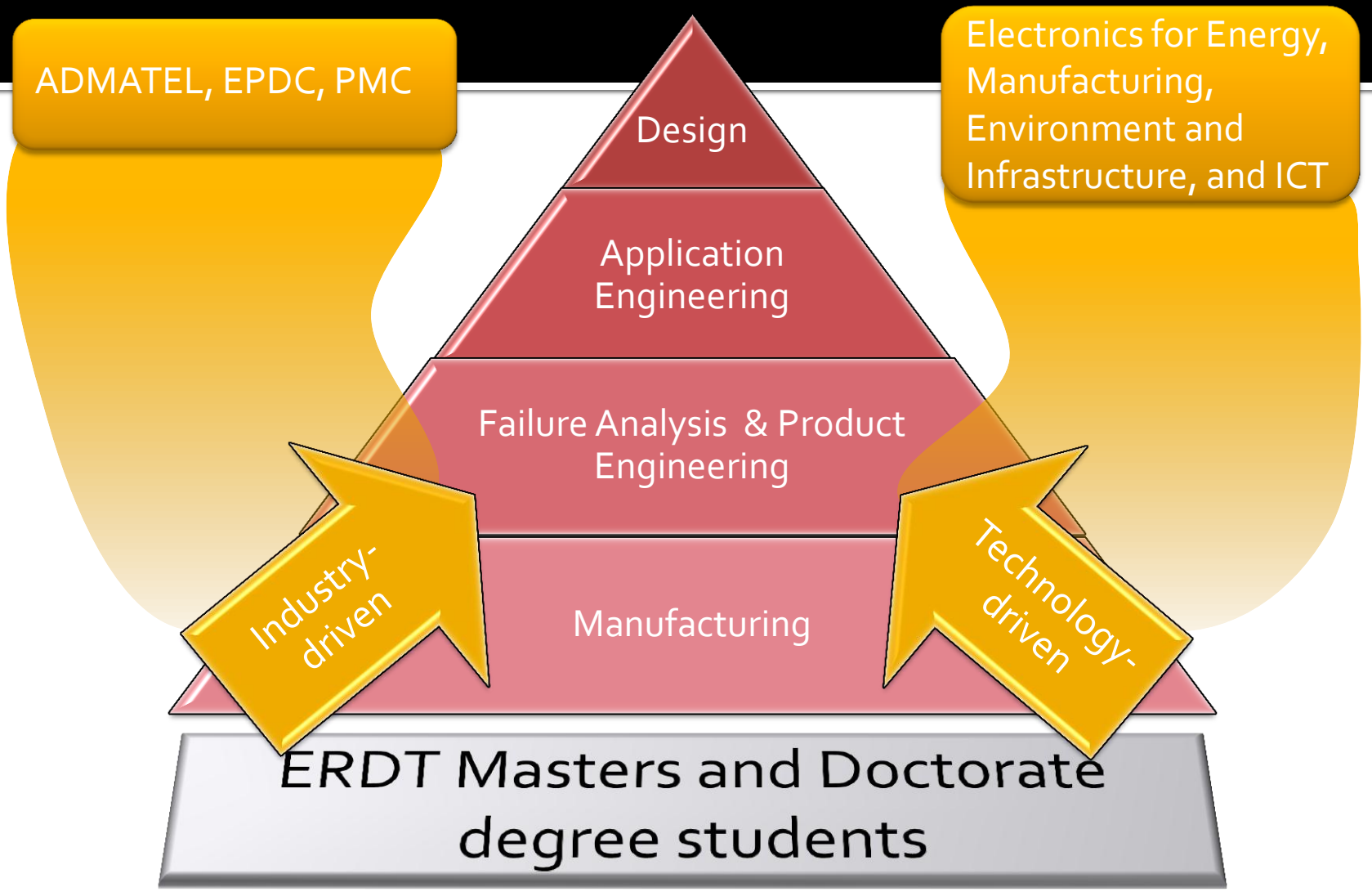
- How would the ERDT SM&E track support these industry-led initiatives?

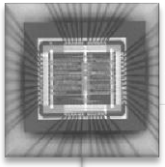
The ERDT SM&E Sub-Tracks

Semiconductor Materials and Electronics (SM&E)

- Chip Design
- High value added materials
- Electronic products and application engineering
- High volume manufacturing
- Failure analysis and reliability

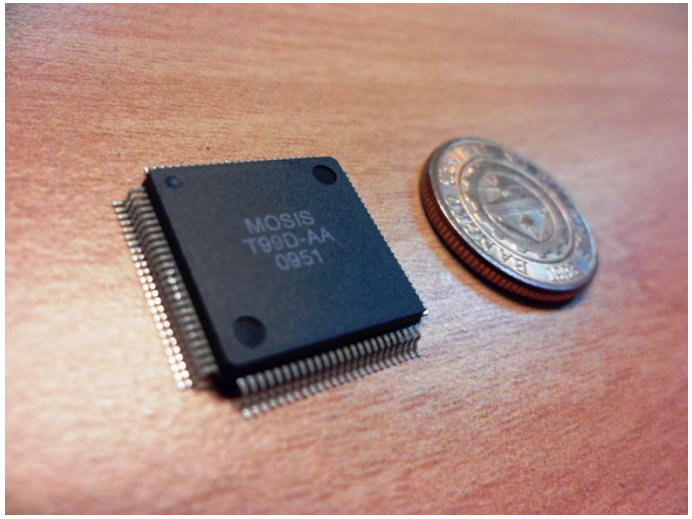
ERDT S&E R & D Agenda for 2013-2016:

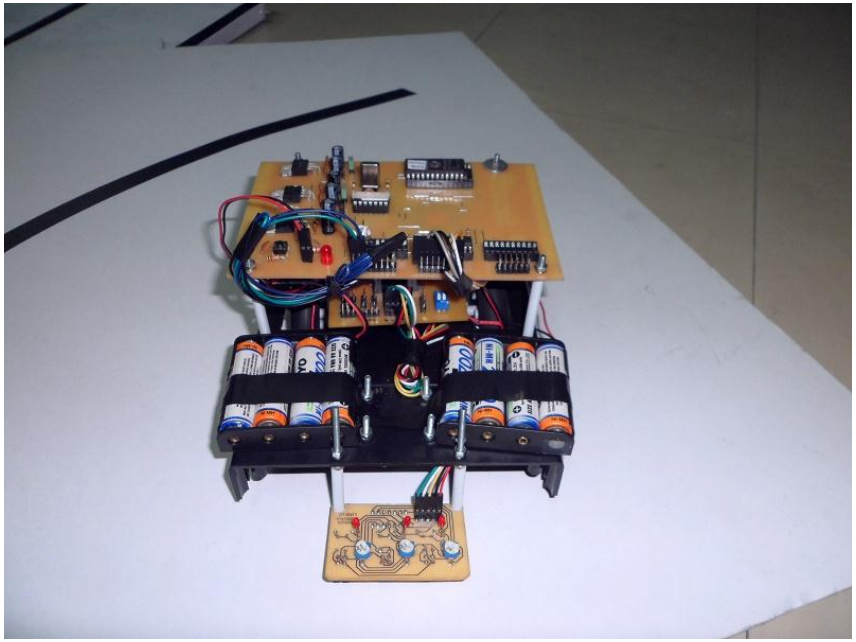




Chip Design

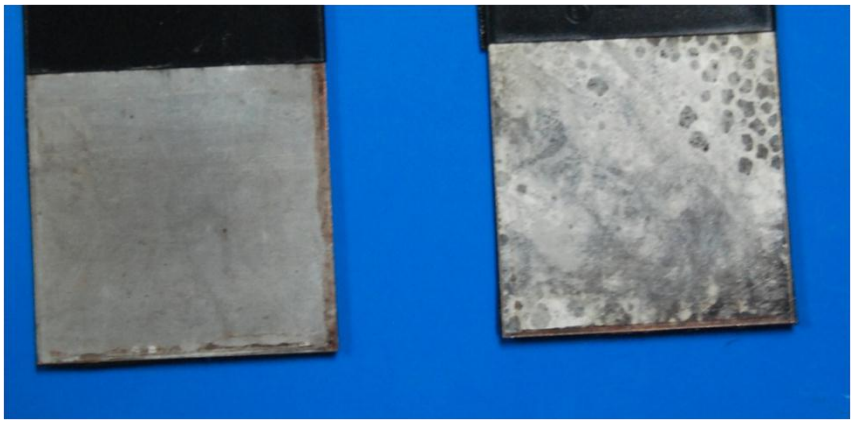
- Lower power digital electronics
- RFIC design
- Analog and Mixed Signal Design
- Application specific ICs
- Energy monitoring ICs



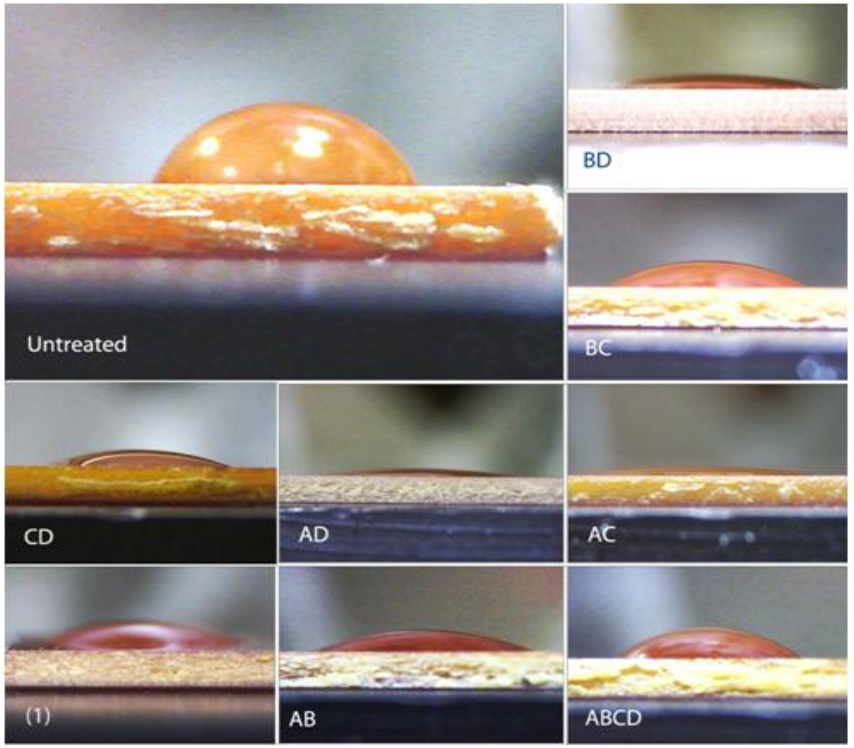


High Value added Products

- Modification of surface properties of polymer
- Nanocomposite for thermal management
- Deposition of superior metallization layers
- Sensor design



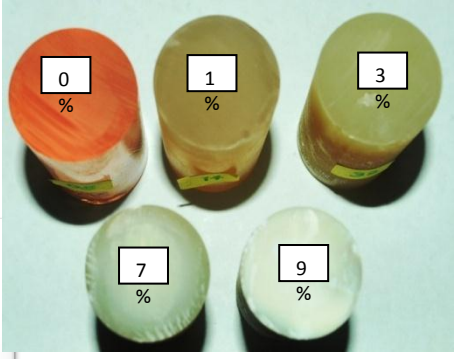
Superior tin metallization layer on copper via pulse plating



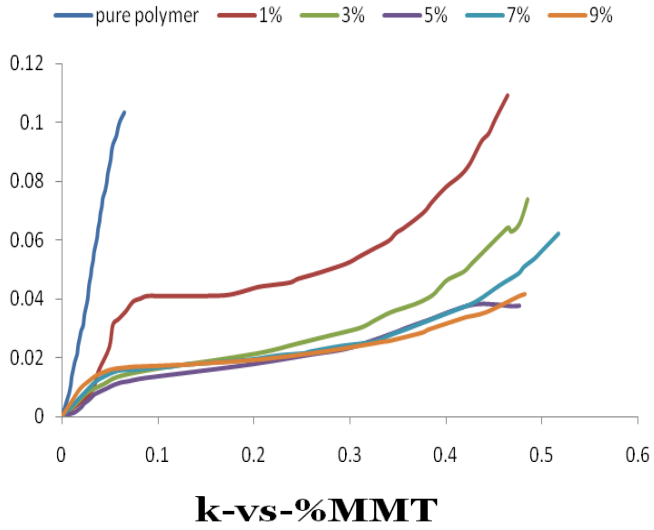
Controlled wettability of polyimide via plasma treatment

High Value added Products

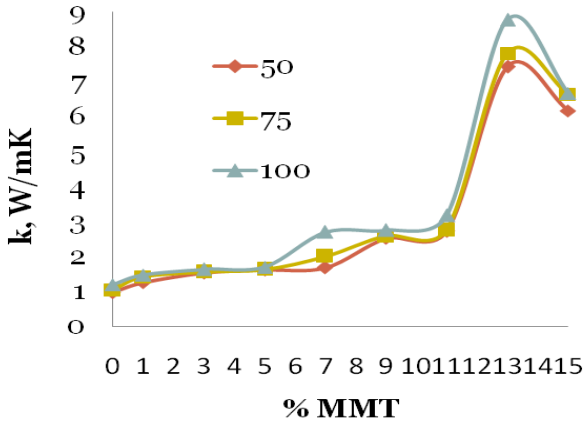
- Modification of surface properties of polymer
- Nanocomposite for thermal management
- Deposition of superior metallization layers



Customized properties of polymer nanocomposite via nanotechnology

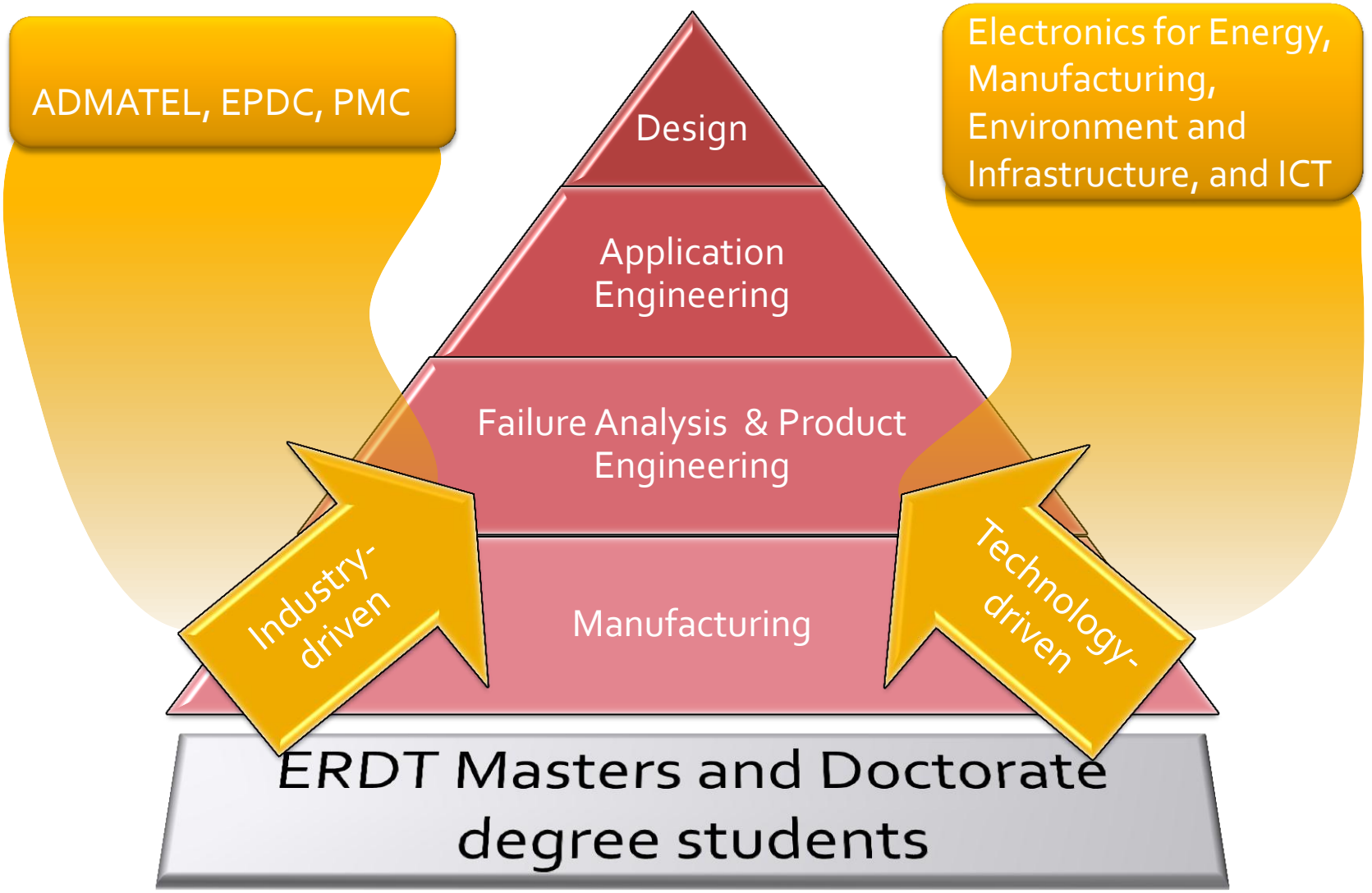


Customized pliability of thermoset polymer



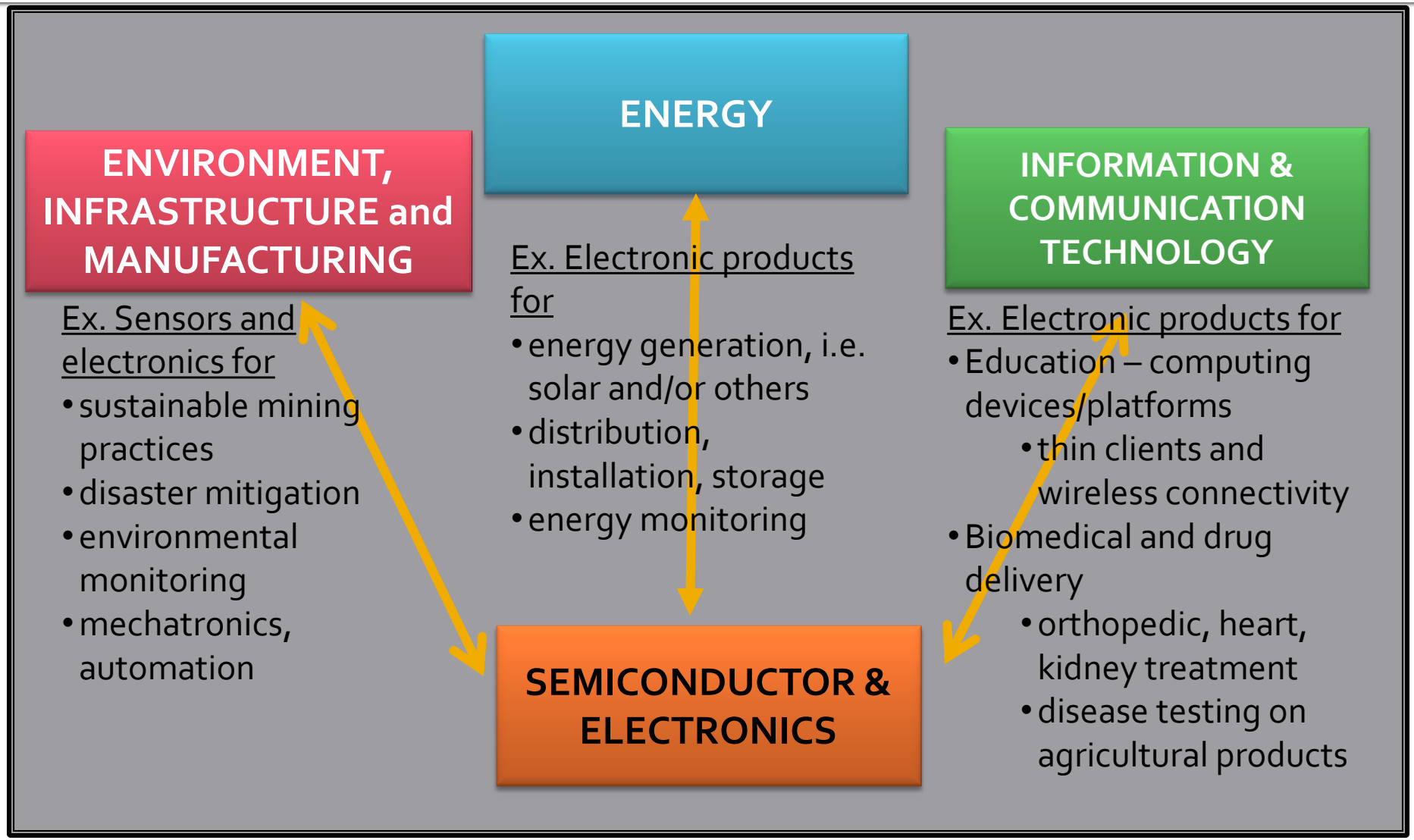
Induced desirable thermal conductivity in polymer

ERDT S&E R & D Agenda for 2013-2016:



R&D on Application ELECTRONICS

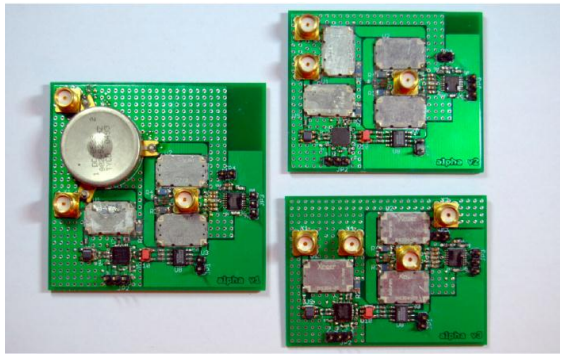
Theme: Enabling Technologies for Energy, Environment & Infrastructure, Manufacturing and ICT through Semiconductor and Electronics R&D

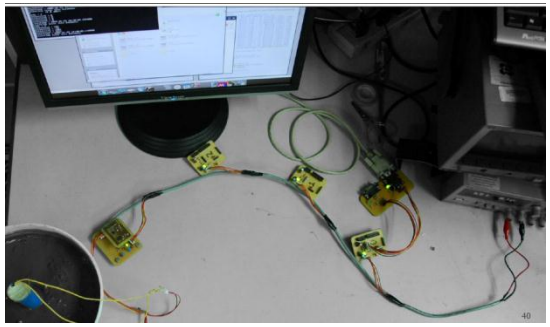


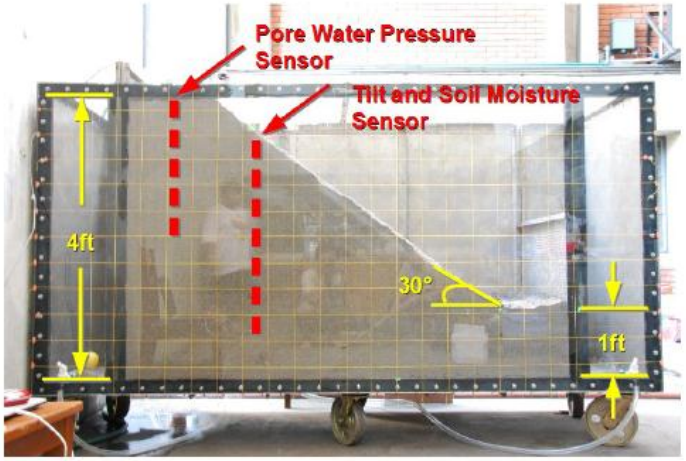
Electronic Products

- Interface modules
- High-speed PCB design
- Sensor signal conditioning and processing

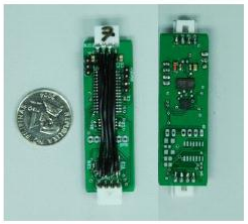
Cost: P14M





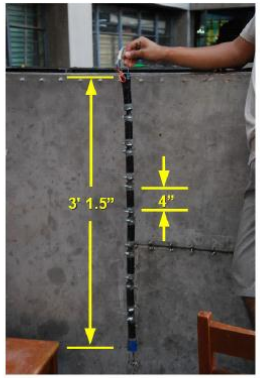


Slope dimensions and instrument placing

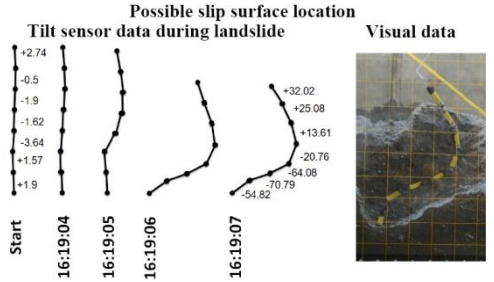


Tilt and soil moisture sensor board

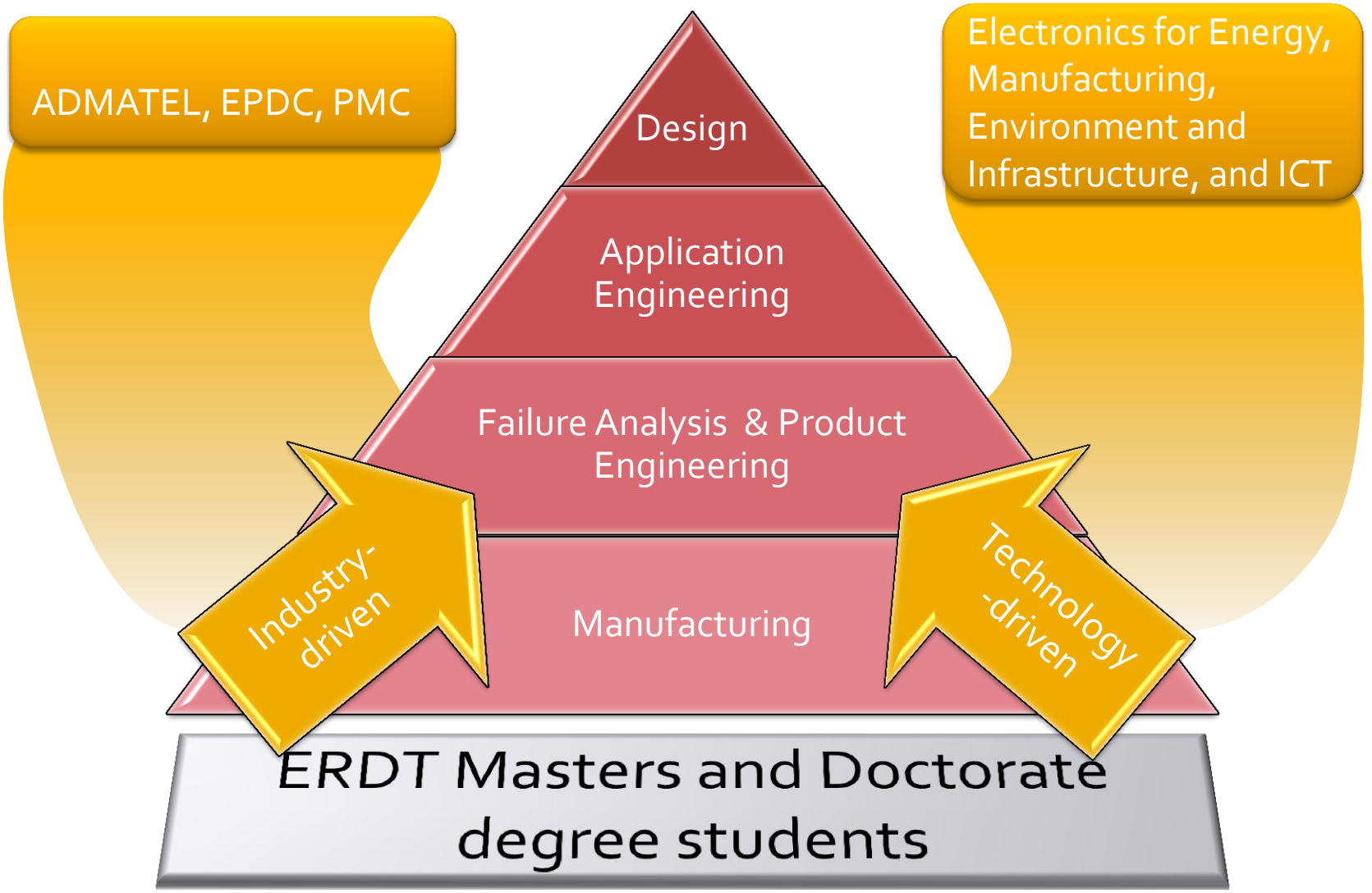
- Stuffing, testing and debugging of integrated sensor boards (8 nodes)
- Construction of 8 soil moisture sensors and alignment of tilt sensors to form the sensor array column



Tilt and soil moisture sensor array column



ERDT S&E R & D Agenda for 2013-2016:



ERDT Consortium / DOST

HUMAN RESOURCES
- graduate students
- graduate faculty
- visiting professors
- visiting researchers

FUND SHARE
- capital fund for top-of-the-line analytical and testing equipment
- capital fund for infrastructure
- maintenance and operating expenses

- Masters thesis
- Doctorate dissertation
- Faculty research projects

SEMICONDUCTOR AND ELECTRONICS MANUFACTURING TECHNOLOGY RESEARCH PROGRAM

Material Properties Characterization, Modification, and Failure Analysis, Packaging

Engineering Support Services such as tool repair and/or refurbishing, equipment retrofitting

Test development and methodologies

Reliability Testing

Increasing local content in the supply chain

Increasing manufacturing efficiency, Process improvements

SEIPI – ASEMEP

MATERIAL INPUTS
- raw materials
- problem topic / areas of concern

HUMAN RESOURCE
- technicians or expert user of analytical and testing equipment
- adjunct researchers

AFFILIATION FEE
- Maintenance, operating, and other expenses

- locally accessible testing facility
- skilled and competent research scientists and engineers

Conclusion

- The R&D agenda of the ERDT SE&M track supports the "Designed, Built and Tested in the Philippines " thrust for global competitiveness.

- Boosting local design and development of electronics in the Philippines
  - Spur growth in local manufacturing
  - Creating robust jobs by providing opportunities for development of local products
  - Defensible, differentiated and world-class products

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Credits

- Mr. Vic Gruet (EIAPI) for the slides on EPDC
- Mr. Bong Minguez (Xynix) for the slides on PMC
- All RTD participants from academe, industry and government
- ERDT leadership and staff

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