



RESEARCH IN THE IITs VISION 2020?

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OUTLINE OF TALK

- Global R & D Investments
- Global and National Challenges
- Core Competence
- The Drivers of Research
- The Research Park



MURRAY GELMANN

Science is inherently an arrogant pursuit:
a small creature on a small planet
revolving around a small sun in a
medium sized galaxy thinks it can
understand the universe!

We in the IITs seem more modest!

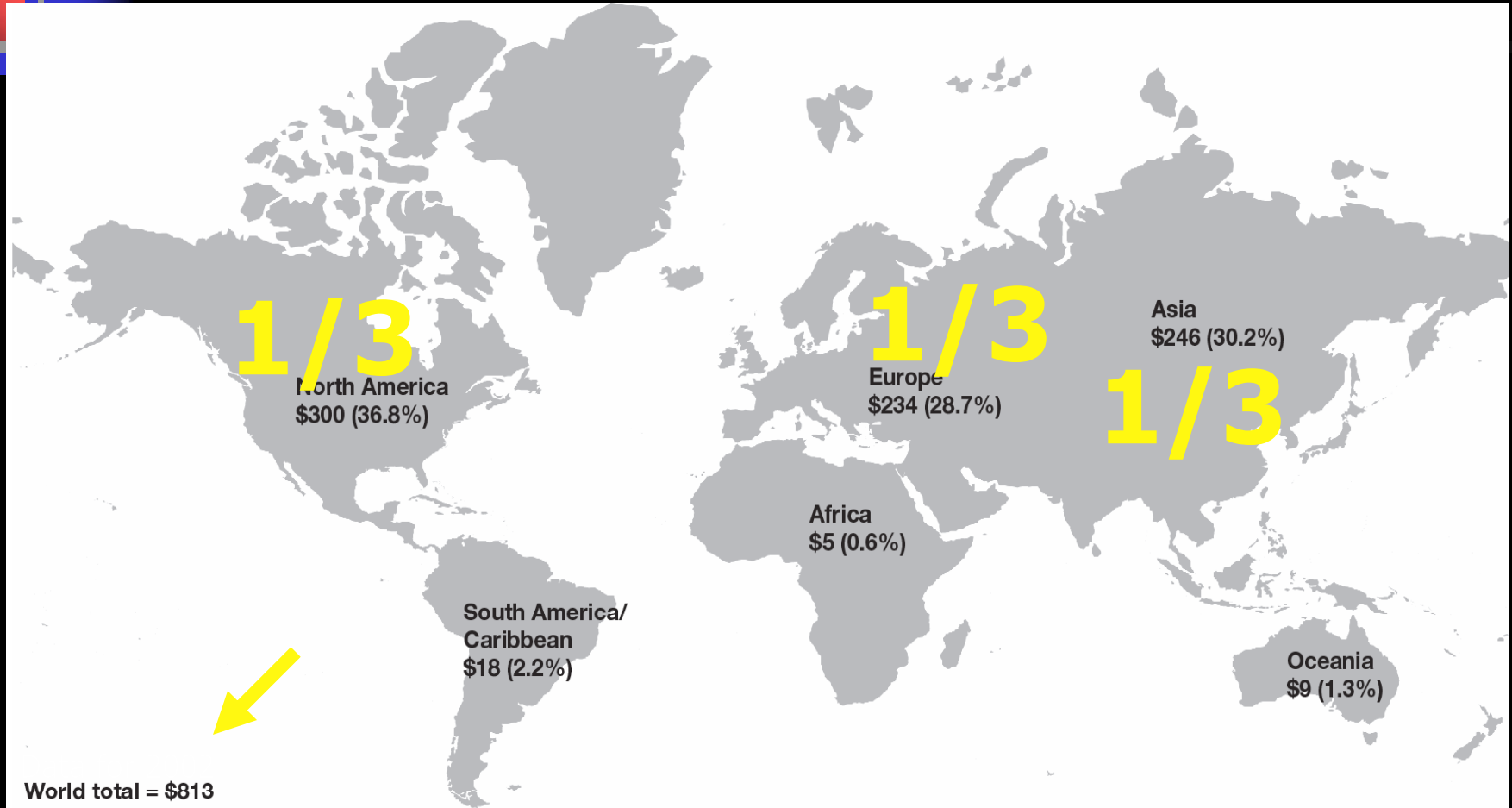


LEWIS & RANDALL

When we visit ancient monuments, we are often filled with wonder. We talk in hushed tones....Go back in your mind to the past when it was under construction. You can hear the noise of workmen cursing and swearingYou realise that these awe-inspiring monuments are the result of ordinary human effort given a direction and purpose by a vision

GLOBAL R&D INVESTMENTS

R&D Expenditures and Share of World Total



NOTES: R&D estimates from 91 countries in billions of purchasing power parity dollars. Percentages may not add to 100 because of rounding.



GLOBAL GRAND CHALLENGES

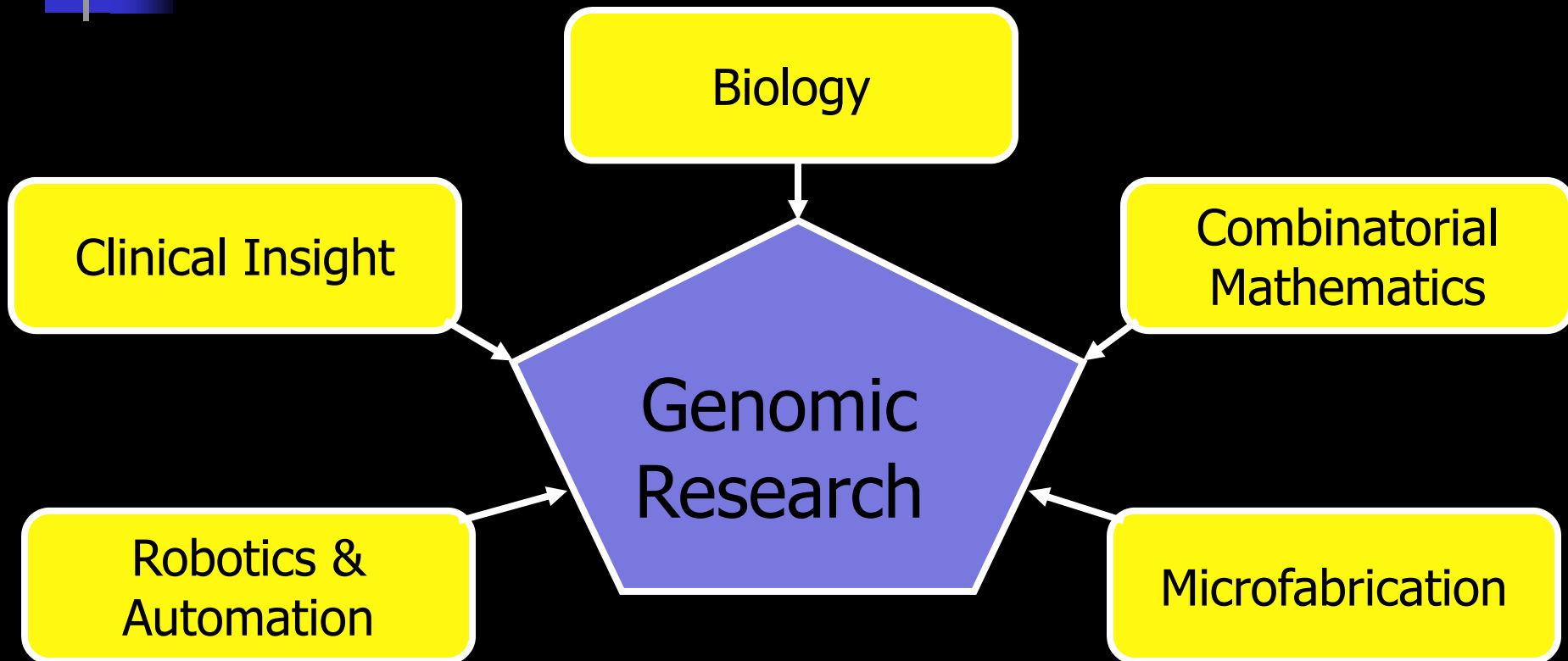
- Climate Change
- Energy and Environment
- Improving Healthcare
- Natural Hazard Mitigation
- Sustainability



NATIONAL CHALLENGES

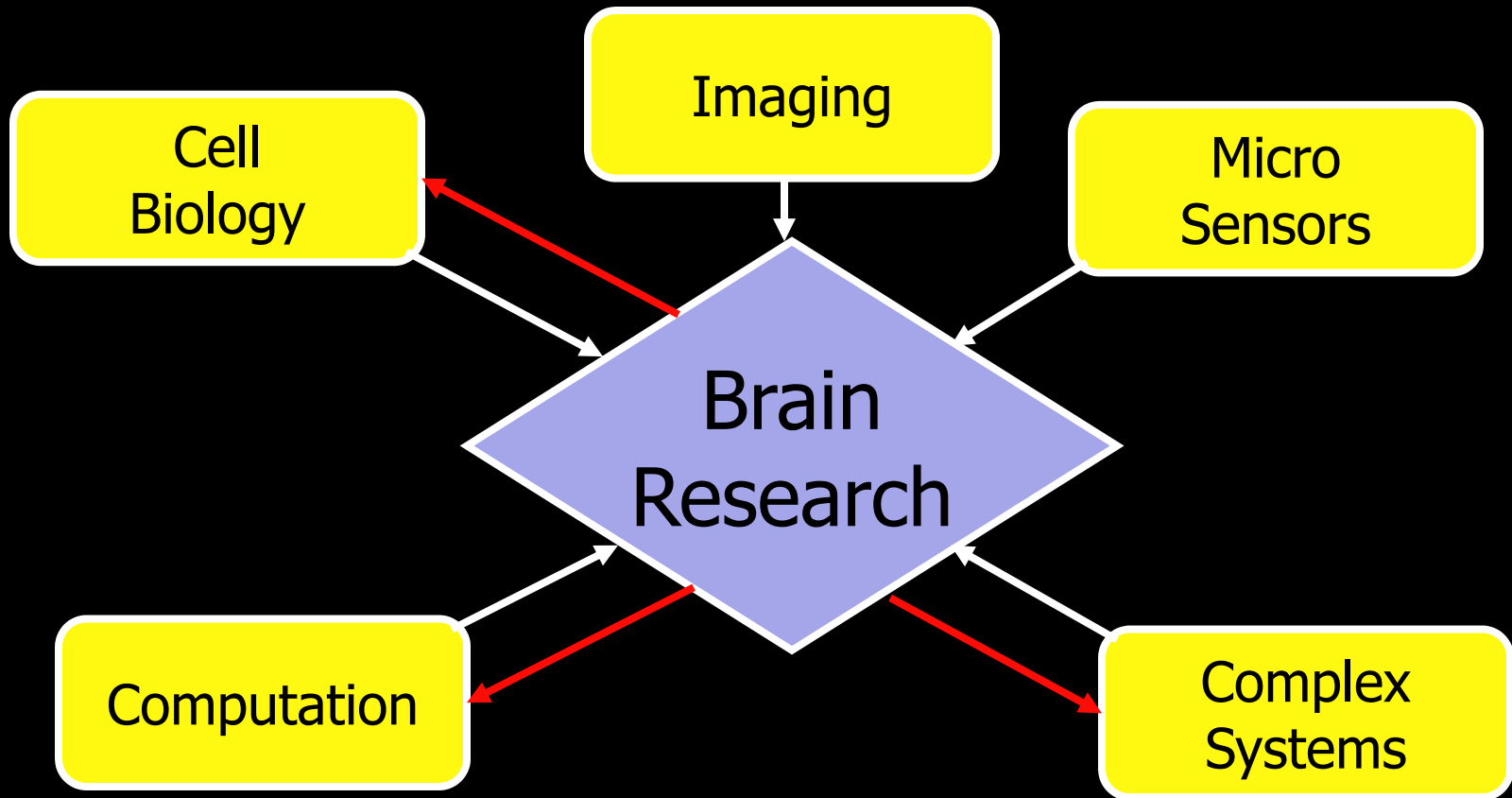
- Food Security
- Water Security
- Manufacturing especially MSME sector
- Infrastructure
- Logistics
- Keeping up with the developed world!

GENOMIC RESEARCH



Courtesy Prof. Charles Vest

BRAIN RESEARCH



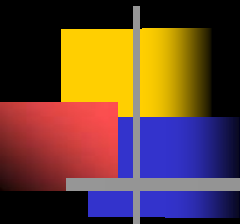
Courtesy Prof. Charles Vest



COLLECTIVE INTELLIGENCE

Can people and computers be connected so that collectively they act more intelligently than any person, group, or computer has ever done before?

R&D IN "PASTEUR'S QUADRANT"



| | | Consideration of use? | |
|----------------------------|-----|-------------------------------|--|
| | | No | Yes |
| Fundamental Understanding? | Yes | Pure Basic Research (Bohr) | Use-inspired Basic Research (Pasteur) |
| | No | | Pure Applied Research (Edison) |

Adapted from *Pasteur's Quadrant*, Donald E. Stokes 1997

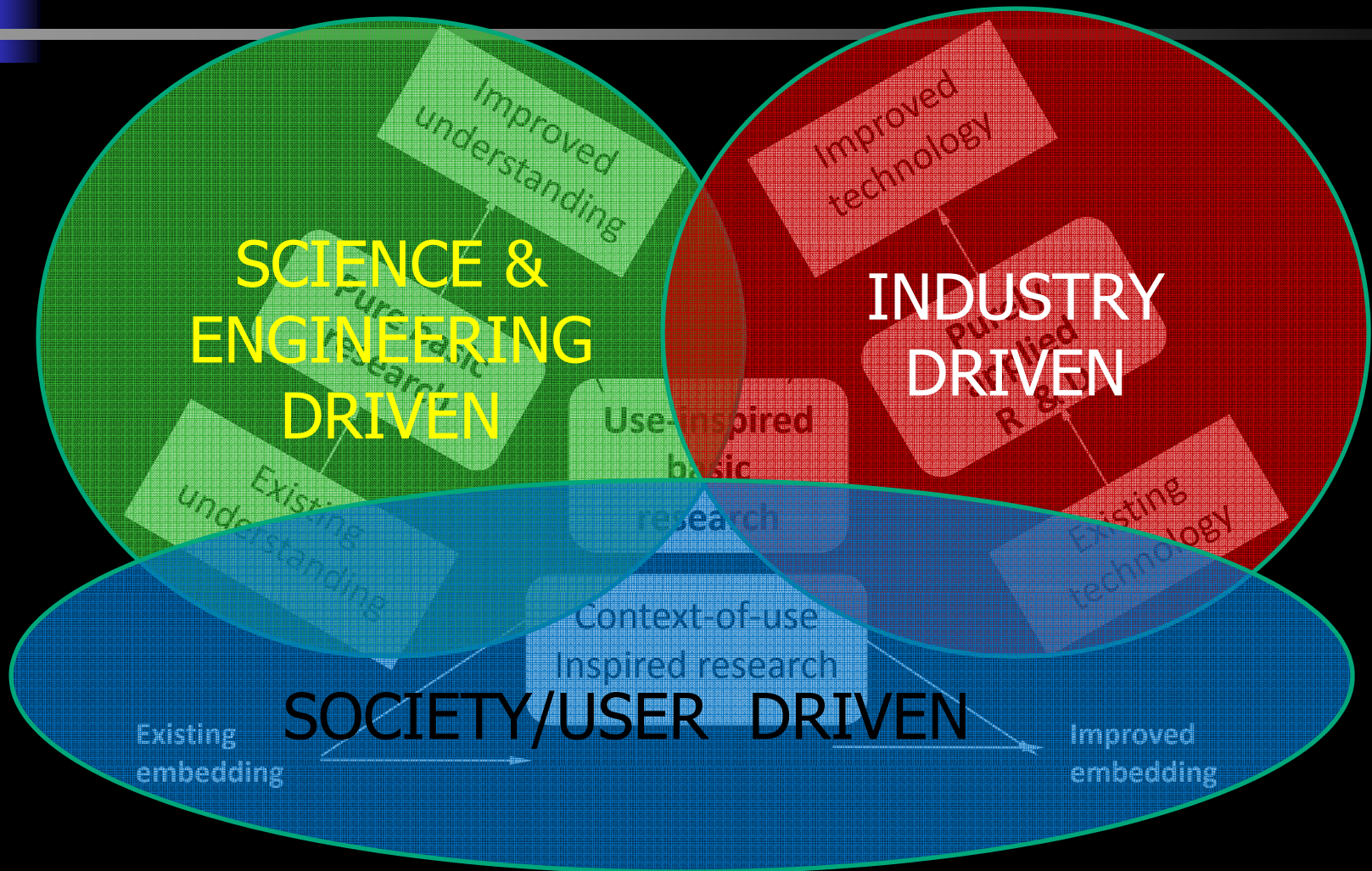


DRIVERS-TOOLS & EXPECTED RESULTS

- Discovery and Invention - Pure basic research - improved understanding
- Industry - Pure applied research - improved technology
- Society - **Innovation & Entrepreneurship** - embedded solutions addressing the whole value chain

COLLABORATIVE R & D

(adapted from President, U of Twente)





CORE COMPETENCE

- Biotechnology
- Nanotechnology
- Information Technology
- Communication Technology
- Complex Systems
- Computational Science and Engineering
- Design and Manufacturing

...Contd.

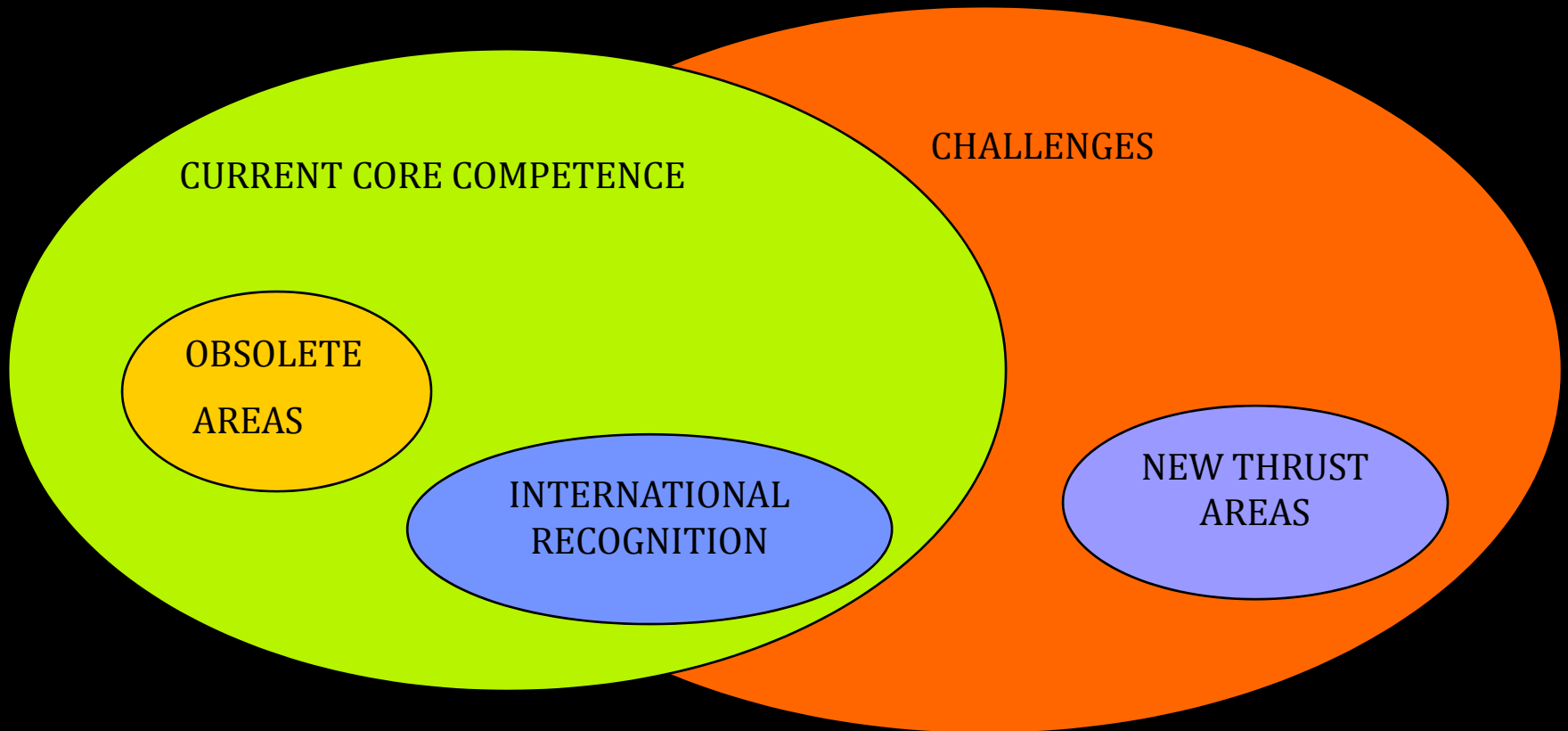


CORE COMPETENCE

...Contd.

- Development Studies
- Transportation Engineering
- Energy Technology
- Environmental Technology
- Infrastructure Technology
- Materials Technology
- System Engineering

RESEARCH AREAS





MANAGING CREATIVITY

- The 'Magic Garden' approach for Discovery and Invention :hire brilliant minds, provide the atmosphere, leave them alone andpray!
- The 'Idea Factory' approach for Innovation: bring unlike minds together and create opportunities for interaction.



BRINGING 'UNLIKE' MINDS TOGETHER

- A. Internationalisation - different cultures
- B. Interdisciplinarity - different disciplines
- C. Research Parks - different attitudes



A. INTERNATIONALISATION

- Science is universal but scientists have a cultural identity and associated prejudices
- Need mix of unlike minds for innovation
- 25% PG students from other cultures
- 10% Faculty from other countries



B. INTERDISCIPLINARITY

- Interdisciplinary approach first used as a management tool to solve ‘real’ problems in specific sectors eg. Bell Labs in 1930s
- “Put mix of academic disciplines to action”
- Freedom at work/forced formal exchange of ideas
- IPR specialists hired to identify opportunities



C. RESEARCH PARKS

- Entrepreneurship flourishes in the vicinity of high quality educational institutions
- Innovation promoted by unlike minds :
 - Faculty : sound theoretical knowledge
 - Industrial R&D personnel : convert ideas into marketable products
 - Students: spirited & ignorant of the impossible



iitm
research
park

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GINGER HOTELS



javagreen
coffee and more



**Coffee &
Coffee Station**

- Espresso
- Macchiato
- Cappuccino
- Latte
- Hot Chocolate

Coffee Cones

- Espresso Cone
- Latte Cone
- Hot Chocolate Cone

**Hot - Coffee &
Smoothies & Shakes**

- Espresso
- Macchiato
- Cappuccino
- Latte
- Hot Chocolate

Ice Blended Smoothies

- Espresso
- Macchiato
- Cappuccino
- Latte
- Hot Chocolate

Hot Soups

- Hot Soup

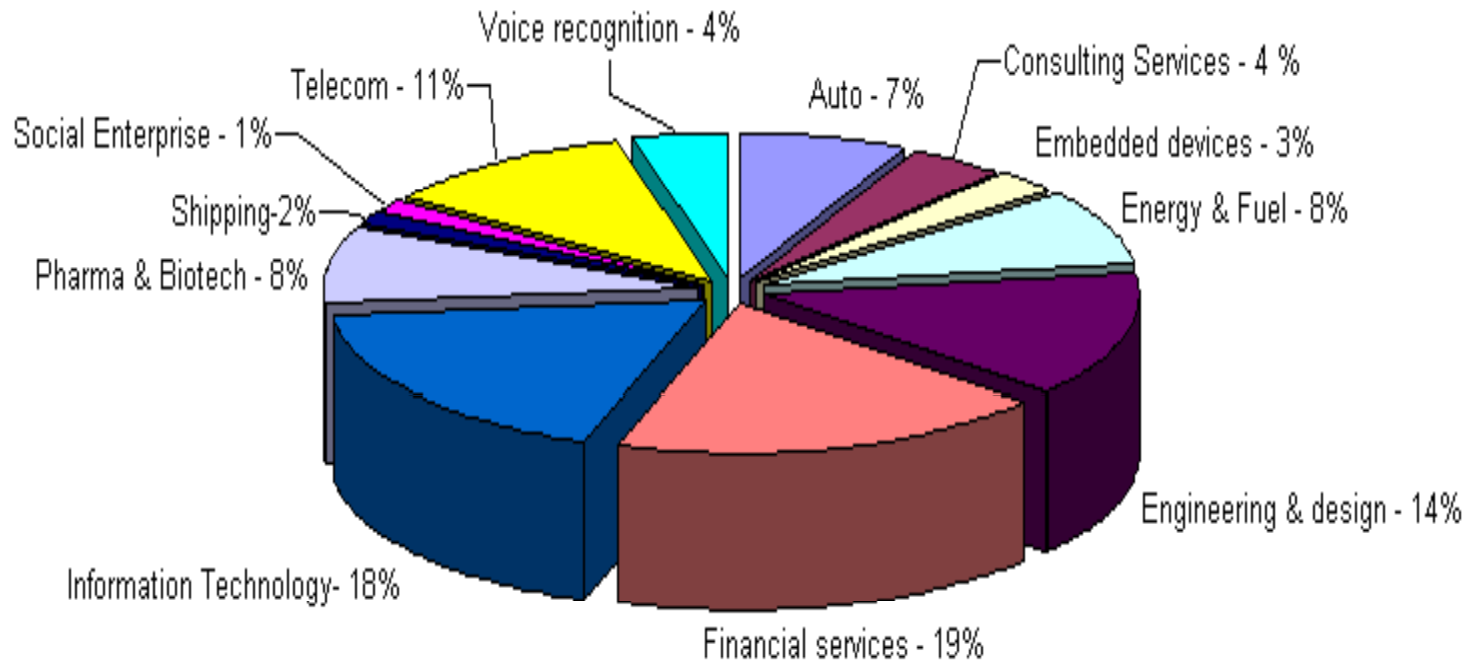


Hot Soups

- Hot Soup

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coffee and more

INDUSTRY WISE CLIENTS



INCUBATEES



ROPE



Uniphore



invention labs
ENGINEERING PRODUCTS PRIVATE LIMITED

THE CREDIT SYSTEM!

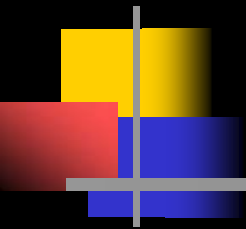
- R&D projects in IITM (credits per Rs 1M)
- Consultancy to IIT Faculty (credits per Rs 1M)
- Royalty (credits per Rs 100K)
- Sponsored Ph.D / Masters Students (per year)
- Adjunct faculty (per year)
- Teaching by Industry personnel per hour
- Joint guidance PhD/ MS/B.Tech (per year)
- Part-time employment PhD/MS/BTech (per mo)

Minimum credits/year/sqft to stay in the Park!



SUMMARY

- Asia's share of global R & D is about a third
- India needs IITs to play a significant role
- IITs need a vision - depends on core competence & the global/ national challenges
- Society is willing to support mainly use-inspired research
- Use-inspired research is driven by innovation and enterprise
- Research Parks best promote both



Thank you for your patience