High Technology Management: The Way Forward

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Importance of High Technology Industry

**Employment Creation**
- It has been a popular view that high technology enterprises are the key to new job creation.
- High Tech Small and Medium Enterprises (HTSMEs) is a powerful medium for creation of new jobs, but it is not fully exploited in most countries.

**Wealth Generation**
- Returns from high technology ventures can be huge and the owners of many high technology firms have made fortunes.
- Contribution of HTSMEs is their impact on national wealth through the balance of payments mechanism.

**Research and Development Spillover Benefits**
- Scientific findings or breakthroughs may yield potential uses beyond the applications of a specific producer.
- Scientists and engineers may leave an established company to set up a competing one.
The High Tech Paradigm

Engineering

Physical Sciences

Breakthrough technologies of the future

Life Sciences

Medicine

Entrepreneurship

New Technology-based Venture Creation
# Problems in Defining High Technology

| What constitutes a high technology firm or industry? | The measures used to categorize industries as high technology | McQuaid and Breheny: The reason why the definition is so problematical is that researchers are trying to compromise between devising a conceptually sound, consistent and exhaustive definition which allows measurement and is practicable. |

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### Conceptual Definition of High Technology

| Kondratieff or long wave theory of economic change | Schumpeter (1939) proposed the diffusion of major new technologies produces a cyclical pattern of growth in capitalist economies | Product and profit cycle theories |

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The proportion of engineers and scientists (including technologists) employed in an industry (PSEE).

The ratio of research and development expenditure to turnover (RRDET).
The proportion of engineers and scientists (including technologists) employed in an industry (PSEE).

- The proportion of engineers, technicians and scientists (including life and computer scientists) exceeds the industrial average.
- "How an industry is able to harness scientific and technical expertise in the development of new products"
- This measurement is more reliable than other criteria

The ratio of research and development expenditure to turnover (RRDET).

- An above average R&D expenditure as a percentage of total industry sales
- Give some idea of an industry's capacity for "technical evolution" and its "information content".
- Quite misleading for sectors where a large sales volume makes up the denominator of the measurement, such as the petroleum refining sector.
• In determining the criteria for high technology industries, the US Department of Commerce suggested the following cut-off points:

- **Technology-intensive industries** are defined as those which normally **spend 5 percent or more** of their gross product on R&D and/or normally **5 percent or more** of their total employment consists of ‘natural’ scientists, engineers and technicians.

- **High technology industries** normally **spend at least 10 percent** of their gross product (value added) on R & D and/or at **least 10 percent** of their total employment consists of ‘natural’ scientists, engineers and technicians.
Inward FDI tightly restricted -- until financial crisis. Outward FDI promoted

Import protection: high, prolonged but selective

Heavy investments in human capital

Industrial policy dominant - strong, clear leadership commitment to competitiveness

Directed and subsidised credit.

Offset by strongly export-orientation, with ‘push’ not ‘pull’: detailed targeting and pressures

Support for SME R&D: 2,278 units by 1997

Chaebol spearheaded export, technology drive

Korean Technology Policy
Taiwan Technology Policy

Selective protection, Subsidised & directed credit Strategic technology targeting Human resources: education & training

Technology promoted by
FDI targeting and local content/diffusion
Superlative extension services: subsidised training, finance, technology and marketing
Strong public R&D, incentives for contract R&D, venture capital, public R&D spin-offs
Government ‘orchestration’ of technology: import, adaptation, diffusion and innovation
Science parks and technology clusters
Dynamic comparative advantage by design

From labour to capital intensive, then to technology intensive and finally to innovation itself

Growth of local ‘technopreneurs’ based on innovation

Latest industrial strategy is biotech and bio-medicine

How did Singapore ‘use’ MNCs?

Targeting by efficient, honest and competent agency (EDB) with power to coordinate & implement changes

Public sector played catalytic role, leading private sector and MNCs, recently in R&D by setting up laboratories

Superb infrastructure, financed by highest savings rate

MNCs participated directly in policy making process

Upgrading education & industrial skills (‘best workforce in world’) and importing high level manpower
Hong Kong Technology Policy

- Interventions for SME upgrading and export marketing; land subsidies for manufacturing
- Unique initial advantages: Hongs, entrepôt experience, financial and physical infrastructure, influx of skills from Mainland China
- **High** initial export growth, but lack of deepening forced industry to relocate
- Manufacturing and export growth now negative: only Asian Tiger to go into industrial decline
- Some late attempts at technology promotion
- Growth based on servicing China -- but Shanghai taking over important functions
- Few lessons for other countries in technology policy
Incentives for high technology industries include the High Technology Incentives, Incentives for Software Development, Incentives for R&D and the Commercialisation of R&D Fund, Technology Fund, Innovation Fund. However, most of the financial support is short-term, ignoring the fact that high technology new ventures/start-up are exposed to “long lead times and high up-front costs”. It is not surprising that more than 70 percent of SMEs in Malaysia started their business with their own personal funds.
PHASES OF INDUSTRIAL GROWTH WITHIN THE ASIAN ECONOMY

Adapted from: NEAC

Labour-driven Economy

Investment-driven Economy

Productivity-driven Economy

Knowledge-driven Economy

Innovation-driven Economy


Primary Commodities
Assembly-type Manufacturing
Medium-tech Manufacturing & Services
High-tech Manufacturing & Services
Labour-driven Economy

Innovation-based
Knowledge-based

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The Way Forward

- Innovation
- High Tech Development
- Rapid Economic Growth
Nature of Innovation
-Dr. Suhas Patil (Founder & Owner of Cirrus Logic)

- Going beyond conventional thinking
- Being counter-intuitive
- Inventing new more effective way of doing things
- Inventing solutions to a missing link and that opens up a whole new way of doing things

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How to Foster Innovation

Dr. Suhas Patil, Founder & Owner of Cirrus Logic
- Build environment of open thinking
- Don’t kill initiative
- Don’t punish failure
- Be more collaborative and less authoritative
- Explain your reasoning behind your decisions
- Be less prescriptive

Eric Schmidt, CEO of Google
- “The cleverest ideas don't come from leaders, but rather from the leaders listening and encouraging and kind of creating a discussion.”
Creating an innovative culture is without doubt a leadership issue.

Two Key Principles of Innovation

Not developing individual creativity alone, but creating a sustainable innovative environment. This is a leadership task.

Not get better at a portion of the creative abilities, but to get better at all of them as a system.
To Create Innovative Culture

Leaders must be able to:

- Identify and overcome the basic barriers to innovation.
- Apply prototyping principles to organizational innovation.
- Create and deploy proven internal marketing principles to better incubate innovative projects.
- Provide appropriate stimulation for constituents.
- Create and maintain a culture of creative tension.
- Use an appreciative approach to maintaining energy and resolve to complete innovative projects.
- Maintain a culture of continuous play.
The Fish Tank Analogy

Take a moment to consider your organization as a tropical fish tank in need of a good cleaning.

Leading innovation is about cleaning the tank, not the fish.
Innovation Needs Leadership
Azli Paat, Vice President, Interactive Vista Sdn. Bhd. (DAPAT.com)

Understand the products
Understand the market
Communicate the vision to the staff
Steers the company
Positioning Innovation as a Leadership Imperative…

Findings from the 2000 Thunderbolt Thinking Innovation Surveys

Based on the findings of the study it is clear that more leaders need to step into a proactive role and more clearly define areas in need of innovative solutions.

They also need to build practical ways to capture learning gained while engaging in this process.

Only 33% of leaders reporting adequate coaching and facilitation skills, leaders need to refine and enhance their role as a coach to truly support each and every employee’s attempts to innovate.
LEADERSHIP ROLE IN INNOVATION
(Bartol & Martin)

Orchestrator
- Articulates need for innovation
- Creates incentives
- Facilitates implementation
- Recognizes idea's significance
- Protects idea creation
- Believes in value of a new idea

Sponsor
- Funding
- Recognizes idea's significance

Idea Champion
- New Idea
- Believes in value of a new idea

Innovation Culture

THANK YOU