THE ACADEMIA – INDUSTRY INTERFACE : MYTHS AND REALITY

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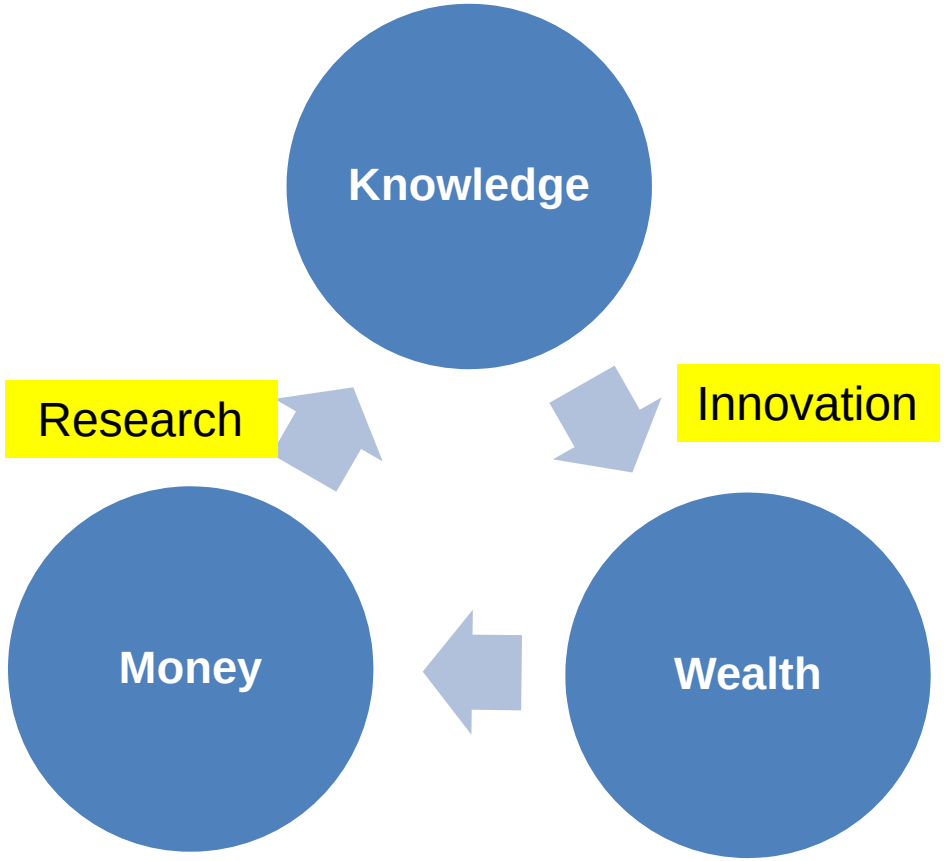
OUTLINE

- The evolution of scientific enterprise
- Academia and industry : The two cultures
- Academic research : The new paradigm
- Academia- industry partnerships : Some personal experiences
- Academia – industry partnerships: The Indian scene
- Academia – industry relationships: Myths, realties and prescription for success

CREATING WEALTH OUT OF KNOWLEDGE

- ***Where*** : Universities, research laboratories, society, industry
- ***Who*** : Faculties, scientists, students, individuals as well as S&T professionals in industry
- ***How*** : Technology transfer and licensing, consulting, spin off ventures, in house conversion to products and services, out-licensing and co-development with partners
- ***Why*** : To create a virtuous cycle of wealth creation from knowledge



STRUCTURE OF SCIENTIFIC ENTERPRISE AT THE BEGINNING OF THE 20th CENTURY

Money

University **Government** Laws, Regulation

Industry

(Professor/Student/Problem/Thesis)

(Development, Manufacturing, Distribution/Sales)

Justus von Liebig 1803-1873

Students: Employment

Professor : Consultant

Knowledge, People

Products/Solutions for Problems

Many of Liebig's students became pioneers of the German chemical industry around 1900

THE RISE AND FALL OF CORPORATE R&D

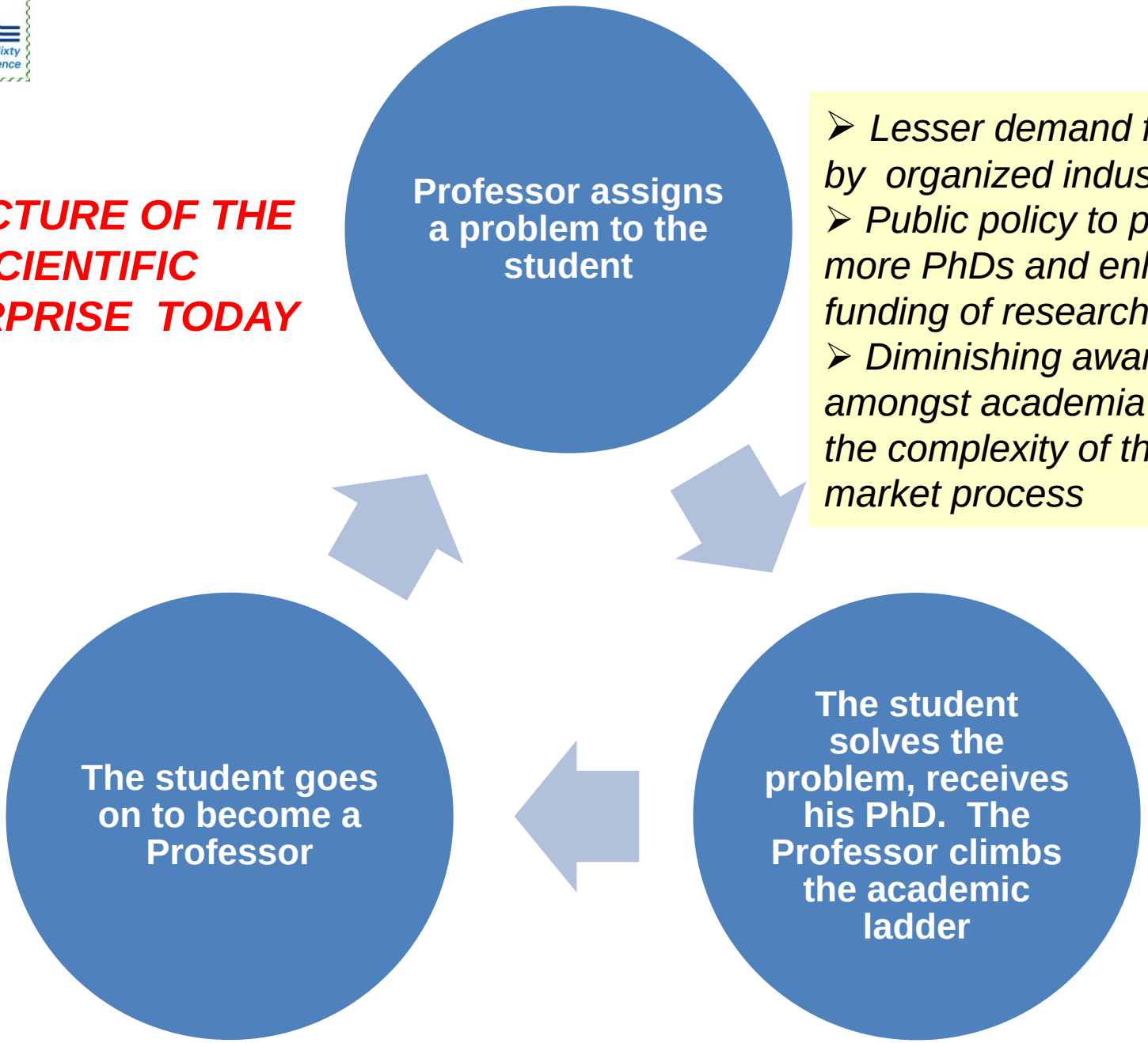
- Corporate R&D flourished for over two centuries, ushering in the explosive growth of industries in Europe, Japan and America
- DuPont, GE, GM, IBM, Exxon, Bell Labs, Kodak, Shell, BASF, ICI, Dow , Monsanto, Hoechst, Ciba, Bayer etc became great hub for science and technology.
- Corporate R&D were large and diverse with a balance of curiosity and market driven programs . Industry had great execution and process skills .It attracted the best of talent ; Flory, Rochow, Knowles, Pederson, Davisson, Bardeen, Shockley, Penzias, Carothers, Langmuir, Hay , some of whom went on to win Nobel Prize.
- Post nineties R&D restructured as part of SBU and funded by business; leadership transitioned from professional R&D managers who had cut their teeth in S&T to professional business managers
- Corporate leadership came under increasing pressure to perform; time needed to recover investments in R&D became short.
- Increasing input costs, globalization of businesses, revolution in ICT, easier diffusion of proprietary technologies, product liability, environment , health, safety and sustainability issues made investment in R&D progressively more risky.

THE RISE AND FALL OF CORPORATE R&D

- Breakup of large corporations: mergers, acquisitions by private equity and even disappearance of companies: ICI, Hoechst, Monsanto, Ciba
- Research expenses became a cost ; cost reduction led to downsizing of internal R&D.
- Corporations sought out external partners for performing research and seed new ideas. Initial motivation was cost reduction
- Academic labs became once again innovation hubs for industry
- New models of academic industry interactions emerged
  - Contract/ collaborative R&D
  - Industrial consortia around knowledge competencies
  - Joint centers of research in academic campuses
  - Industry new venture funds to encourage academic start ups

These changes, created in its wake, new dichotomies, dilemma and mutual learning; industry and academia began to drift even farther apart

STRUCTURE OF THE SCIENTIFIC ENTERPRISE TODAY



- *Lesser demand for PhDs by organized industry*
- *Public policy to produce more PhDs and enlarge funding of research*
- *Diminishing awareness amongst academia about the complexity of the lab to market process*

THE TWO CULTURES OF ACADEMIA AND INDUSTRY

ACADEMIA

- Explore – curiosity driven research
- Create and disseminate knowledge
- Organized discipline wise; often a lone professor and his students
- No hierarchical control; not amenable to top down approach

INDUSTRY

- Exploit – business driven research
- Utilize knowledge
- Inter/multidisciplinary
- Structured/hierarchical control

Academia and industry : Fundamentally different goals and value systems; whereas, industry has problems for which they seek solutions, academia comes up with solutions where seemingly there is no problem !

PURPOSE OF A UNIVERSITY

- Teach to educate
- Perform research to train
- Exploit Knowledge for public good or private good ?

Teaching and knowledge generation and dissemination was the core purpose of an University, not exploitation
Universities are good at discovery and creation of new knowledge; they have poor skills in exploitation

ISSUES IN EXPLOITATION OF ACADEMIC RESEARCH

- One extreme view is that academic research and commercial considerations of results do not mix
- Commercial considerations of research do create conflict in academia between the need to disseminate knowledge and limit access to knowledge
- Public pays twice for the same invention; taxes support university research that yields the invention and the high monopoly prices charged by the provider when the invention reaches the market

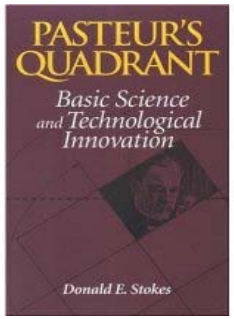
Should academic departments avoid redirecting research purely for commercial outcomes ? Should commercial opportunities be considered only as welcome by products ?

BASIC AND APPLIED SCIENCE : ARE THEY DIFFERENT ?

There is science and the applications of science : Louis Pasteur

The emergence of concept of use inspired science
It means using basic science for a purpose and practical problems as stimulus to curiosity driven research (G.W.Whitesides and J, Deutch, Nature 460, 21 (2011)

Pasteur's Quadrant



1997

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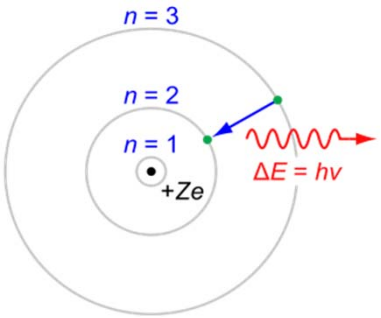
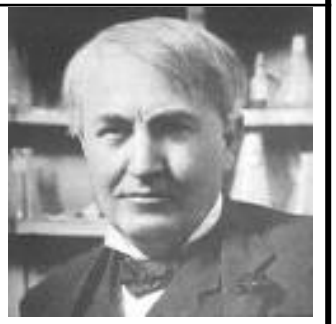


Pasteur

Average
Academic
&
Industrial
R & D



Edison

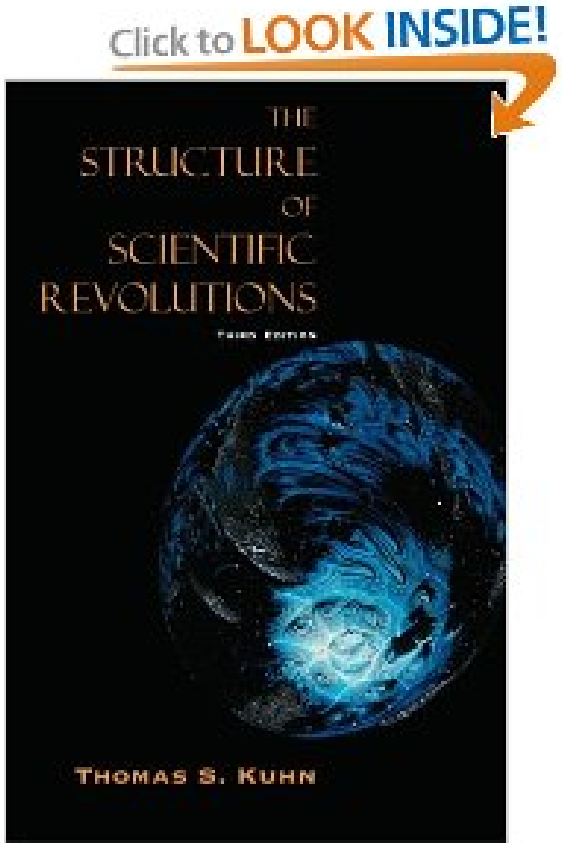
Fundamental Research

Use Inspired Research

THE NORMAL AND DISCOVERY SCIENCE

- Normal Science : Develops existing and accepted ideas or scientific paradigms; solution of puzzles; answer is not important, but elegance of solution is more important
- Discovery Science: Fundamental change in thought; solutions to problems; answer is important

Increasing tendency for segmentation



The Structure of Scientific Revolution, T .S. Kuhn , University of Chicago Press, 1962

SOME EXAMPLES OF MAJOR DISCOVERIES FROM ACADEMIA

- Taxol : University of Florida
- Cis Platin : Michigan State University
- Steptomycin : Rutgers (Waksman, Nobel Prize)
- Polio vaccine : University of Pittsburgh (Jonas Salk, Nobel Prize)
- Insulin : University of Toronto
- Recombinant DNA : Stanford and University of California (Cohen and Boyer)
- MRI : State University of New York
- Fluoride in toothpaste : Indiana University
- Gatorade : University of Florida

DISCOVERY SCIENCE BEGETS NEW TO THE WORLD TECHNOLOGIES

A few names from the world of academia whose work has spawned new businesses

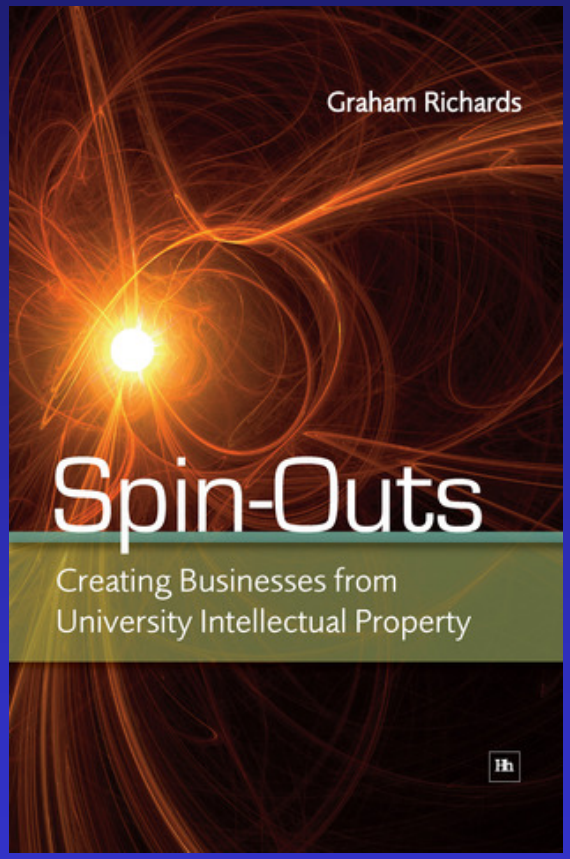
- Michael Graetzel
- George Whitesides
- Robert Grubbs
- Chad Mirkin
- Richard Friend
- Robert Langer etc. etc.

Excellence in science and creating new technologies are not mutually exclusive

SPIN OUTS : CREATING BUSINESSES FROM UNIVERSITY INTELLECTUAL PROPERTY : GRAHAM RICHARDS (2009)

- **Experience has shown that most of the really successful spin outs have been based on research that was not seen originally to be a likely source of profitable intellectual property. The so called " blue skies" research is a far better source than that which obviously exploitable for profit at the outset.**

- **The key is to recognize the potential, The best person to do this is the individual who is doing the research with a little advice and support form someone who understands the commercial process**



Spin Outs : Creating Businesses Form University Intellectual Property, Graham Richards, Harriman House, 2008

BASIC RESEARCH IN TIMES OF CHANGE IN SOCIAL CONTRACT BETWEEN SCIENCE AND SOCIETY

Do basic research

(and someone will solve societal problems)

Solve societal problems

(and, by the way, if you want to do some fundamental research, that's OK

Learning to connect principles of science to the concerns of society ; emphasis on application and functions; Focus on problems that need to be solved , not merely those that can be solved

Mere exploration without exploitation of knowledge is sterile. In an environment where research is predominantly publicly funded, this situation leads to loss of credibility amongst stakeholders

Professor J. P. Kennedy
University of Akron
Obtained his 100th US patent at the age of eighty !

FROM LAB TO MARKET : A CASE STUDY

- 1997 : PhD research of L. S. Ramanathan
- 1999 : Four US patents and publications (US Pat.,5,814,675; 5,859,075; 5,962,003; 6,123,988)
- We had a solution, but there was no problem !
- 2000-2005 : Incubation and presented results in many forums including industries, Indian and Global
- 2006: One such chance encounter defines the problem; Getting fragrances into clothes presents a challenge for detergent companies and suppliers
- 2007 : Problem definition; potential application of knowledge; product development begins
- 2007 : Research collaboration set up with P&G; product fine tuning, scale up. Product evaluation with Laundry Science group at New castle and Brussels
- 2010 : Applications patents applied for
- 2010 : Product enters market – Downy Fabric Softeners

MICROCAPSULATED PERFUME

“ Getting fragrance onto clothes presents a challenge for detergent companies and their suppliers”

Cover story: Chemical & Engineering News, January 29,2007

Customer perceptions

•Nice fragrance while taking out the fabric from washing machine

•Fragrance persists when washed fabric is being used i.e. superior “tenacity “ is desired.

•Far better ”tenacity” fragrance should have good “substantivity”

•To protect the perfume from different chemicals present in detergent composition i.e. perfume should have good storage stability in the product.

Is perfume microencapsulation a solution to this problem ?

Procter's gamble

How much force do you need to twist the cap off a bottle? How do you keep clothes smelling nice even a week after they've been washed? Just some of the questions that allow one of the world's largest consumer goods giants to take its Indian brains global

Seema Singh
seema.s@livemint.com

Stepping inside the innovation centre of the world's largest consumer goods company in suburban Bangalore, anticipation runs high: how does the $78.9 billion Procter & Gamble Co., maker of Tide detergent and Pampers diapers, come up with its next blockbuster product? How big is the innovation funnel that has spewed out products ranging from paper towels to dentifrice to boatloads of over-the-counter brands?

Inside the fifth floor of Neil Rao Towers at Whitefield, a thin veil of disappointment descends when all that comes to view is a bunch of P&G products neatly displayed in the hallway, and later, deliberately arranged in the conference room.

But as Ashish Chatterjee, head of the Bangalore Innovation Centre (BLIC), starts talking about some of the 200 brands that the company sells, and how it immerses itself into the lives of consumers, it dawns that the consumer business is far from being a pedestrian affair.

What should be the optimum force needed for twisting open a bottle cap?

What's the right pressure for the plunger on a bottle of skincare cream?

Why should the black box that a lotion comes in be replaced with transparent packaging, as with Olay products?

These and many such questions dominate researchers' work as they drive "purpose-inspired innovation" at P&G. "It's certainly not an aircraft engine; we don't always go for the big bang," says Chatterjee. "Our innovation is driven by consumer inspiration."

He sums it up as two moments of truth — one, when the consumer browses in a store and ends up buying a P&G product; second, when the person returns to buy either the same or any other item made by the company.

Defined by these moments of truth, BLIC was set up in July 2008 as one of the 28 innovation centres within P&G. It is a capability hub, smaller than some of P&G's mega centres, and provides modelling and open innovation resources for the global enterprise.

It was in 2000 that the Connect and Develop, or C+D, concept of open innovation was mooted by the then chief executive Alan G. Lafley. It wasn't the best of times for P&G: the stock had just lost half its value amid an aggressive growth plan and Lafley decided to shed bricks and mortar R&D infrastructure for open innovation. He directed that ideas and innovations sourced from outside should go up from 10 per cent to 50 per cent in the next five years.

A decade later, the company has far exceeded that limit. It has also changed tack — from getting the world to its lab to taking its labs to the world. For each of its 100 engineers and scientists working in Bangalore, the centre collaborates with five researchers outside.

Now, at two-year-old BLIC, there are a few tangible results, says Chatterjee, who is also director, Asia C+D and Bangalore Beauty Care.

Using computer modelling, this centre has screened millions of molecules to identify a new molecule in the area of skin improvement. While it's into clinical studies now, Chatterjee emphasises that in such studies, knowing "how it works", rather than "why it works" is more important so that the active can be used in other skin applications as well. The computing expertise of BLIC, which Chatterjee likens to "Intel Inside", powers the P&G innovation engine but isn't visible from outside.

From simulating entire packaging lines to complete plant production units, modelling is used to reduce the start-up cost, eliminate waste in the system and to optimise existing operations. A new multi-category production system, designed at BLIC, has just been rolled out which Chatterjee says will save "several millions of dollars for P&G". In this industry, there's no such thing as a cost that can't be cut.

As economic recovery has been slow in many parts of world and consumers are still hurting, premium brands continue to struggle. Meanwhile, in India, where the $24 billion consumer packaged-goods industry is growing at 12 per cent per year according to Nielsen Co., P&G lags behind its closest rival, Unilever, in market share.

Historically, says Ramesh Srinivas, executive director, consumer business practice, KPMG Advisory Services India, P&G has placed its products globally; it won't be looking at just regional benefits arising out of these innovation centres. He is right.

Though some of the BLIC-designed packaging, such as of Olay Total Effects and Olay Regenerist, have been selling in global stores, one of the earliest examples of open innovation from here has gone into products that have not yet entered the Indian market.

For instance, BLIC and the National Chemical Laboratory, a Council of Scientific and Industrial Research laboratory in Pune, have developed a new micro-encapsulating technology that has gone into its fabric softener Downy. Yet to hit Indian stores, the company says its fragrance lasts for a week after the wash, longer than rival products.

The key lies in the technology that allows the perfume-containing micro capsules to open up when the dehydration process kicks in. The end product, says Chatterjee, is "cheaper and better". The laundry science groups in Newcastle and Brussels were also involved in the development of the product.

P&G, like many other consumer goods companies, is trying hard to boost sales in the US and Europe.

While sales growth in emerging markets is easier to come by, in mature markets the company needs to rely on lowering prices or come up with innovative products, says Jack P. Russo, an analyst with the Edward Jones, a retail brokerage in St Louis, US.

"P&G is relying on both of these measures but it appears the emphasis on innovation has been more pronounced since (Robert) McDonald has taken over as CEO (in June 2009)."

Consumers definitely want innovative products but because they are also seeking value P&G won't be able to charge a premium on these as it would have done in the past, added Russo.

The Cincinnati giant is already treading that path. C+D 2.0, which has been effective since 2008, is all about value creation for the company and its partners", Chatterjee says.

P&G's products touch about four billion lives today. The company intends to add another billion to this in the next five years, spurred by its well-oiled innovation machine. To the two Asian megs' centres in China and Japan, a third one is being added in Singapore. "It's no secret Asia is a battleground," says Chatterjee, who is firming up plans to add more products as well as processes to BLIC's modelling capabilities.

yeswecan

- **Bangalore Innovation Centre Started: 2008**
- **Made in India: New 'holistic' designs of Head & Shoulder shampoo and conditioner bottles; a new molecule/active for skin improvement; transparent packaging of Olay products; microencapsulating technology that has gone into its fabric softener Downy**

BLIC head Ashish Chatterjee poses with P&G's products at its Bangalore centre.

Laboratories at P&G's innovation centre in Bangalore support computer modelling. HEMANT MISHRA / MINT PHOTOS

Every Friday, this series chronicles technological innovation and India's rise as a global R&D hub. Read previous stories at www.hindustantimes.com/innovation

Hindustan Times 17th Sept. 2010

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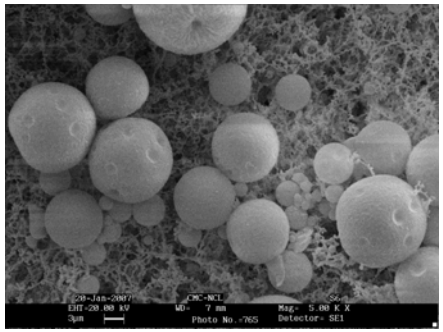
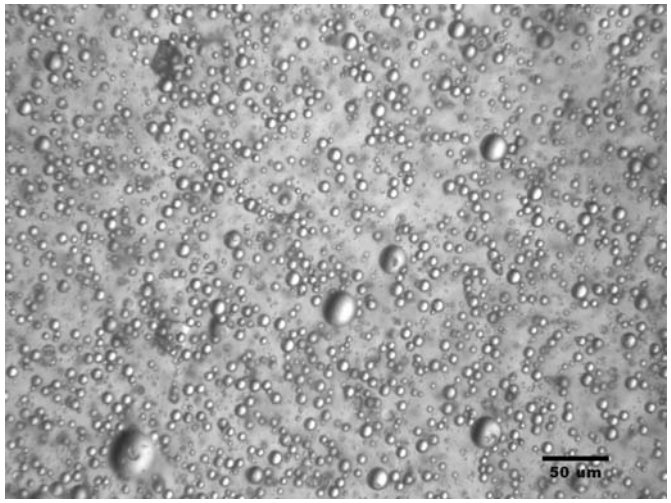
Patent applications filed US 2010/0119679 and WO 2010/053940

Polymer microcapsules for fabric care



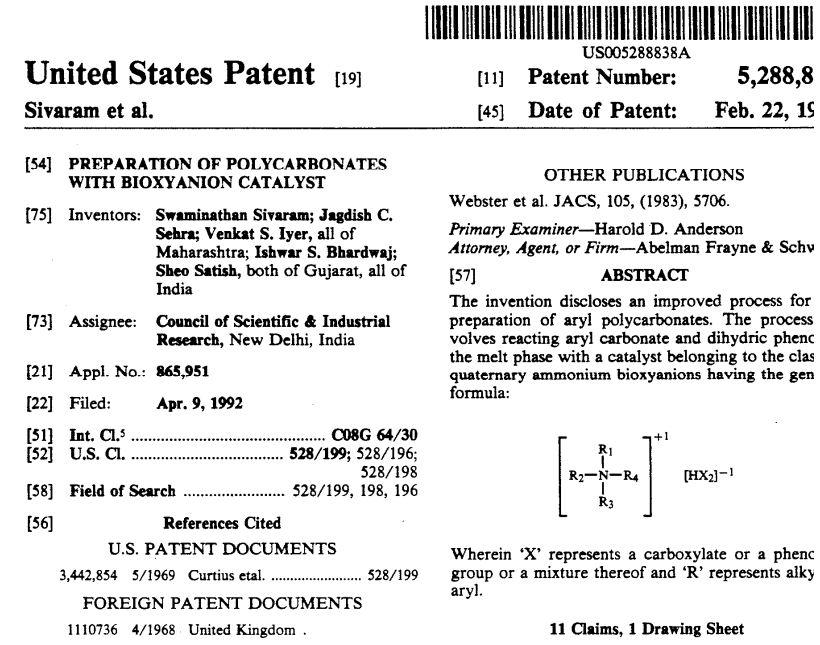


CREATING WEALTH OUT OF INTELLECTUAL PROPERTY

- Curiosity driven research initiated in 1989 in the area of high performance materials
- Research performed by PhD students
- Research aimed at new processes to make poly(carbonate)s and poly(ester - carbonate)s without phosgene and at substantially lower temperatures, than hitherto practiced
- Research resulted in three PhD thesis, eight US patents and several publications
- Negotiations with GE Plastics initiated in 1993 for sale of patents on "as is where is" basis; negotiations concluded in 1995 with GE Plastics licensing all the NCL - CSIR patents
- Ratio of value earned to research cost ~ 100

First example of licensing from CSIR

EARLY YEARS AT NCL : THE THRILL OF PATENTING



US005288838A

United States Patent [19]

Sivaram et al.

[11] **Patent Number: 5,288,8**

[45] **Date of Patent: Feb. 22, 19**

[54] **PREPARATION OF POLYCARBONATES WITH BIOXYANION CATALYST**

[75] Inventors: **Swaminathan Sivaram; Jagdish C. Sehra; Venkat S. Iyer,** all of Maharashtra; **Ishwar S. Bhardwaj; Sheo Satish,** both of Gujarat, all of India

[73] Assignee: **Council of Scientific & Industrial Research,** New Delhi, India

[21] Appl. No.: **865,951**

[22] Filed: **Apr. 9, 1992**

[51] **Int. Cl.**[5] **C08G 64/30**

[52] **U.S. Cl.** **528/199;** 528/196; 528/198

[58] **Field of Search** 528/199, 198, 196

[56] **References Cited**

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3,442,854 5/1969 Curtius etal. 528/199

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Webster et al. JACS, 105, (1983), 5706.

Primary Examiner—Harold D. Anderson

Attorney, Agent, or Firm—Abelman Frayne & Schv

[57] **ABSTRACT**

The invention discloses an improved process for preparation of aryl polycarbonates. The process volves reacting aryl carbonate and dihydric phenc the melt phase with a catalyst belonging to the clas quaternary ammonium bioxyanions having the gen formula:

$$\left[R_2-\overset{\overset{R_1}{|}}{\underset{\underset{R_3}{|}}{N}}-R_4 \right]^{+1} \quad [HX_2]^{-1}$$

Wherein 'X' represents a carboxylate or a phenc group or a mixture thereof and 'R' represents alky aryl.

11 Claims, 1 Drawing Sheet

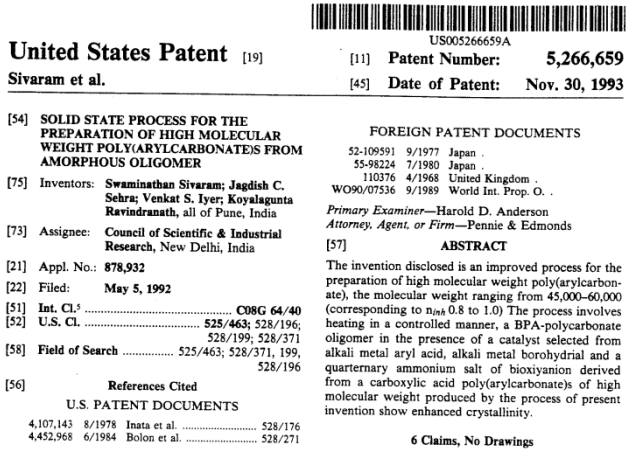
Over twenty five US patents in the broad area of polycondensation chemistry

Over 10 million dollars of income through patent licensing fee, royalties, research and consulting fee to NCL

The Beginning

This patent led to over ten years of very productive and exciting research in the area of solid state polymerizations of polycarbonates, resulting in several PhD thesis, publications and industrial partnership with GE plastics. This also established the principle of "organic catalysis" for polymer synthesis

EARLY YEARS AT NCL : THE THRILL OF PATENTING



US005266659A

United States Patent [19]

Sivaram et al.

[11] **Patent Number: 5,266,659**

[45] **Date of Patent: Nov. 30, 1993**

[54] **SOLID STATE PROCESS FOR THE PREPARATION OF HIGH MOLECULAR WEIGHT POLY(ARYLCARBONATE)S FROM AMORPHOUS OLIGOMER**

[75] Inventors: **Swaminathan Sivaram; Jagdish C. Sehra; Venkat S. Iyer; Koyalagunta Ravindranath,** all of Pune, India

[73] Assignee: **Council of Scientific & Industrial Research,** New Delhi, India

[21] Appl. No.: **878,932**

[22] Filed: **May 5, 1992**

[51] **Int. Cl.**[5] **C08G 64/40**

[52] **U.S. Cl.** **525/463;** 528/196; 528/199; 528/371

[58] **Field of Search** 525/463; 528/371, 199, 528/196

[56] **References Cited**

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4,452,968 6/1984 Bolon et al. 528/271

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55-98224 7/1980 Japan .
110376 4/1968 United Kingdom .
WO90/07536 9/1989 World Int. Prop. O. .

Primary Examiner—Harold D. Anderson
Attorney, Agent, or Firm—Pennie & Edmonds

[57] **ABSTRACT**

The invention disclosed is an improved process for the preparation of high molecular weight poly(arylcarbonate), the molecular weight ranging from 45,000–60,000 (corresponding to η_{inh} 0.8 to 1.0) The process involves heating in a controlled manner, a BPA-polycarbonate oligomer in the presence of a catalyst selected from alkali metal aryl acid, alkali metal borohydrial and a quarternary ammonium salt of bioxiyanion derived from a carboxylic acid poly(arylcarbonate)s of high molecular weight produced by the process of present invention show enhanced crystallinity.

6 Claims, No Drawings

Published in Macromolecules, 26, 1186 (1993)

Genesis of CSIR's IP Policy 1996

"The history of CSIR's recent patent successes has origins in the patent filed on May 5, 1992 by S. Sivaram et al of National Chemical Laboratory , Pune (US Pat 5,266,659 dated 30 November 1993) with the assignee as CSIR. This was followed by what was to be a milestone in Indian patenting history , when GE showed immense interest in the work pertaining to the NCL patent "

Current Science, 85, p.571, 10 September 2003

CREATING VALUE TO CUSTOMER THROUGH INTELLECTUAL PROPERTY

- GE - NCL Research Alliance established in 1995
- Ten year alliance, multi project and guaranteed annual funding
- Global teams (R&D, technology, marketing, production) focused on challenging new product/process platforms
- Value of relationship judged based on creation of patents estate; Offensive patenting strategy to create high barriers for competition to practice technology

From little acorns do tall oaks grow

United States Patent: 5,288,638 - Microsoft Internet Explorer

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Address

United States Patent

Sivaram , et al.

Preparation of polycarbonates with bioxyanion catalyst

Abstract

The invention discloses an improved process for the preparation of aryl polycarbonates. The process involves reacting aryl carbonate and dihydric phenol in the melt phase with a catalyst belonging to the class of quaternary ammonium bioxyanions having the general formula: ##STR1## Wherein 'X' represents a carboxylate or a phenolate group or a mixture thereof and 'R' represents alkyl or aryl.

Inventors: **Sivaram; Swaminathan** (Maharashtra, IN); **Sehra; Jagdish C.** (Maharashtra, IN); **Iyer; Venkat S.** (Maharashtra, IN); **Bhardwaj; Ishwar S.** (Gujarat, IN); **Satish; Sheo** (Gujarat, IN)

Assignee: **Council of Scientific & Industrial Research** (New Delhi, IN)

Appl. No.: **865951**

Filed: **April 9, 1992**

Current U.S. Class: **528/199**, 528/196, 528/198

Intern'l Class: C08G 064/30

Done Internet

FROM CONCEPT TO MARKET : LESSONS LEARNT

- The power of partnership
- Staying with an idea long enough
- Communication to multiple interest groups
- The power of cross functional teams to deliver the product to the market

Investment in idea generation and curiosity driven research always pay off

SOME USEFUL LESSONS

- Learn to walk the last mile
- Putting the team together and energizing the team
- Patience , perseverance and failure tolerant
- Who gets the glory and who gets the blame
- The role of a champion; the leader as a champion
- Going beyond the written contract
- Passion to succeed; Are you ready to stake your reputation?

Science is an individual effort; technology is a collective endeavor

INDUSTRY – ACADEMIA LINKAGE : INDIAN SCENE

- Weak and rare; reasons are both social and cultural
- The competitive advantage of companies in India not dependent on technological innovations but on process innovations
- Few large companies with deep traditions of research
- The western world moved from agrarian to industrial and then on to service based enterprises over two hundred years. The work force had the time to accept and manage the change through skill up-gradation and education
- In India we seem to have missed the full blown industrial revolution. Our businesses are increasingly focused on service models.
- We, therefore, missed the beneficial aspects of the manufacturing revolution. India began to industrialize in the early fifties, but before this process reached maturity, India migrated to a service economy
- R&D in industrial enterprises never became institutionalized. There was no established innovation processes in majority of the Indian companies, barring a few honorable exceptions.
- Service industry does not require process or product innovations, but only innovations in delivery and cost management.

INDUSTRY – ACADEMIA LINKAGE : INDIAN SCENE

- In India, even R&D began to assume a service model, largely due to the cost arbitrage. A large proportion of R&D that is conducted in India by companies are for customers outside India, both by global MNC's and by Indian companies.
- The outsourced R&D model never gave Indian organizations an opportunity to take a concept to the market completing the full innovation chain. Instead they were only deployed to do those things where they had some competence
- The large corporations of the world knew better how to manage Indian talent. Indian talent today creates IP and value for the global corporations
- Few Indian organizations have learnt to effectively manage intellectual talent
- Universities and academia are driven by goals of peer recognition, pursuit of fashion in science and the tyranny of factors and indices (H-index , Impact factor, funds); wealth creation not on top of its agenda

Can India become an science and technology driven innovation powerhouse if the share of manufacturing in our GDP continues to be so dismally low ?

HOW DO I KNOW WHAT IS USEFUL OR IMPORTANT ?

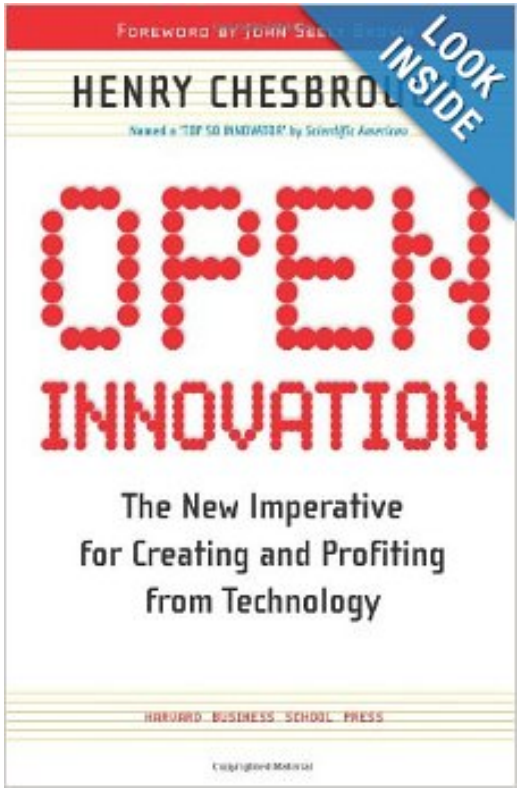
- Industrial consultancy
- Academic lectures in industry/ speakers from industry in academia
- Participation in industry focused conferences/trade shows
- Building professional networks with professionals from industry
- Assisting industry in small and seemingly trivial tasks without considering them as distractions
- Reading trade and commercial literature
- Generally, keeping eyes and ears open

OPEN INNOVATION

- Interface Portals
  - Innocentive
  - Yet2.com
  - Nine Sigma

- Open Challenges
  - X Prize
  - Mahindra RISE Prize

- Company Portals
  - P&G, Unilever, Astra Zeneca, BASF (Creator Space)



Henry Chesbrough,
Harvard Business School Press, 2003

INDUSTRY- ACADEMIA INTERFACE: SOME MYTHS

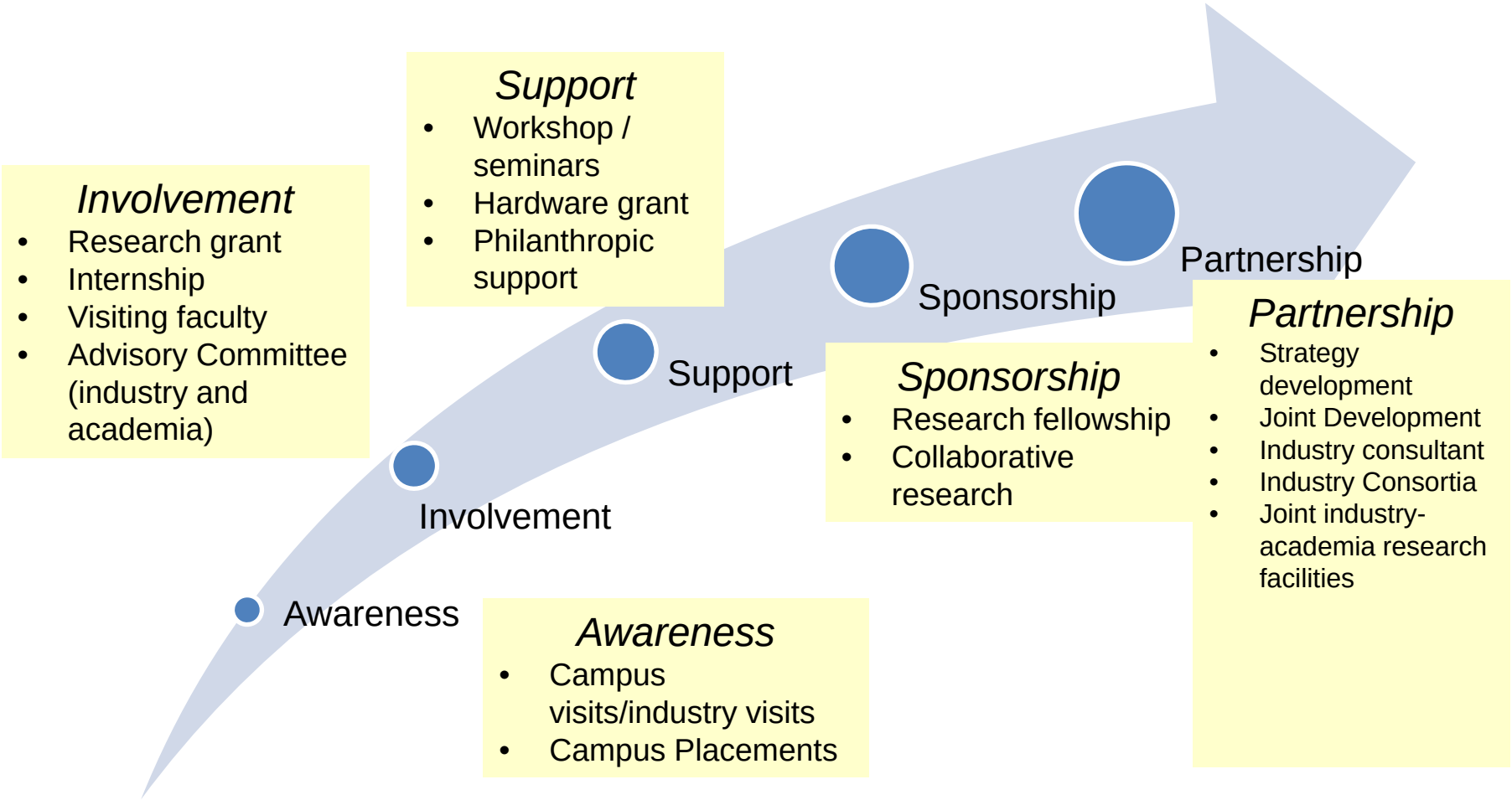
- Industry has to depend on academia for new ideas and concepts
- Cost of performing research in an academic institution is low compared to performing in industry
- The IP generated by academia is undervalued by industry
- Industry's problems do not need cutting edge science
- The reward that industry offers to academic partners is a small fraction of what the industry gains and is often inequitable
- "We can buy any technology that we need"; industry believes it can acquire businesses with technology rather than develop

INDUSTRY- ACADEMIA INTERFACE: REALITIES

- Academia generally overestimates the value of its IP
- Academia has no idea of what it takes to move an idea from the laboratory to the point where it can be turned into a new product or service for which there is a commercial value
- Academia has poor appreciation of market risks of a new technology
- Academia has poor understanding of regulatory and EHS issues
- Academia has a misplaced goal of revenue generation from working with industry ; give us the money and we will work on something related to your interest"
- Scientists are usually looking for support for their own ideas, not tuning their research to suit the needs of the industry
- Timescales in public institutions are much longer than companies can tolerate; companies are generally not in business to fund Ph D thesis

THE PARTNERSHIP CONTINUUM

(Source: Guiding Principles of University- Industry Endeavors, April 2006)



SCIENCE, TECHNOLOGY AND MARKETS

Science

- Possibilities
- Options
- Solutions

Can I do it ?

Technology

- Opportunities
- Feasibility
- Desirability

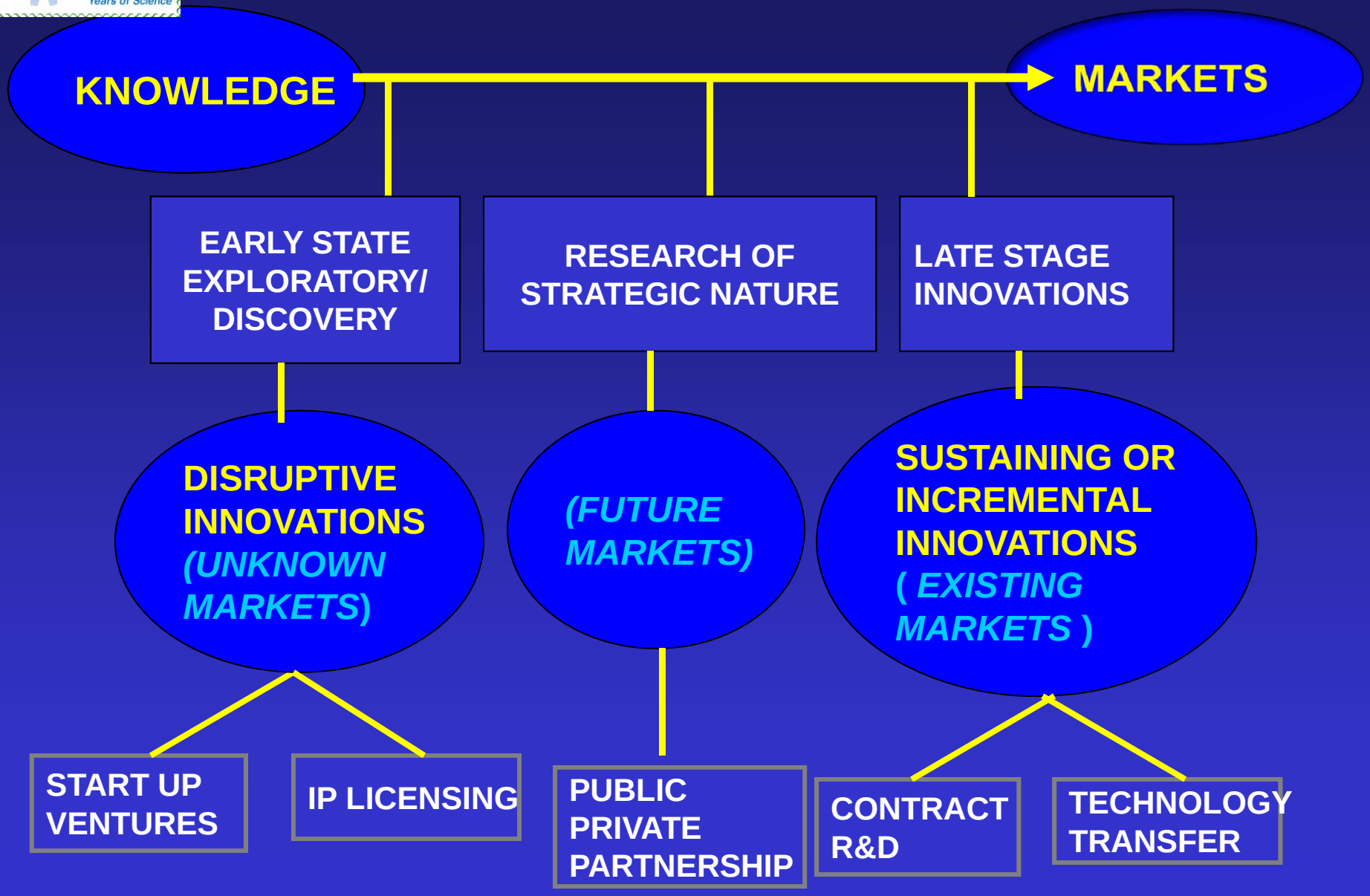
Is it worth doing it ?

Markets

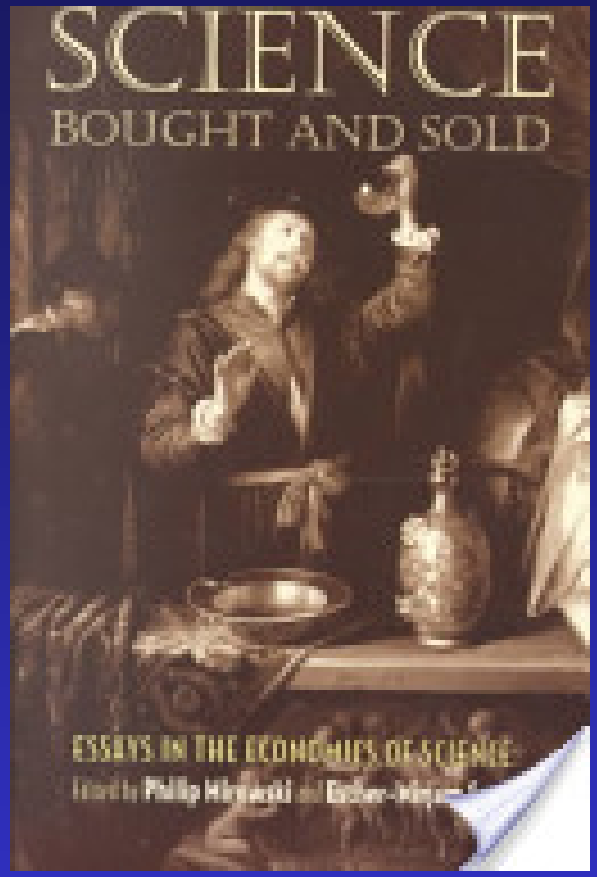
- Uniqueness
- Customer choice
- Will the customer pay ?

Does anyone need what I am doing ?

LINKING KNOWLEDGE TO MARKETS



Goethe once said about science: "To one man it is the highest thing, a goddess; to another it is a productive cow who supplies them with butter. We must honor the goddess and feed the cow.



Science Bought and Sold: Essays in the Economics of Science, University of Chicago Press, 2002

THANK YOU