

# Management of Technology

## B02-2. Technological Innovation Process



- Code: 166125-01
- Course: Management of Technology
- Period: Spring 2013
- Professor: Sync Sangwon Lee, Ph. D

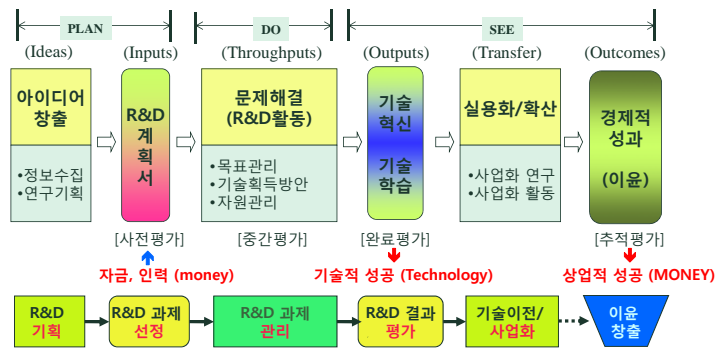
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## 01-2. Process Model of Inv.

- Plan-Do-See
  - Idea generation → problem solving → implementation & diffusion

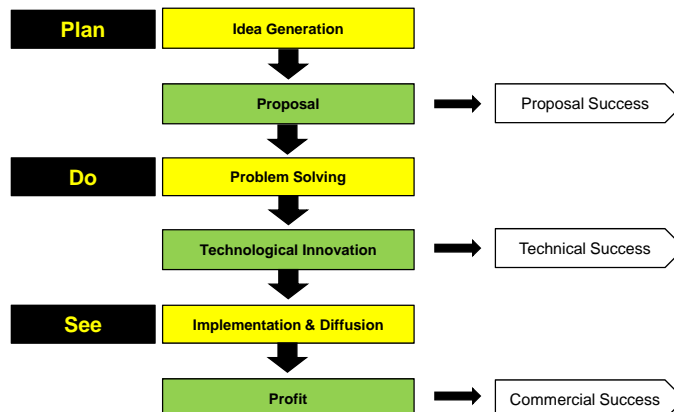


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## 01-2. Process Model of Inv.

- Plan-Do-See
  - Idea generation → problem solving → implementation & diffusion



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## 01-2. Process Model of Inv.

- (Plan) Idea Generation
  - Activities
    - Management(collection/classification/manipulation/analysis) of information related to technology and market/industry environment
    - Planning of technology
  - Market-pull(= demand pull): demand recognition → seeking for a technological solution (more effective)
  - Technology-push: a result of technology development → applied to another use



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## 01-2. Process Model of Inv.

- (Plan) Idea Generation
  - Sources of information
    - External information > internal information → a person in the know is important.
  - Results
    - R&D program → proposal success
  - CSF
    - Communication
    - Fair competition



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## 01-2. Process Model of Inv.

- (Do) Problem Solving
  - Activities
    - Setting-up definite objectives for each phase/task
    - Seeking for alternative solutions
  - Cf. PM(project management)
    - MBO(management by objectives) → result
    - TM(time management) → progress
    - CM(cost management) → budgets, government supports



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## 01-2. Process Model of Inv.

- (Do) Problem Solving
  - Sources of information
    - External information < internal information → an information center or information management is important.
      - Information search should be progressed in the order of easy of access.
      - Easily accessible data (memory, documents) → The 2<sup>nd</sup> data (publications) → The 1<sup>st</sup> data (direct research)
  - Results
    - Technological innovation/learning → technical success
  - CSF
    - Technical factors (complexity of innovation)
    - Passion of innovators
    - Government supports



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## 01-2. Process Model of Inv.

- (See) Implementation and Diffusion
  - Activities
    - Commercialization research
    - Commercialization activity
  - The connection with related department is important.
  - Engineering and market shipment are included.



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## 01-2. Process Model of Inv.

- (See) Implementation and Diffusion
  - Sources of information
    - Both of internal information and external information are important.
  - Results
    - Profit → commercial success
  - CSF
    - Relative advantage of performance/price



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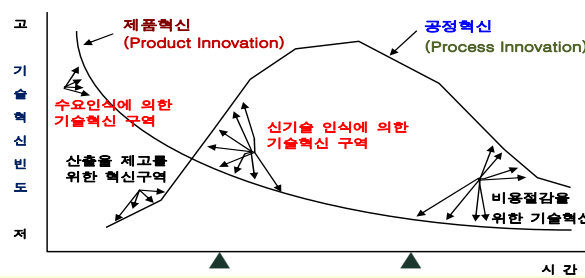
## 01-2. Process Model of Inv.

- Cf. Another Process Model of Innovation [Roberts]
  - Recognition of opportunity: interactions of technology and market
  - Idea formation: fusion into design concept
  - Problem solving: search for technology/market information + use
  - Prototype solution: use of existing invention/technology + market test
  - Commercial development: flaw solution + scale-up
  - Technology utilization and diffusion: movement to production



## 01-3. Dynamic Model of Inv.

- FTS
  - Fluid → transition → specific



□ 단계 :	유동기 (Fluid)	→	과도기 (Transition)	→	경화기 (Specific)
▪ 제품혁신 :	성능극대화		판매극대화		비용극소화
▪ 공정혁신 :	비조정기		단편적 자동화기		체계적 자동화기
▪ 단계특성 :	제품혁신중심		공정혁신중심		혁신정체단계

J. M. Utterback and W. J. Abernathy, "A Dynamic Model of Process and Product Innovation," *Omega*, Vol.3, 1975.

## 01-3. Dynamic Model of Inv.

• Stages of Dynamic Model

	Stage 1	Stage 2	Stage 3
Stage	Fluid	Transition	Specific
Innovation	Product Innovation	Process Innovation	Innovation Stagnancy
Product Innovation	Performance maximization	Sales maximization	Cost minimization
Process Innovation	No-automation	Partial-automation	Full-automation

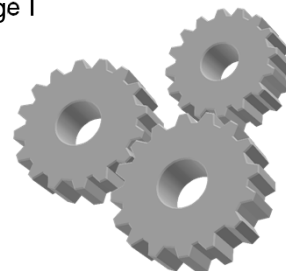
Stages	1(Fluid)	2(Transition)	3(Specific)
<b>Product Technology Innovation</b>	<ul style="list-style-type: none"> <li>· 제품성능의 극대화 강조</li> <li>· 사용자/시장수요에 의해 기술혁신 발생</li> <li>· 창의적이고 급진적임</li> <li>· 기술혁신 빈도가 아주 높음</li> <li>· 기술혁신은 주로 제품 혁신임.</li> </ul>	경계조건 (F) (S)  (T) 과도적 상황	<ul style="list-style-type: none"> <li>· 비용의 절감을 강조</li> <li>· 혁신은 제품/공정 모두 점진적임.</li> <li>· 창의적/급진적 혁신은 거의 발생하지 않고 외부에서 발생</li> <li>· 기술혁신에 대한 자극은 파괴적인 외부의 힘에 의해서 생김</li> </ul>
<b>Production Process Status</b>	<ul style="list-style-type: none"> <li>· 생산공정/조직은 융통성이 있으나 비효율</li> <li>· 규모나 크기는 작음</li> <li>· 범용설비나 기기가 사용됨</li> <li>· 제품은 자주 변경되며 고객의 요구에 따라 설계됨</li> </ul>	변환의 정상적 방향 →→→	<ul style="list-style-type: none"> <li>· 생산공정은 효율적/체계적/자본집약적</li> <li>· 공정변화에 따른 비용이 아주 높음</li> <li>· 시장점유율, 설비규모가 아주 큼</li> <li>· 전용설비와 기기가 사용됨</li> <li>· 제품의 다양화가 거의 없게 됨</li> </ul>

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## 01-3. Dynamic Model of Inv.

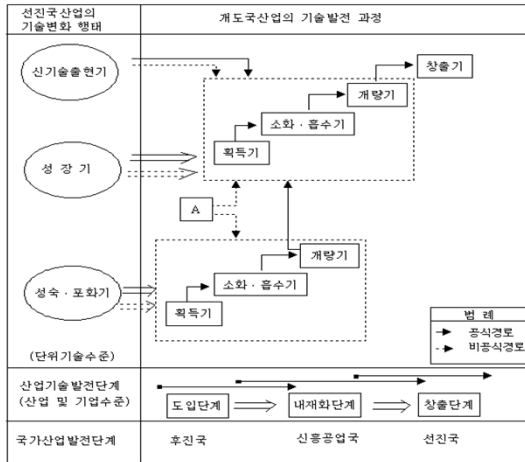
• Notion of Dynamic Model

- There is a relation between dynamic model and marketing strategy.
- Continuous process innovation and technology accumulation are important.
  - Continuous process innovation is needed after production shipment. → Technology learning is important.
  - Ex. Car cost by process innovation: \$5,000 → \$900
- Post-dynamic model
  - Dematurity
  - Industrial renaissance: stage III → stage I



## 01-4. Global Model of Inv.

- Global-Perspective Model
  - Initiation → internalization → generation



- 1) 관련기술축적기(A)는 교육/훈련, 전통기술, 다른 분야 등에서 축적된 경험에 의하여 이루어짐
- 2) 기술발전단계(도입단계 → 내재화단계 → 창출 단계)의 분석단위는 산업 및 기업이며, 획득기 → 소화·흡수기 → 개발기의 기술발전 단계 분석단위는 기업 단위기술임.
- 3) 실선은 공식경로, 점선은 경로를 의미하며, 선의 두께는 각 경로의 광용빈도를 나타냄

Lee, Bae & Choi, 1988

## 01-4. Global Model of Inv.

- Notion of Global-Perspective Model
  - The model can analyze the pattern of technological development multi-dimensionally.
  - Informal imitation(technology transfer) is important in technological innovation.
  - It is needed to connect advanced countries with developing countries from the global perspective.
    - The pattern of technological development in developing countries is dynamic.
    - The pattern of technological development in developing countries has the opposite direction of that in advanced countries.





## 01-4. Global Model of Inv.

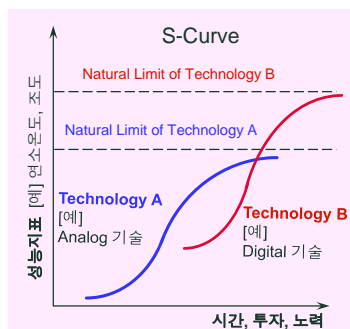
- Cf. Pattern of Technological Development in Developing Countries
  - Imitative learning type
  - Technological self-reliance type
  - Technology dependency type
  - Laissez-faire type



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## 01-5. Sustaining/Disruptive Model of Inv.

- S Curve (Harvard Model)



- **존속적 혁신 (Sustaining Innovation)**
  - Capacity-Enhancing Innovation
  - Incremental Innovation
- **파괴적 혁신 (Disruptive Innovation)**
  - Capacity-Destroying Innovation
  - Radical Innovation

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## 01-5. Sustaining/Disruptive Model of Inv.

- NT(New Technology) vs. OT(Old Technology)
  - NT could substitute OT.
    - When NT overcomes limits of OT
    - When limits of NT is the same as that of OT but performance advancement of NT is faster than that of OT
  - Reasons of OT's weak action against NT
    - Performance of NT is weaker than that of OT in early days.
    - Innovator's dilemma
      - Mentality and confidence of disinvestment in OT



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## 01-5. Sustaining/Disruptive Model of Inv.

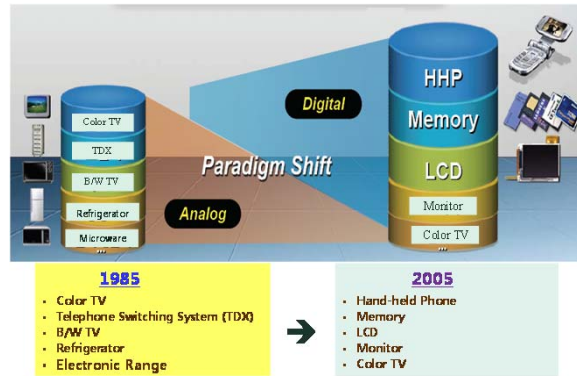
- Notion of Sustaining/Disruptive Model
  - The development process of technology conforms to s-curve.
    - → NT could substitute OT
  - As ROI(returns on investment) of OT decreases, entrepreneurs search for NT.
  - Switching cost from OT to NT is high.
    - → Innovator's dilemma



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## 01-5. Sustaining/Disruptive Model of Inv.

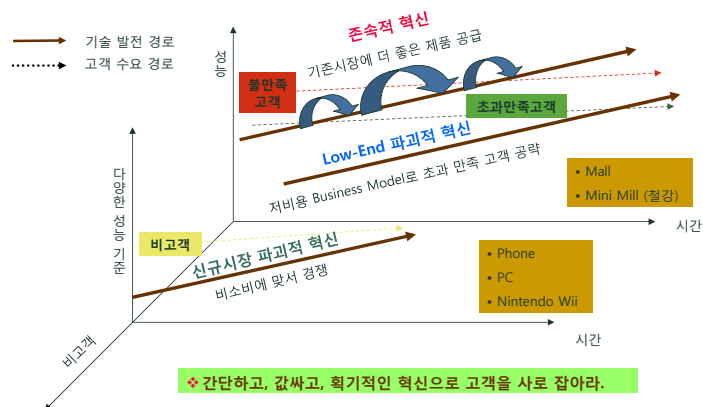
- Ex. Samsung vs. Sony



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## 01-5. Sustaining/Disruptive Model of Inv.

- Cf. Disruptive (or Collapsing) Model



Christensen, 2004