Creative Model of Science Park Development

Case study on Daedeok Innopolis

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Introduction

Why we need Science Park, Technopolis, and innovation clusters?

Andrew Dearing, “Enabling Europe to innovate”, SCIENCE, 19 January 2007

Today it depend on the created assets such as a highly educated and flexible workforce and appropriated supporting infrastructure (SW/HW) like STPs, Technopolises, and Innovation Clusters.
Science Park/ Technopolis / Innovation Cluster

Regional and national competitiveness is often decided by these *Science park / Technopolis / Innovation clusters* which will be provided with an applicability for development policy and insight to regional competitiveness.

**Important issues**

- **Dynamics of their creation and support mechanisms**
- **How effective it can be as an instrument of regional innovation policy and for stimulating technology-led economic development**
Daedeok Innopolis

- **Regional platform** for comprehensive approach of technology-based regional development in sustainable context

- **National and regional development policy** efforts from the last 30 years to achieve a technology-based economic growth and regional innovation

- **Symbolic achievement of the regional innovation policy** targeting for innovative cluster: instruments to achieve sustainable development through collaboration between HEI's, research institutes, industries, and government.
This paper consists of four parts.

- **Science Park’s Concept & Development types**
  - Definition & Types of Development
    - Science Park, Technopolis, Innovation Cluster

- **Analysis Framework**
  - Functions & Components of Science Park development

- **Case Study: Daedeok Innopolis**
  - Historical Review
  - Analysis of Structural Change

- **Economic growth & Regional Innovation by Daedeok Innopolis**
  - Regional Impacts: the growth pattern and trend in general
  - Growth pattern and trend in time sequence
### Key Features of Technopolis development

<table>
<thead>
<tr>
<th>Types</th>
<th>Physical characteristics</th>
<th>Focus</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Park</td>
<td>Creation of new settlement (research park, new town)</td>
<td>Basic R&amp;D</td>
<td>Tsukuba, Japan Daedeok Science Town, Korea (’80-’90)</td>
</tr>
<tr>
<td>Technopolis</td>
<td>Creation of new settlement including production activity</td>
<td>High-tech production</td>
<td>Kumanoto, Japan Sophia Antipolis, France Daedeok Science Town, Korea (’98-2005)</td>
</tr>
<tr>
<td>Innovation Cluster</td>
<td>Clustered development of Technopolis and Science Park in the Region</td>
<td>Innovative and entrepreneurial cluster in the region</td>
<td>Daedeok Innopolis, Korea (2005~ ) Silicon Forest, Silicon Valley, USA Milano Clothing Industry, Italy</td>
</tr>
</tbody>
</table>
Science Park: Property-based Initiative

- **formal links** with a university or other higher educational and research institution
- **encourage the formation and growth** of knowledge-based businesses and other organizations normally resident on site
- **management function** which is actively engaged in the transfer of technology and business skills to the organizations on site
Science Park model

Cambridge Science Park, UK

Dortmund Technology Park, Germany

Surrey Research Park, UK
Technopolis / Science City: Urban development

• emphasizes the need for a balanced approach

• Instead of only focusing on technology it involves the creation of new settlement, complete with research park, new universities, technology centers, housing and cultural facilities (Tatsuno, 1986)

• larger in scale and often linked to the development of infrastructure and facilities on the new town model
  ⇒ whereas science parks are more limited in scope (Masser, 1991; Oh, 1997)

• more production oriented than science parks

• have both national and regional objectives
**Technopolis Model**

Tsukuba Science City, Japan

Hsinchu Science Park, Chinese Taipei

Research Triangle Park, USA

Sophia Antipolis, France
Innovation networking in clusters aims to enhance the innovative capacity and foster the strategic industry for regional and national competitiveness.

*Integrated approaches* to create the necessary institutional thickness for *innovation cluster development* are as followings.

- The promotion of new technology areas.
- The setting up of science parks and agencies, software centers, transportation infrastructure technologies, data highways, and science cities.
- The establishment of technology transfer centers.
- Technology centers’ support of business start-ups.
- The establishment of ‘New Business Associations’ aimed at young entrepreneurs.
- Technology aid schemes to support SME’s.
- Joint research project between SMEs, technology transfer centers, and other firms.
**Regional Innovation Cluster**

- **To develop a network building** of available intellectual, innovative and entrepreneurial resources
- **To use these resources effectively** Innovation cluster
  - a favourable business, social, and political environment
  - necessary to effectively utilize the intellectual, innovative, and entrepreneurial resource
- **Provided with an applicability** for development policy and insight to regional competitiveness
Innovation Cluster model

Kista Science City, Sweden

Oulu Science City, Finland

Zhongguancun, Beijing, China
**Main Structure of Science Park: Function & Components**

<table>
<thead>
<tr>
<th>Main Functions</th>
<th>Components</th>
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</thead>
<tbody>
<tr>
<td>R&amp;D</td>
<td>HEI, Public R&amp;D, Private R&amp;D, Collaborative R&amp;D, Technology Commercialization</td>
</tr>
<tr>
<td>Business &amp; Networked Entrepreneurship</td>
<td>Entrepreneurship, Incubating, Venture Capital, Networking</td>
</tr>
<tr>
<td>Management &amp; Globalization</td>
<td>Training Program, Financial aid, Marketing, Property for Rent, Globalization</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Land-use, R&amp;D Facilities, Business Facilities, Management Facilities, Housing &amp; Settlement</td>
</tr>
</tbody>
</table>
## Main functions and components in Science Parks

<table>
<thead>
<tr>
<th>Functions</th>
<th>Components</th>
<th>Science Parks</th>
<th>Technopolis (Science city)</th>
<th>Innovation Clusters</th>
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<tbody>
<tr>
<td>1 R&amp;D</td>
<td>A HEI</td>
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<td>● ● ● ● ● ● ● ● ● ● ● ● ● ●</td>
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<td>B Public R&amp;D</td>
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<td>C Private R&amp;D</td>
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<td>D Collaborative R&amp;D</td>
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<td>E Technology Commercialization</td>
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<td>2 Business</td>
<td>A Entrepreneurship</td>
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<td>3 Management</td>
<td>A Training Program</td>
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<td>B Financial Aid</td>
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<td>4 Infrastructure</td>
<td>A Land-use</td>
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**Notes** – ● Primary, ○ Secondary

a: Cambridge Science Park (UK), b: Dortmund Technology Park (Germany), c: Surrey Research Park (UK), d: Sophia Antipolis (France), e: Research Triangle Park (USA), f: Tsukuba Science City (Japan), g: Hsinchu Science Park (Chinese Taipei), h: San Diego Cluster (USA), i: Zhongguancun Science Park (China), j: Kista Science City (Sweden), k: Oulu Technopolis (Finland)
## Functional Relationship: Synergy Effect

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Elements</th>
<th>R&amp;D</th>
<th>Business</th>
<th>Management</th>
<th>Infrastructure</th>
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<td>1B</td>
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<td>1D</td>
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<td>R&amp;D</td>
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<td>Networking</td>
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<td>Management &amp; Globalization</td>
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<td>Housing &amp; Settlement</td>
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</table>
Framework according with development stage of Daedeok Innopolis

Structure

- R&D
- Business & Clustering
- Management
- Infrastructure

Functional Features

- Research & Development
- Business & Networked Entrepreneurship
- Management & Globalization
- Infrastructure

Regional Impacts
: Economic Growth and Regional Innovation
**The analysis consists of four step:**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Overview and historical background of science park development in Daedeok are reviewed.</td>
</tr>
<tr>
<td>Second</td>
<td><strong>Functional structure</strong> which is characterized with each science park model is identified: Science Park, Technopolis, Innovation Cluster.</td>
</tr>
</tbody>
</table>
| Third | **Functional relationship and linkage among functions and components** as well as **functional features** are analyzed in accordance with development stage of science park.  
- **How to work together** with its own functions and components  
- **How to play a vital role** for successful science park development and regional innovation |
| Fourth | Regional impacts on economic growth and innovation of Daedeok Innopolis are identified based on **growth pattern in time sequence of science park development** |
### Overview

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Geographical Location</td>
<td>Daedeok, Daejeon, Republic of Korea</td>
</tr>
<tr>
<td>Size</td>
<td>Total 70.4 Km²</td>
</tr>
<tr>
<td></td>
<td>- Daedeok Science Town 27.8 km² / Daedeok Techno-Valley 4.3 km²</td>
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<tr>
<td></td>
<td>- Daedeok Industrial Complex Corp. 3.1 km² / Agency for Defense Development 5.0 km²</td>
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<tr>
<td></td>
<td>- Green-Belt area in North of Daedeok 30.2 km²</td>
</tr>
<tr>
<td>Employment</td>
<td>23,558 (6.236 Ph.D.s) as of 2005</td>
</tr>
<tr>
<td></td>
<td>: Very low becoming active, formal and informal groups</td>
</tr>
<tr>
<td>Tenant Organizations</td>
<td>Total 242 organizations in DST</td>
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<tr>
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<td>- 21 Government Sponsored Research Institutes,</td>
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<tr>
<td></td>
<td>39 Private Research Institutes and 148 Venture firms</td>
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<td></td>
<td>Spin-offs from GRI technology-based ventures</td>
</tr>
<tr>
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<td>- Approx. 800 companies</td>
</tr>
<tr>
<td>Major Fields</td>
<td>IT (40%), BT (14%), Material Science (9%)</td>
</tr>
<tr>
<td></td>
<td>Chemical Engineering (8%), Energy Resource (8%)</td>
</tr>
<tr>
<td>Current Status</td>
<td>• Mecca and Symbol of Korea’s Science and Technology</td>
</tr>
<tr>
<td></td>
<td>• Economic and industrial growth Model</td>
</tr>
<tr>
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<td>for benchmarking by developing countries</td>
</tr>
<tr>
<td></td>
<td>• Special R&amp;D Zone (2005)</td>
</tr>
</tbody>
</table>
Total : 70.4 km²

Zone 1. Daedeok Science Town : 27.8 km²
Zone 2. Daedeok Techno-Valley : 4.3 km²
Zone 3. Daedeok Industrial Complex : 3.1 km²
Zone 4. Agency for Defense Development : 5.0 km²
Zone 5. Green-Belt area in North of Daedeok : 30.2 km²

Land-use:
- Residential area
- Business (commercial)
- Green-Belt area
- Greens
- Education, Research
- Industrial area
- Parks
R&D facilities in DST
Residential area
Business support facilities

Daedeok Innopolis Management Office

Daedeok Business Hub Center

Daedeok Science Town Children’s House (Childcare Center)

Daejeon Convention Center
R&D support facilities

- Daejeon Small and Medium Business Support center for patent Information and total Consulting
- Center Research Facilities in Chungnam National University
- KAIST Research Supporting Team
- Jyang-YoungSil Gwan (Venture Town)
- Daejeon Bio Venture Town
Daedeok Techno Valley (DTV)
Land-use of Daedeok Techno Valley (DTV)
Residential area in DTV

Shopping center

Commercial area/ Service facilities

Housing

Ecological development: parks, greens, stream etc.
Venture parks (Industries)

High-tech Ventures and Industries

Daejeon Technopark
Culture and Leisure (DTV)

Cultural area

Facilities for sports(golf) & leisure
Daedeok Industrial Complex corp.
When DST was incorporated administratively into Daejeon in 1983, DST was merely a secondary urban center.

- **New turning point** in terms of its role for urban structure
- High-tech cluster to support the regional growth
- Linkage between mother city and New Capital

Map of Daejeon Metropolitan City
- DST functioned as a pure science city in the initial stage: focused on R&D and education to enhance the capability of high-technology development.

- Venture Incubation began to grow remarkably in DV (From the late 1990s)

- A demand for Industrial Function was raised not from outside but inside of DV

- Daedeok Techno-Valley (DTV) project created near DST in 2003

- Daedeok Innopolis since 2005
Changing Role of Daedeok Innopolis

- Leading the National R&D Capability through GRIs
- Promotion of Mega-Sized R&D Projects
- Assistance to Corporate R&D Activities
- Emphasis on Development of Advanced Technologies
- Focal Points for the Linkages between Universities, Industries, and Research Institute
- Response to the Development of Advanced Technologies
- Utilization of the S&T output
- Promotion of Venture Start-ups

Timeline:
- 1973: Construction of infrastructure
- 1978: Expansion of R&D Base
- 1993: Creation of Innovation
- 1999: Formation of Innovation Cluster
- 2008: Changing Role of Daedeok Innopolis
# Historical Review

<table>
<thead>
<tr>
<th>Stage</th>
<th>the time of year</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial stage</strong></td>
<td></td>
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<tr>
<td><strong>Middle stage</strong></td>
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<tr>
<td>2000-2004 Cluster Formation</td>
<td>March 2000, Nov. 2004</td>
<td>High-tech start-ups started moving in, DST renamed as Daedeok Valley(DV) Daedeok Special R&amp;D Zone Law enacted</td>
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<tr>
<td><strong>Mature stage</strong></td>
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</table>
Main Objectives of DST development

- Creating a foundation of technology based competitiveness
- Fostering closer links among research institutes, academia and industry
  - through the effective placement of public and private R&D Centers and HEIs
- Establishing a pollution-free science garden city
  ▶ The dominant role of the government is particularly evident in the initial stage of DST development
  ▶ DST has been criticized for being unable to fulfill such needs of technology transfer and commercialization
Later stage of Development (2002- present)

Technopolis / Regional Innovation Cluster

- expanded development along the axis
  - In 2002, central government has designated DST and its vicinity as DV
    - all accommodating within the Daejeon Metropolitan City
      - Daedeok Science Town(DST), Daedeok Techno-Valley(DTV), Venture Parks
        - 3rd and 4th Industrial Complex, Yuseong zone,
- to be re-designated the first "National R&D Special Zone"
Initial Stage: Science Park

**R&D**
- Public R&D Institutes
- HEIs
- Basic & Applied Research
  - Spin-off
- Technology Business Incubator
  - Start-up firms

**Infrastructure / Management**
- Land Allocation / Housing & Settlement
  - Physical Planning of the Science Park: Zoning, Land-use etc.
- Daedeok Science Town Administrative Office
  - Limited Management, Administration & Maintenance
This science park model contains three main functions: R&D, Business and Infrastructure. Management is only limited to infrastructure-related service.

**Research & Development**
- HEIs and public R&D centers: the main role of development.
- Public research institutes focused on conducting national R&D projects Private R&D institutes formed a hierarchical relationship with their mother firms and concentrated on R&D

**Business & networked Entrepreneurship**
- Business incubation was limited to start-ups in labs of HEIs or R&D institutes (the Daedeok Science Town focused on non-industrial basic science activities in the initial stage)
### Functional Features

<table>
<thead>
<tr>
<th>Function</th>
<th>Main Features</th>
<th>Key Role</th>
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</table>
| **R&D**                          | - **HEIs**: a leading role of basic and applied research  
- **Public institutes**: (Government affiliated research institutes)  
- to increase national science and technology capacity  
- major R&D projects supported by national government | **HEIs, National R&D Center**                |
| **Business activities & Networked entrepreneurship** | - **Technology transfer and commercialization**  
- **Venture firms** that originated from labs in HEIs or research institutes (research centered HEIs) | **Spin-offs from R&D labs**                  |
| **Infrastructure**               | - **DSTAO**: a special management office  
(established by the central government, managed and operated the Science Park)  
- **Zoning Ordinance for R&D**  
- **Housing & Settlement**     | **Management Office**                        |
Main objectives in the initial stage of the Science Park are:
- Constructing infrastructure:
- Managing and operating the Science Park:
- Constructing institutional infrastructure:
2 Middle Stage: Technopolis Model

**R&D**
- Public R&D
- Private R&D
- HEIs
- Collaborative R&D / Spin-offs
- Technology Commercialization
- Pre-Incubator
- TBI
- Post-TBI

**Business**
Entrepreneurship / One-stop service program

**Infrastructure / Management**
- Land-use: MXD
- Flexible Zoning: Multi-functions
- High-tech Park: Daedeok Techno-Valley

Multi-functional Management Office / Local Government Cooperation
Research & Development
- **HEIs**: the source of venture firm start-ups. Various local HEIs moved into the Science Park and contributed in collaborative R&D activities
- **Public research institutes**: leading the main role of collaborative research projects with industries and HEIs

Business & networked Entrepreneurship
- a **system** to utilize research results from research institutes and HEIs in order to support potential entrepreneurs and venture firms.
- **Business incubation** activities expanded from a small number of public institutes and HEIs to various local institutes.
- Strategy should be integrated with networked entrepreneurship (new high-tech products)
Networked Entrepreneurship: CDMA
Management & Globalization
- Technology Commercialization: the core topic of sustainable growth of high-tech venture firms:
  - service activity,
  - technology marketing,
  - technology management,
  - technology commercialization,
  - advertisement of products,
- financial aid for venture firms, marketing services, institutional support, various equipments, facilities

One-stop service mechanism: Entrepreneurship
Infrastructure

- Industrial complex for venture firms and R&D facilities to cover the request from R&D centers for technology commercialization.

- Accessibility to the service facilities of quality of life (housing and community facilities)

- The integration of cultural society (emphasized to make best use of mother town’s infrastructure)
### Functional Features

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</table>
| **R&D**                   | - Sustainable growth of high-tech start-ups (HEI, R&D Center)  
- Active Collaborative research programs among industries, HEIs, and research institutes  
- Enhancing local R&D support capacity.                                                                                                       | Collaboration among firms, HEIs, and research institutes                                    |
| **Business activities & Networked entrepreneurship** | - Various business incubation centers  
- Active technology commercialization systematic support for sound entrepreneurship.  
- Settledown of Graduates from TBI and high-tech SME's  
- one stop service programs, to encourage the investment and settlement.                                                                 | TBI Complex (Pre Incubator; TBI; Post-TBI)                                                  |
| **Management / Infrastructure** | - A multi-functional office: to cope with the expansion of the Science Park.  
- To control the surrounding area of the Science Park, the management office closely work with the local government  
- Venture Park, Techno Park  
- Accessibility to QoL facilities (Integration of cultural society)                                                                 | Multi-functional management office in cooperation with Local government's                  |
An **total system for innovation and technology commercialization**. This model is operated in four main functions and their components.
Mature Stage: Innovation Cluster Model

**R&D / Business**

- Public R&D
- Private R&D
- HEIs
- Regional Innovation (High-tech Cluster)
- IT/ BT/ NT
- TBI Complex
- Commercialization Center
- Global Business Network
- Local Business Network
- Global Business Network

**Infrastructure / Management**

- Science Park
- Clustered Development
- Industrial Park
- Daedeok Innopolis: Headquarter/ Business Hub Center

**Conurbation**

- Mother City: Daejeon
- High-tech Super Corridor: link with Sejong/ Cheongju
- Global Network
• Regional innovation cluster created in Daedeok Innopolis
• **A specialized network** to maximize innovation of science and technology to enhance the global marketing strategies at the end.
  : Cooperation with international innovative clusters and global marketing strategies

• **Integrated support system** of networked entrepreneurships and professional training programs for sustainable growth of high-tech firms are required to build an regional innovative cluster.
There are also support for closer **Networking and Dissemination**

**Strengthen Relationships**
between High-Tech Clusters and Other Regions

- Provide a model of success based on measurable results
- Support ties between clusters from various regions

**Build Knowledge Creation & System**
to Apply Knowledge

- Create a comprehensive database: institutes, universities & firms’ products & R&D efforts & milestones
- Build an R&D strategy information center that allows knowledge integration
Research & Development

Research universities led R&D activities in national strategic industries. (National R&D of IT, BT and NT) → formation of high-tech clusters

Business & networked Entrepreneurship

- An institutional system and infrastructure was established to support entrepreneurship activities (led to the construction of an innovative cluster)
- Potential entrepreneurs in strategic industries are strongly to build an industrial cluster within a Regional Innovative System.
### Major Research Institutes and their Spin-offs

<table>
<thead>
<tr>
<th>Name of research Institute</th>
<th>No. of Spin-off Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric and Telecommunication Research Institute (ETRI)</td>
<td>57</td>
</tr>
<tr>
<td>Korea Research Institute of Standard Science (KRISS)</td>
<td>19</td>
</tr>
<tr>
<td>Korea Advanced Institute of Science and Technology (KAIST)</td>
<td>117</td>
</tr>
<tr>
<td><strong>Total of major R&amp;D spin-offs (88.1% of total R&amp;D spin offs)</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>
Origins of Spin-offs Activities

![Graph showing the origins of spin-offs activities from 1979 to 2004. The graph illustrates the number of institutes involved in spin-off activities over time, with a significant increase after 2000. The graph includes lines representing government or public institutes, private institutes, branch offices of government, universities, and supporting institutes.](image-url)
Management & Globalization

- Technology marketing to be supported in different technology clusters.
- Financial aid for supporting industrial activities of specialized or advanced technologies.
- Cooperation among different technology clusters is necessary.
- Network building with other domestic regional clusters and foreign clusters
Infrastructure

- Land-use Zoning System: more flexibly integrated to cover the establishment of R&D and production (foreign firms)
- Land use planning MXD structure.
- The Business Hub Center to cover the various request of business space and service facilities
- The Integrated R&D and Production
- Flexible tenant system to cope with various demands from high-tech SME’s.
## Functional Features

| Function                      | Main Features                                                                                                                                                                                                 | Key Role                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------Adam                                             |
| R&D                           | - An innovative cluster to promote the growth of strategic industries (IT/BT/NT) (created by the cooperation between science park and local governments)  
- Collaborative network among firms, HEIs and research institutes is enhanced. | Network building among R&D and Industry       |
| Business activities & Entrepreneurship | - A support system for business incubation activities  
- One-stop Service Center: Technology marketing, technology commercialization, and technology transaction (managed by specific centers of regional innovation)  
- Techno-park as the core of regional platform.  
- The Strategic Industry Planning Team (future oriented strategy for globalization) | Leading firms of High-tech industry, (networked entrepreneurship) |
| **Management** | | **-Daedok Innopolis (Head quarter / Business Hub)** |
| - Cooperation among different industry cluster  
  - Global approach to link with other foreign cluster  
    including other regional clusters  
 - Technology marketing and management  
 - Educational programs Integrated education programs to train R&D experts and to support professionals |
| **Infrastructure** | | **-Global business infrastructure (local government support for global network of high-tech cluster)** |
| - Flexible zoning system to promote business activities and R&D activities within innovation cluster etc.  
 - Mixed-use development (convention, hotel, housing, community and cultural facilities)  
 - High-tech corridor link with urban conurbation |
Daedeok Innopolis’ Impacts on Economic Growth and Regional Innovation

**Regional Impacts**

**R&D institutes & Professional Manpower**

- The **volume of employment** is relatively small by global standards.
  - However, taking into account **professional manpower**

- The **employment** is **more meaningful**.
  - About 86 institutes are currently located in Daedeok Innopolis

- **Private research institutes** are following ones.
  - Government contributed institutes were a number one occupant of the Park until 1990.

- **Daedeok is a good place to transfer technology**.
  - but it does not hold a sizable population.
• About **22,000 researchers** including 6,000 Ph.D. holders who work in private, public research institutes and universities.

• **Foreign scientists** began to settle in Daedeok Innopolis from **1999**

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<tbody>
<tr>
<td>Total</td>
<td></td>
<td>9</td>
<td>13</td>
<td>33</td>
<td>52</td>
<td>68</td>
<td>86</td>
</tr>
<tr>
<td>Number of researchers</td>
<td></td>
<td>3,879</td>
<td>6,129</td>
<td>6,920</td>
<td>7,640</td>
<td>14,913</td>
<td>22,395</td>
</tr>
<tr>
<td>Govt' contributed institutes</td>
<td></td>
<td>5</td>
<td>8</td>
<td>19</td>
<td>17</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Private institutes</td>
<td></td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>21</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>Investment organizations</td>
<td></td>
<td>6</td>
<td></td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>High education institutes</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Number of foreign scientists</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Other organizations</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Public organizations</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supporting Organizations</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Venture Business

- **Economic impacts** rapidly growing venture business.
  - From the late 1990s, **active spin-offs** and **start-ups** had spread into whole of Daejeon area and currently **about 824 firms** are under operations

- Over the last 15 years, **venture firms in Daedeok Innopolis** have made **outstanding progress**.
  - not significant but growth rate is very high

| Table 11. Number and volume of sales by venture firms in Daedeok Innopolis |
| (Unit: firm, thousand US$) |
|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                             | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Total                       | 250  | 300  | 500  | 776  | 811  | 824  |
| Identified                  | 150  | 170  | 340  | 503  | 413  | 425  |
| Unidentified                | 100  | 130  | 160  | 273  | 398  | 399  |
| Amount of annual sales      | 2,095| 3,637| 3,676| 3,646| 4,800| 7,773|
• **Venture firm's start-up** was initiated from the end of 1980s and it grew up very slowly until IMF Crisis in Korea.

- But it grew very rapidly **from year 1999** on due to the central government's support policy.

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</tr>
</thead>
<tbody>
<tr>
<td>No. of firms</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>20</td>
<td>154</td>
<td>130</td>
<td>219</td>
</tr>
<tr>
<td>No. of jobs created</td>
<td>35</td>
<td>84</td>
<td>96</td>
<td>187</td>
<td>924</td>
<td>2,212</td>
<td>3,237</td>
</tr>
</tbody>
</table>
• **Key functions for a successful business incubation**
  1) proper planning,
  2) management
  3) location selection
  4) making connections with universities.

• Currently **about 322 venture firms** are **under incubation** and **some 3,000 employees** are working

<table>
<thead>
<tr>
<th>Year</th>
<th>Incubating Institute</th>
<th>No. of occupants (firms)</th>
<th>No. of occupants (persons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1</td>
<td>140</td>
<td>893</td>
</tr>
<tr>
<td>2000</td>
<td>16</td>
<td>350</td>
<td>2,523</td>
</tr>
<tr>
<td>2002</td>
<td>18</td>
<td>310</td>
<td>2,943</td>
</tr>
<tr>
<td>2004</td>
<td>18</td>
<td>287</td>
<td>2,601</td>
</tr>
<tr>
<td>2007</td>
<td>20</td>
<td>322</td>
<td>2,994</td>
</tr>
</tbody>
</table>
**Intellectual Property**

- Intellectual property is very rapidly growing
- Daedeok Innopolis is the **hub of knowledge innovation and the center for future oriented growth pole**

<table>
<thead>
<tr>
<th>Year</th>
<th>Domestic Patents</th>
<th>Domestic Patent on a new device</th>
<th>Computer Programs</th>
<th>International Patents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>4,125</td>
<td>201</td>
<td>8,142</td>
<td>623</td>
</tr>
<tr>
<td>2000</td>
<td>12,289</td>
<td>609</td>
<td>14,379</td>
<td>2,026</td>
</tr>
<tr>
<td>2002</td>
<td>14,221</td>
<td>778</td>
<td>19,488</td>
<td>2,687</td>
</tr>
<tr>
<td>2004</td>
<td>19,787</td>
<td>1,304</td>
<td>26,767</td>
<td>5,597</td>
</tr>
</tbody>
</table>
Growth pattern and trend in time sequence

Three distinct phases in the development of Daedeok Innopolis

Initial stage: Science Park

- Main objectives of DST development are creating a foundation for joining the ranks of the advanced countries, fostering closer links among research institutes, academia and industry

- Public research institutes were responsible for building a national R&D infrastructure

- Technology commercialization and venture activities were mainly conducted in labs located inside research institutes and HEIs.

- Funds were mainly provided to venture firms by individual investors (Risk Financing)
Middle stage: Technopolis

- Support the **commercialization** of R&D results
- **All HEIs** conducted technology commercialization and collaborative **research** with firms, research institutes, and HEIs
- **Various business incubation centers** were built and managed in HEIs and research institutes to support venture firms

Mature stage: Innovation Cluster

- Companies in DV are estimated to be **at 3,000 units in 2015**
- **A cooperation system** among firms, HEIs, and research institutes was enhanced in **strategic industrial fields such as IT, BT, and NT**
Three clear phases of Science Park development were identified in Daedeok Innopolis.

**Science Park** at initial stage
- a national hub for development of science and technology

**Technopolis** at middle stage
- an total system for innovation and technology commercialization

**Regional Innovation Cluster** at mature stage
- center of business excellence on high-tech industry in the global science.
**Daedeok Innopolis** created as an **engine of enhancing national competitiveness** in high technology and economic development through the agglomeration of research institutes.

**Research complex** has been built with the **investment of $ 3.16 billion** over the past 40 years.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Growth Pattern</th>
<th>Regional Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Stage</td>
<td>- Leading the national R&amp;D capacity through government research institutes.</td>
<td>Since Daedeok Innopolis was established by the central government initiative, there has been weak linkage between the science park and surrounding region. Therefore impact from job creation and regional economic growth was meager.</td>
</tr>
</tbody>
</table>
| Middle Stage   | - Venture firms were created to take advantage of research results from the Daedeok Innopolis.  
- Spin-offs and start-ups were strongly supported by the central government. | Emphasis was given to the development of advanced technologies.  
**Linkage** between HEIs, industries and research institutes was strengthened. |
| Mature Stage   | - Number of foreign R&D institutes is expected to rise dramatically and international patent registration will grow very fast.  
- Science and technology output will be more extensively utilized. | Daedeok Innopolis is expected to play a role as a **worldwide regional innovation cluster**. |
The **creative model of science park** development should be **integrated with the functional structure** at different stages of development.

**Driving Forces**

- **Science Park**
  : R&D, Spin-offs

- **Technopolis**
  : Sustainable growth of high-tech SME’s

- **Innovation Cluster**
  : Networked entrepreneurship and clustered development of specialized industrial sectors
Infrastructure should be harmonized with flexible request from high-tech industry.  
: Mixed-use development  
: Flexible zoning  
: Business-hub  
: Flexible tenant system

Quality of Life is another important factor for high-qualified human resource to work and live.  
: Creative city development approach with social sustainability (Culture, Environment and community)
Korea's 35-year Experience of STPs

a. In terms of Background
- dominated by pressure towards regional decentralization
- a strong drive by central government

b. In terms of Development Features
- Korea’s technopolis programs are part of urban development plans: involved with research parks, new universities, R&D centers, housing and urban facilities

First stage (National Science Cities in the 1970s)
: was planned around the concept of basic R&D with the relocation of government research institutes and high-grade universities.

Second stage (Technopolis / Technopark program)
: emphasized the need for high-tech industries to link with research activities as well as the importance of infrastructure

Third stage (Regional Innovation Cluster)
: aims to develop the high-technology region targetting for regional innovation based on the former development of science city
: expect future development of regional innovation cluster supported by local technoparks in each prefecture
c. **In terms of Nature of Industrial and Technological Development**

- **National Science City**: basic research in **public R&D Centres** (former stage)
- Established technology parks in the vicinity to provide a location for high-tech industry to exploit the findings of the R&D (Later stage)
  : emphasizes on links between research and production technology transfer
- **Local technoparks in Korea**
  : to attract industrial plants to create an agglomeration of industrial activities
  : also serve mainly as incubators for SMEs
  : to overcome the problems of technology transfer
  : more production oriented through attracting high-tech firms to remedy the poor base of high tech industries in many localities
d. **In terms of Public Sector Involvement and Support Mechanisms**

- Daedeok’s technopolis program differs in terms of **policy-making and the extent of involvement**
  - The **real strength** of central government has **stimulated local efforts**
  - Technology policy provides a stimulus for **bottom up efforts** at the local level
  - It is strongly dependent on **government support** to provide the necessary conditions for high-tech development
  - Focused on giving **relocation promotion incentives** for firms and subsidizing spin-offs from R&D centres
Thank You