

# Management Of Innovative Technology

A Talk on “Technological Innovation & Strategy”

July 21, 2011

National Cheng Kung University Leadership Workshop

At

College of ETCS, IPFW

Professor Paul I-Hai Lin

Purdue University Fort Wayne Campus

## References:

- [1] Robert A. Burgelman, Clayton M. Christensen, and Steven C. Wheelwright, *Strategic Management of Technology and Innovation*, 5th edition, McGraw-Hill, ISBN 0073381543, 2009.
- [2] Hans J. Thamhain, *Management of Technology*, John Wiley & Sons, Inc., 2005
- [3] M.E. Porter, “The Technological Dimension of Competitive Strategy,” *Research of Technological Innovation, Management, and Policy* 1, 1983, pp. 1-33.

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

1

## Topics

### ■ Basic Terms

- Technology, Innovation, Management, Strategy, History & Classification of Technology
- Inventions/Discoveries/Technologies
- Intellectual Properties

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

2

## Topics

- Strategic Management of Technology & Innovation: Who, What, How
  - Assessment of Innovative Capabilities
  - Technology Portfolio & Business Portfolio
  - Technology and Competitive Strategy
  - Technology and Product-Market Strategy
  - Technology and the Value Chain (Inbound & Outbound logistics, Marketing, Sales, Services, IT, Manufacturing, R&D, etc.)
  - Technology Evolution & Forecasting

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

3

## Technology: Definitions

- Technology: theoretical and practical knowledge, skills, and artifacts that
  - Can be used to develop products and services, production and delivery systems etc.
  - Can be embodied in people, materials, cognitive and physical processes, plant, equipment, and tools
- Technologies: usually the outcome of development activities to put inventions and discoveries to practical use

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

4

## Management – Definitions

- **“Management”** defined in the Webster’s New Collegiate Dictionary
  - The act or art of managing
  - The conducting or supervising of something (as a business)
  - The collective body of those who manage or direct an enterprise

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

5

## Innovation

- Innovation
  - The introduction of something new: a new idea, method, device, etc.

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

6

## Strategy – Definitions

- **“Strategy”** defined in the Webster's New Collegiate Dictionary
  - The science and art of employing the political, economic, psychological, and military forces of a nation or group of nations to afford the maximum support to adopted policies in peace or war
  - The science and art of military command exercised to meet the enemy in combat under advantageous conditions
  - A careful plan or method
  - The art of devising or employing plans or stratagems toward a goal

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

7

## History of Technology

- Technology in Archaeology
  - Material technologies (stone tools, wood, pottery, copper, bronze, iron (steel))
  - Agriculture technologies
  - Information technologies (cave art, Venus figures, writing)
  - Energy technologies (fire, irrigation, sailing ships, wheeled vehicles)

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

8

## History of Technology

- Transportation Technology
  - Horse, wheeled vehicles
  - Ship, stream boat, submarines
  - railroads, steam locomotive, high-speed rails
  - Cars, trucks
  - Air planes, rocket
- Energy Technology
  - Man power
  - Animal power
  - Wind power
  - Solar power
  - Coal, steam power
  - Fossil fuel power

2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

9

## History of Technology

- Technology – Military Conflicts
  - Ancient warfare (weapons and armor; clubs, spears, knives, bow and arrows)
  - Medieval warfare (military tactics, cavalry-based forces)
  - Gun power warfare (first developed in Song Dynasty, 960 – 1279, China)
  - Industrial warfare (mass-conscripted armies; rapid transportation – railroads, sea, and air; telegraph and wireless communications)
  - Modern warfare (variety of tools and methods available to modern battlefield commanders)

2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

10

## Classifications of Technology

### Specific Applications

- Aerospace Technology
- Biological Technology
- Biomedical
- Business Technology
- Computer Technology
- Energy Technology
- Information Technology
- Information Technology
- Material Technology
- Military Technology
- Medical Technology
- Transportation Technology
- Vehicular Technology
- Nanotechnology
- etc

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

11

## Management in Today's High Tech Business Environment [2]

- Activities
  - Cluster around projects with team efforts that span organizational lines involving a broad spectrum of
    - Personnel,
    - Support groups,
    - Subcontractors,
    - Vendors,
    - Partners,
    - Government agencies and
    - Customer organizations

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

12

## Management in Today's High Tech Business Environment [2]

- Characteristics and Challenges of Today's Technology-Based Business
  - High task complexities, risks, and uncertainties
  - Fast-changing markets, technology, regulations
  - Intense competition, open global markets
  - Resource constraint, tough performance requirements
  - Tight, end-date-driven schedules

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

13

## Management in Today's High Tech Business Environment [2]

- Characteristics and Challenges of Today's Technology-Based Business (cont.)
  - Total project life-cycle considerations
  - Complex organizations and cross-functional linkages
  - Joint venture, alliance and partnerships
  - Different organizational cultures and values
  - Complex business process and stakeholder communities

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

14

## Management in Today's High Tech Business Environment [2]

- Characteristics and Challenges of Today's Technology-Based Business (cont.)
  - Need for continuous improvements, upgrades, and enhancements
  - Need for sophisticated people skills, ability to deal with organizational conflict, power, and policies
  - Virtual organizations, markets, and support systems
  - Increasing impact of IT and e-business

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

15

## Scope of Management of Technology (MOT) and Focus [2]

- MOT should not be confined to
  - R&D,
  - Engineering, or
  - Scientific work, but
- Includes many other facets of the enterprise and its environment

2/10/2012

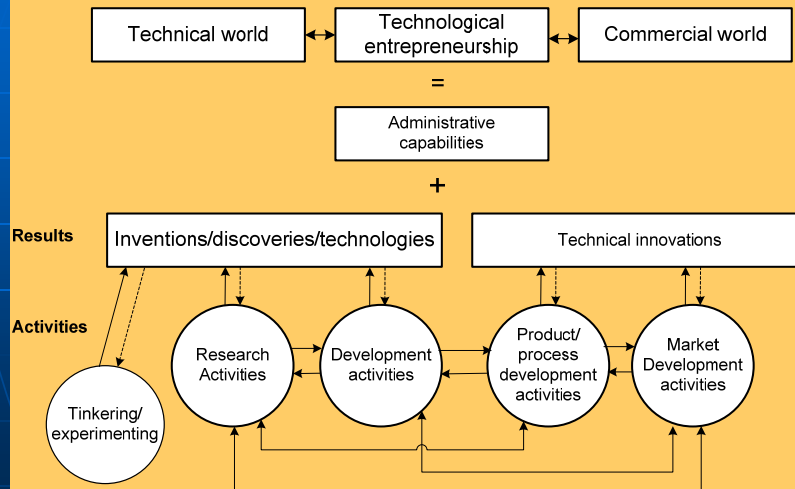
NCKU-IPFW Talk on Management of Innovative Tech

16



## Interrelations Among Key Concepts Concerning Technological Innovation [1]

EXHIBIT 1 The Relationships Among Key Concepts Concerning Technological Innovation



2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

17

## Technological Policies and Generic Competitive Strategies [3]

### Generic strategy

	Overall cost leadership	Overall diff.	Focus-seg. cost leadership	Focus-seg. diff.
	<b>Technological Policies</b>			
<b>Product Tech. Change</b>	<ul style="list-style-type: none"> <li>Product dev. to reduce prod. cost by lowering materials content</li> <li>Facilitating ease manufacturing</li> <li>Simplifying logistical req.</li> </ul>	<ul style="list-style-type: none"> <li>Product dev. to enhance quality, features, deliverability, or switching costs</li> </ul>	<ul style="list-style-type: none"> <li>Product dev. to design only enough performance for the segment's needs</li> </ul>	<ul style="list-style-type: none"> <li>Product dev. to meet exactly the needs of the particular business seg. application</li> </ul>
<b>Process Tech. Change</b>	<ul style="list-style-type: none"> <li>Learning curve process improvement</li> <li>Process improvement to enhance economics of scale</li> </ul>	<ul style="list-style-type: none"> <li>Process dev. to support high tolerance</li> <li>Greater QC</li> <li>More reliable scheduling</li> <li>Faster response time to orders</li> <li>Others</li> </ul>	<ul style="list-style-type: none"> <li>Product dev. to tune production and delivery system to seg. needs in order to lower cost</li> </ul>	<ul style="list-style-type: none"> <li>Process dev. to tune the production &amp; delivery system to seg. need in order to improve performance</li> </ul>

2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

18

## Developing the Technology Portfolio [4]

- Technology Portfolio
- Technology Lifecycle
- Relative Technology Position to its Competitors
  - Patent position
  - Know-how
  - Trade-secrete
  - Learning curve effects
  - Key talent

[4] A. Fufeld, "How to Put Technology into Corporate Planning," Technology Review, May 1978.

2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

19

## The Product/Technology Matrix [4]

	Product A	Product B	...	Product N
Technology 1	(*)			
Technology 2				
•				
•				
•				
Technology ∞				

**Note: Each entry (\*) should establish the firm's relative strength vis-à-vis the state of the art**

2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

20

## Developing the Technology Portfolio [5]

- Technology Portfolio
- Technology Lifecycle
- Relative Technology Position to its Competitors
  - Patent position
  - Know-how
  - Trade-secrete
  - Learning curve effects
  - Key talent

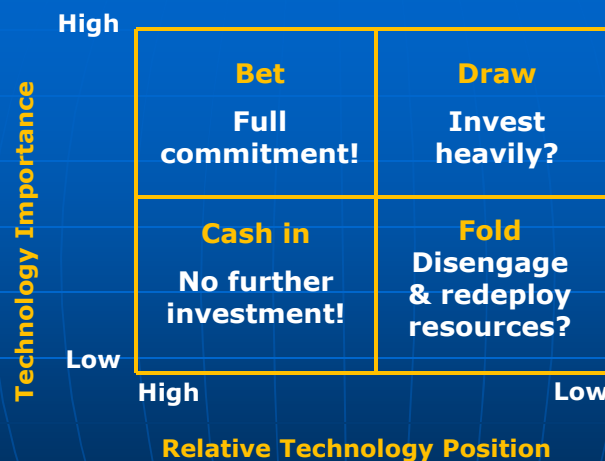
[5] J.M. Harris, R.W. Shaw Jr., and W.P.Somers. The Strategic Management of Technology (New York: Booz Allen Hamilton Inc., 1981)

2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

21

## Developing the Technology Portfolio [5]

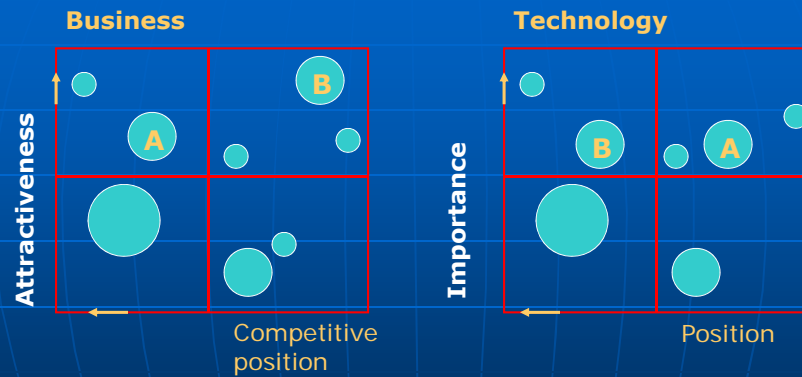


2/10/2012

NCKU-IPFW Talk on Mangement of Innovative Tech

22

## Technology Portfolio and Business Portfolio [5]



- Technologies supporting businesses
- Matched areas
- Mismatched areas: A, B

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

23

## Representative Technologies in a Firm's Value Chain

Exhibit 6 Representative Technologies in a Firm's Value Chain

Transportation technology	Basic product technology	Transportation technology		
Material handling technology	Material technology	Material handling technology	Media technology	Diagnostic and testing technology
Storage and preservation technology	Machine tool technology	Packaging technology	Audio and video recording technology	Communication system technology
Communication system technology	Material handling technology	Communication system technology	Information system technology	Information system technology
Testing technology	Packaging technology	Information system technology		
Information system technology	Maintenance methods			
	Testing technology			
	Building design			
	operation technology			
	Information system technology			
Inbound logistics		Operations	Outbound logistics	Marketing sales
				Services

Source: M.E. Porter, Competitive Advantage: Creating and Sustaining Superior Performance, New York: Free Press 1985

2/10/2012

NCKU-IPFW Talk on Management of Innovative Tech

24

## Technology Evolution and Forecasting [1]

- Technology Lifecycle
  - Affecting firm's competitive position
  - Difficult to respond to such changes
- Integrating Technology & Strategy
  - Should be a dynamic process
  - Should understand the links between Stages in Technology Life Cycle & the Potential for Competitive Advantages

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

25

## Technology Life Cycle and Competitive Advantages [1]

### Stages in Technology Life Cycle

#### I. Emerging technologies

#### II. Packing technologies

#### III. Key technologies

#### IV. Base technologies

### Importance of Technologies for Competitive Advantages.

Have not yet demonstrated potential for changing the basis of competition.

Have demonstrated their potential for changing the basis of competition.

Are embedded in and enable product/process.

Have major impact on value-added stream (cost, performance, quality).

Allow proprietary/patented positions

Have minor impact on value-added stream; common to all competitors; commodity

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

26

## Northeast Indiana

### ■ Core Industry

- Advanced Manufacturing
- Defense
- Financial Services
- Food Processing
- Medical Devices
- Transportation & Logistics

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

27

## General Electric Motor & Industrial Systems Fort Wayne, IN

- GE, [www.ge.com](http://www.ge.com) , 1982-present, Headquarters: Fairfield, CT
  - Founded 1878 by Thomas Edison, becoming General Electric with the 1882 merger of the Edison General Electric Company with the Thomson-Houston Company
  - Bought Fort Wayne Electric in 1899
  - By 1969, GE's Fort Wayne employment reached 10,000
  - GE Motor & Industrial Systems
  - GE Energy Industrial Solutions

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

28

## Regal Beloit Corporation

- Regal Beloit Corporation, Electrical & mechanical motion control product,  
<http://www.regalbeloit.com/>
- GE Commercial Motors by RBC, Ft Wayne, IN,  
<http://ebiz.regalbeloit.com/ftwcoop/>

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

29

## HP – Palo Alto, CA

- HP, founded by Bill Hewlett & Dave Packard 1957 - present
  - The World's Largest IT Company
  - **Technology Leadership** (core technology areas)
    - The Personal System Group
    - The Imaging and Printing Group
    - Enterprise Business
  - **Growth** – HP is focused on three technology shifts that have the power to shift our customers' lives and businesses.
    - Information explosion
    - Digital transformation
    - Environmental sustainability

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

30

## HP – Palo Alto, CA (continue)

- HP, present
  - **HP Research & Labs**, <http://www.hpl.hp.com/>
    - Energy-Smart Home
    - Cloud Security
    - Information Analytics
    - Intelligent Infrastructure
    - Mobile Immersive
    - Networking Communication
    - Print Content
    - Services
    - Sustainability

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

31

## HP – Palo Alto, CA (continue)

- HP, - present
  - Products: Laptops, Tablets, Desktops, Ink & Toner
  - New Products
    - SmartPhone
      - HP completes \$1.2 billion Palm Acquisition, \$5.7 per share, 2010/7/01, USA Today,
      - 9 models, as of 2011/7/21
    - HP Touchpad – for business application, [www.hp.com/go/touchpadbusiness](http://www.hp.com/go/touchpadbusiness) ;
      - webOS, Apps, etc
      - Wall Street Journal, Advertisement, 2011/7/21

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

32



## Intel – Santa Clara, CA

- Intel, 1971 – present,  
<http://www.intel.com/about/index.htm?iid=hdr+about>
  - **Technology Leadership**
    - Architecture & Silicon
    - Product Technologies
    - Manufacturing
    - Research
    - Standards
  - **Healthcare Technologies**
    - Intel in Healthcare
    - Intel-GE Care Innovations LLC
  - **New Technology Development**
    - Intel's 22 nm 3-D Tri-Gate Transistor Technology,  
<http://newsroom.intel.com/docs/DOC-2035>

2/10/2012

NCKU-IPFW Talk on Management of  
Innovative Tech

33

## Intel – Santa Clara, CA

- Challenges & Competitions
  - Economy
  - Apple's iPad
  - Other Tablet devices
- Corporate News
  - Intel Sees Hope for PCs, by Don Clark & Shara Tibken, WSJ, 2011/7/21, page B4,
    - Demand growing for more powerful and expensive chips

2/10/2012

NCKU-IPFW Talk on Management of  
Innovative Tech

34

## Cisco Systems, Inc – San Jose, CA

- Cisco Systems, Inc, San Jose, CA,  
[www.cisco.com/web/about/index.html](http://www.cisco.com/web/about/index.html)
  - New Product
    - The first business Tablet from Cisco
    - Cisco Cius, [www.cisco.com/cius](http://www.cisco.com/cius)
    - Secure mobile collaboration and apps
    - Cisco AppHQ store

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

35

## Conclusion

2/10/2012

NCKU-IPFW Talk on Mangement of  
Innovative Tech

36