GLOBAL VALUE CHAINS, INDUSTRY 4.0, AND KOREAN INDUSTRIAL TRANSFORMATION

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Duke GVC Center research team in collaboration with KIET:
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KIET-DUKE PROJECT – KOREA IN GVCs

• One year joint project between KIET and Duke
  • Initiated by KIET; first study to focus on GVCs in Korea

• **Objective:** Identify upgrading opportunities for the Korean economy using a global value chain (GVC) perspective

• Research report covers
  • GVC and Industry 4.0 trends
  • Two GVC case studies on electronics and shipbuilding
  • Recommendations and future directions for Korea

• Today’s presentation highlights Korea’s position in GVCs, key findings from the research, and a global perspective on GVCs, Industry 4.0 and industrial policy trends.
KOREA IN GLOBAL VALUE CHAINS: PATHWAYS FOR INDUSTRIAL TRANSFORMATION

• Korea’s economic development to date based on considerable strength in manufacturing
• Global playing field is changing → Industry 4.0 technologies are creating new digital economy
• Competitiveness of traditional manufacturing base under potential threat
  • Lower cost locations (e.g., China, Vietnam)
  • Innovation hubs (e.g., US, Europe, Japan)

Key Questions:
What pathways should Korea pursue to drive economic growth?
Can GVC Analysis help identify opportunities?
Key Features of GVC Analysis
Shift from movement between sectors to movement within sectors

From low to high value activities within sectors

HIGH VALUE-ADDED
- Pre-production R&D
- Technological development
- Specialized services

MEDIUM-SKILLED SUPPORT & SALES
- Design
- Commercialization
- After-sale services

PRIMARY
- Basic production
- Assembly

KEY TRENDS IN GVCS & IMPLICATIONS FOR DEVELOPMENT POLICY

• Rationalization
  • Lead firms preference to work with large suppliers/partners
    • SMEs cut out from volume business, must focus on niches

• Asian regionalization
  • Early GVC regionalization (e.g. NAFTA, EU)
  • Strong demand drive & relocation of production activities
    • New products for Asian markets

• Changing production technologies
  • Automation – scale industries/segments
  • 3D Printing – niche sectors
    • Capital substitution of labor; geography of chain

• Servicification
  • New services activities ➔ Big Data/Internet of Things (IoT)
    • Increased value of after-sales & knowledge-intensive services

INDUSTRY 4.0
ECONOMIC UPGRADING

• Strategies used by firms and countries to improve their positions in global and regional value chains
  • *Entry upgrading* – participate in GVCs
  • *Product upgrading* - moving into more sophisticated product lines
  • *Process upgrading* - transforms inputs into outputs more efficiently by reorganizing the production system or introducing superior technology
  • *Functional upgrading* - acquiring new functions (or abandoning existing ones) to increase the overall skill content of the activities (OEM → ODM → OBM)
  • *Intersectoral (chain) upgrading* – entry or diversification into new value chain by leveraging the knowledge and skills acquired in the current chain (e.g., new materials – graphite in Taiwan; high-tech textiles)
WHERE DOES THE VALUE LIE IN GLOBAL VALUE CHAINS?

Value-Adding Activities

Pre-Production Intangible

Production: Tangible Activities

Post-Production Intangible

Base Price

Added Economic Value

R&D

Design

Logistics: Purchase

Production

Logistics: Distribute

Marketing

Post-sales & Retail Services
Korea in Global Value Chains
# Two Key Sectors

+650,000 jobs  
30% exports  
(US$240,000/employee)

## Electronics

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| **Exports (2015, US$)** | **Share of Korea’s Exports** | $38 billion  
7.3% |
| **396,000 (2012)** | **Employment** | 260,000 |
| Samsung, LG, SK Hynix | **Key Lead Firms** | HHI, SHI, DSME |
| Components/subassemblies (for export)  
Lead firm (final 3C products) | **Main Stages of GVC Participation** | Components  
Lead firms; Integration |
| Cost-driven consumer market | **Current Competitiveness Strategy** | Higher-value, niche markets |

## Shipbuilding

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<tbody>
<tr>
<td><strong>Components</strong></td>
<td><strong>Lead firm (final 3C products)</strong></td>
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KOREA IN GVCS: KEY FINDINGS

• **Upgrading driven by indigenous firms**, not FDI
  - Transfer knowledge via licensing rather than collaboration

• **Limited outsourcing** → Firms have maintained manufacturing capabilities in-house (unique to Korean lead firms)

• **Process & product upgrading** (i.e., productivity & new technologies, incremental product improvements) → major drivers of competitiveness

• Functional upgrading mainly occurred **upstream in GVCs** → applied R&D, new product development
• **Small and medium enterprises** not well linked to innovative activities outside *chaebol* economy

• **Weak presence in services** in value chain
  - Poor services sector overall

• **Focused on small number innovative products** & select end markets
  - China is in all products; Japan declining presence
GVC UPGRAADING:
POTENTIAL PATHWAYS FOR THE FUTURE

• Upgrading into Production Technologies → position Korea at forefront of Industry 4.0

• Functional Upgrading into Services → very strong R&D but only in select GVCs
  • After-sales services → Big data
  • IT services → IoT
  • Manufacturing-related services → use GVC approach to identify these (use manufacturing to move into services)

• Intersectoral (chain) upgrading → Leverage existing knowledge across tech leaders to move into & define new sectors on the technological frontier
UPGRADE INTO SERVICES: POST PRODUCTION & MANUFACTURING-RELATED SERVICES

2017 KOREAN STRENGTHS

- Products
- Products & Services
- Smart Services
- Benchmarking & Performance Consulting

GVC OPPORTUNITIES

- Design services
- ERP
- CRM
- e-Commerce
- Logistics
- Insurance

Potential Markets

- Advertising/targeting marketing
- Political campaign targeting
- City planning/urban development
- Autonomous car programming
- Port logistics
- Navigational services
- Safety services
- Weather forecasting
THREE KEYS TO UNLOCKING THIS POTENTIAL

- Human Capital
- Innovation Systems
- Services Regulation

COHERENT & CONSISTENT INSTITUTIONAL APPROACH
Korea in Comparative Perspective
## INNOVATION SYSTEMS IN EAST ASIA

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<tr>
<th></th>
<th>China</th>
<th>Japan</th>
<th>Korea</th>
<th>Singapore</th>
<th>Taiwan</th>
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<tr>
<td><strong>GVC/Integration Approach</strong></td>
<td>FDI</td>
<td>National Champions</td>
<td>National Champions</td>
<td>FDI</td>
<td>FDI/National Champions</td>
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<td><strong>Capability Development in GVCs</strong></td>
<td>Membership of GVCs</td>
<td>Indigenous Innovation</td>
<td>Indigenous Innovation/Licensing of foreign tech</td>
<td>Membership of GVCs</td>
<td>Membership of GVCs</td>
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<tr>
<td><strong>Policy Approach</strong></td>
<td>SME &amp; Industrial Space</td>
<td>Supporting national champs &amp; core technologies</td>
<td>SME &amp; Industrial Space, Targeted FDI</td>
<td>SME &amp; Industrial Space</td>
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CHINA’S ONE-BELT, ONE-ROAD INITIATIVE

Source: Xinhua News Agency
ASIAN-PACIFIC TOP 10 GDP COUNTRIES, ONE BELT ONE ROAD AND TTP MEMBERS

Top 10 Asian GDPs
- China
- Korea
- India
- Indonesia
- Turkey
- Saudi Arabia
- Iran
- Thailand

One Belt One Road
- UAE
- Philippines
- Pakistan
- Iraq
- Kazakhstan
- Qatar

Japan
- Australia

Malaysia
- Singapore
- Vietnam

New Zealand

Trans-Pacific Partnership
# Made in China 2025: Strategic Industries and Ultimate Goals

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<td>Energy Efficiency &amp; Environmental</td>
<td>Energy Saving &amp; Clean-energy</td>
<td>Green and Sustainable Growth</td>
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<td>Conservation</td>
<td>Vehicles</td>
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<td>New-Energy Vehicles</td>
<td>Power Equipment</td>
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<td>New Energy</td>
<td>Biomedical &amp; High-performance</td>
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<td>Biotechnology</td>
<td>Medical Devices</td>
<td>Indigenous Innovation</td>
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<td>New Materials</td>
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<td>Next Generation Information Technology</td>
<td>Next Generation Information</td>
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<td>Technology</td>
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<td>Computer Numerical Control Tools</td>
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<td>&amp; Robotics</td>
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<td>Agricultural Machinery</td>
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<td>High-End Equipment Manufacturing</td>
<td>Aerospace Equipment</td>
<td>Global Competitiveness in Infrastructure</td>
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<td>Advanced Rail Equipment</td>
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<td>Marine Engineering Equipment &amp;</td>
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<td>High-tech Ships</td>
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Global Value Chains Center
UPGRADING STRATEGIES FOR CHINESE VEHICLE MANUFACTURERS, MID-1990s - PRESENT

## MAJOR R&D CENTERS FOUNDED BY MNCs IN CHINA

<table>
<thead>
<tr>
<th>Industries</th>
<th>MNCs</th>
<th>Year</th>
<th>Location</th>
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<tbody>
<tr>
<td>Electronic Appliances</td>
<td>Intel</td>
<td>1994</td>
<td>Shanghai</td>
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<td></td>
<td>3M</td>
<td>1994</td>
<td>Shanghai</td>
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<tr>
<td></td>
<td>General Electric</td>
<td>2003</td>
<td>Shanghai</td>
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<tr>
<td>Software</td>
<td>IBM</td>
<td>1995</td>
<td>Beijing</td>
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<td></td>
<td>Microsoft</td>
<td>1998</td>
<td>Beijing</td>
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<td></td>
<td>Hewlett Packard</td>
<td>2002</td>
<td>Shanghai</td>
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<tr>
<td>Chemicals</td>
<td>Dow</td>
<td>2004</td>
<td>Shanghai</td>
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<td></td>
<td>DuPont</td>
<td>2005</td>
<td>Shanghai</td>
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<td></td>
<td>Proctor &amp; Gamble</td>
<td>2010</td>
<td>Beijing</td>
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<tr>
<td>Telecommunications</td>
<td>France Telecom</td>
<td>2004</td>
<td>Beijing</td>
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<tr>
<td></td>
<td>Vodafone</td>
<td>2005</td>
<td>Beijing</td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>Johnson &amp; Johnson</td>
<td>1994</td>
<td>Shanghai</td>
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<td></td>
<td>Pfizer</td>
<td>2005</td>
<td>Shanghai</td>
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<td></td>
<td>Novartis</td>
<td>2009</td>
<td>Shanghai</td>
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**THE ARCHITECTURE OF THE DIGITAL ECONOMY & CATEGORIES OF DIGITAL & ICT FIRMS**

**Korea: Very limited participation (1/100 firms); < 1% sales or assets**  
Dominated by US and European firms (90/100)  
E-commerce is a focus area for China

**Korea: 4% of firms; 8% of sales**  
IT devices and components (3/52 firms) (Samsung, LG, SK Hynik)  
IT software and services (1/21) (Samsung SDS)  
Telecommunications (0/27)

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THE ARCHITECTURE OF THE DIGITAL ECONOMY & CATEGORIES OF DIGITAL & ICT FIRMS

Key areas for Korea

Digital content: esp. games and info/media segments

Software/services: smaller firm size; high average share of foreign sales (63%)

• **No more catching-up:** Upgrading in GVCs has been exhausted as a economic growth driver

• **Innovation-driven development** #1 priority, not a S&T policy

• **Benchmarked to global leaders,** esp. Germany “Industrie 4.0"

• **China’s Supply Chain Integrator Model:** Accelerate upgrading through GVCs
  
  • **Platform companies:** Innovation, technology, and services
    • *E-commerce and shared economy*
    • **Increased use of IT** in SMEs
    • **Automation** -- productivity & labor shortage/labor costs
    • **Environmental upgrading**

Still a vision – long way to go.
## POLICY RESPONSE TO INDUSTRY 4.0 IN EAST ASIA

<table>
<thead>
<tr>
<th>Country</th>
<th>Major Institutional Characteristics</th>
<th>Current Policy Approach</th>
<th>Examples of Recent “Industry 4.0” Policy/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Platform/Supply Chain Integrator</td>
<td>Developing indigenous (private) lead firms</td>
<td>Made in China 2025</td>
</tr>
<tr>
<td>Korea</td>
<td>Integration of more domestic actors; low foreign input</td>
<td>Strengthening indigenous lead firm innovation in select sectors</td>
<td>Comprehensive Action Plan for Future New Growth &amp; Industrial Engine</td>
</tr>
<tr>
<td>Singapore</td>
<td>Global integration (Foreign input plays key role)</td>
<td>Leading services hub in region; regional HQs</td>
<td>National Additive Manufacturing Innovation Cluster</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Global integration (Foreign input plays key role)</td>
<td>Developing software capabilities &amp; design services in IT</td>
<td>Industrial Technology Research Institute (ITRI)’s Cloud Computing Center for Mobile Application (CCCMA)</td>
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</tbody>
</table>
KOREA’S SUCCESS IN GVCs: LEVERAGING STRENGTHS, NEW OPPORTUNITIES

• Korea in East Asia → most dynamic global region

• Korea’s strategy: indigenous R&D, a few core industries, upgrading driven by large national firms

• China’s strategy: diversified GVCs, export-oriented, links to FDIs, use domestic market for innovation & growth

• Industry 4.0: Internet use driving digital economy, upstream (sourcing) and downstream (e-commerce)

• Platform economy: digital and tech MNEs are creating new markets for SMEs (e.g., sharing economy)

• IT services: complement what large companies do, and allows innovation for SMEs (apps, 3DP, health care)