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KOREA DATA CENTER MARKET 2020-2023
1. Overview

1.1 Overview of data center

1.2 Report scope

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1. Overview

1.1 Overview of data center

Data Center Definition

- (Legal definition) A facility that integrates and manages multiple info-communications infrastructures in a certain space to provide info-communications services (Framework Act On National Information, Article 23-3)

Data Center Change Trend

- From 1980s, a small computer room evolved into an integrated data center to efficiently operate/manage IT systems that connected computing resources and networks with the emergence of the Internet in the 1990s.

- Currently, hyperscale data centers that can provide large-scale/high-quality services through the implementation of high-density/high-efficiency equipment have been appeared in response to the activation of ICT services such as cloud and AI.

- Emergence of small computer room that integrates and operates various computing resources in many user places
- In 2002, cloud services that lease and use IT resources developed and spread
- Commercial DC increases as ICT-based services expand across industries
- Emergence of hyperscale data center that provides large scale/high quality service

- Limitations of companies’ own computer room operation

1970s~
Network Oriented

1980s~
Computing Installed

1990s~
Complexity of IT system

2000s~
DC as a Service

- In 1969, development of the first Internet, ARPANET by the US Department of Defense
- In 1991, ARPANET expanded network by developing WWW (World Wide Web) that combines hypertext and the Internet

- For efficient operation of IT resources, data centers appeared that clustered/managed IT systems and that linked to the Internet

- Client server networking became a standard and used
Data center components

- The data center consists of following components; “Computing Space” where IT equipment is integrated, “Supporting Infra” for maintaining constant temperature and humidity of IT equipment and providing the power to it, and “Operation Space”, a work space for operating/managing the entire infrastructure.

### Data Center Components

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Server</td>
<td>Devices to help share HW resources and network</td>
</tr>
<tr>
<td>2</td>
<td>Storage</td>
<td>Storage space for data packet in DC</td>
</tr>
<tr>
<td>3</td>
<td>Rack</td>
<td>Cabinet space for installing server and network equipment</td>
</tr>
<tr>
<td>4</td>
<td>Network</td>
<td>Devices that helps servers in DC connect to the communication network</td>
</tr>
<tr>
<td>5</td>
<td>PDU</td>
<td>Power distribution Unit</td>
</tr>
<tr>
<td>6</td>
<td>UPS</td>
<td>Stable power supply through built-in batteries in case of power failure</td>
</tr>
<tr>
<td>7</td>
<td>Battery</td>
<td>Auxiliary unit for power supply</td>
</tr>
<tr>
<td>8</td>
<td>Generator</td>
<td>Equipment for DC self-generation in case of emergency other than UPS</td>
</tr>
<tr>
<td>9</td>
<td>Power supply</td>
<td>Power system for power supply/distribution of power plants</td>
</tr>
<tr>
<td>10</td>
<td>STS/ATS</td>
<td>Devices capable of receiving constant power supply</td>
</tr>
<tr>
<td>11</td>
<td>Constant</td>
<td>Devices that maintains the temperature and humidity of DC</td>
</tr>
<tr>
<td>12</td>
<td>Pump</td>
<td>Supply of cold water to the bottom channel of the rack for temperature control</td>
</tr>
<tr>
<td>13</td>
<td>Cooling tower</td>
<td>Heat exchanger for reuse of cooling water</td>
</tr>
<tr>
<td>14</td>
<td>Security and</td>
<td>Security and disaster prevention equipment such as CCTV and fire extinguishing gas</td>
</tr>
<tr>
<td>15</td>
<td>DCiM/EMS</td>
<td>Equipment capable of monitoring energy supply status</td>
</tr>
<tr>
<td>16</td>
<td>Office</td>
<td>Staff office space for DC operation and management</td>
</tr>
</tbody>
</table>

Source: KDCC
1. Overview

1.1 Overview of data center

Classification of data center in Korea

- (By operating body) classified into government, public and private (industrial) data centers
  - (Government, Public) Central ministries, local governments, and some large public institutions are actively building data centers
  - (Private) Telecommunications, IT services, finance and securities, and investment companies are actively building data centers

- (By service type) Can be classified into self-use data center (Enterprised) and commercial (Co-location) data center, and in Korea, can be subdivided into four types according to the purpose of use

- **Self-use (internal service)**: Data center for efficient IT resource utilization and IT service for internal members of the company

- **Self-use (external service)**: Data center to efficiently provide its own IT services to external customers (enterprises, individuals, etc.)

- **Commercial (internal/affiliated company service)**: Data center to efficiently utilize IT resources and provide IT services to companies and affiliates

- **Commercial (external customer service)**: Data center to provide efficient IT resource utilization and services to external customers (IT service companies, etc.)

Central/local administrative agencies
- National Information Resources Service
- Integrated DC of wide area organizations

Government agencies
- Energy, transportation, health, education, water and sewage, legal affairs, administrative support, etc.

Telecommunications
- KT, LG U+, SKB, SKT, etc.

Internet service
- Samsung SDS, NBP, SK, LG CNS, NHN, KINX, etc.

Finance and Securities
- IBK, KB, Nonghyup, BNK, KEB, Koscom, Shinhan, etc.
Stable operation of the data center is important, even in various emergency situations and disasters for 24/7 so the concept of availability of data centers appears. The availability of data centers is classified into Tier 1 to 4 according to the degree of construction of spare equipment in “Supporting Infra”. And as the grade increases, the space share/investment cost/operation cost for building the “Supporting Infra” increases.

Definition

Tier is an indicator of data center stability and availability. It is classified into Tier 1 to 4 according to the level of data center infrastructure installation, and the higher the Tier, the higher the reliability of the data center.

Tier 3 requires more space to install power supply and air conditioning equipment than Tier 2, which requires more investment and increases operating costs. Installation and operation of infrastructure to provide cloud computing services in modern data centers usually require Tier 3 level.

<table>
<thead>
<tr>
<th>Data Center Tier</th>
<th>Annual operating rate</th>
<th>Operating characteristics</th>
<th>Installation equipment</th>
<th>Source of demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 4</td>
<td>99.995%</td>
<td>0.4 hours of downtime per year</td>
<td>Power supply path: multiple</td>
<td>Financial institution</td>
</tr>
<tr>
<td></td>
<td>99.98%</td>
<td>1.6 hours of downtime per year</td>
<td>Cooling supply path: multiple</td>
<td>National agencies (Ministry and public services)</td>
</tr>
<tr>
<td>Tier 3</td>
<td>99.74%</td>
<td>22 hours of downtime per year</td>
<td>Power supply path: multiple</td>
<td>Cloud and co-location DC</td>
</tr>
<tr>
<td></td>
<td>99.67%</td>
<td>28.8 hours of downtime per year</td>
<td>Cooling supply path: multiple</td>
<td>IT service providers</td>
</tr>
<tr>
<td>Tier 2</td>
<td>99.9%</td>
<td>Cannot be simultaneously operated and maintained</td>
<td>Power supply path: singular</td>
<td>Small and medium-sized co-location operators</td>
</tr>
<tr>
<td></td>
<td>99.7%</td>
<td>Cannot be completely non-disruptive operated</td>
<td>Cooling supply path: singular</td>
<td>Small research institutes</td>
</tr>
<tr>
<td>Tier 1</td>
<td>99.5%</td>
<td>Cannot be simultaneously operated and maintained</td>
<td>Power supply path: singular</td>
<td>General Internet service</td>
</tr>
<tr>
<td></td>
<td>99.3%</td>
<td>Cannot be completely non-disruptive operated</td>
<td>Cooling supply path: singular</td>
<td>General companies</td>
</tr>
</tbody>
</table>
1. Overview

1.2 Report scope

Scope of this report

By operator
Describes the current status and prospects of private data centers in Korea
* Some data (total statistics) include government and public center data.

By type
Describes commercial (external customer and internal/affiliate service) data center market size, facility status, and future prospects, excluding self-use data center for pure company service

By period
Describes 2019 current status data and 2020-2023 forecast data

By content
Describes current status, prospects and trends of data centers in Korea
• (Status) General status, market and service status, and facility status
• (Prospect) Growth of private (commercial) data centers, and motive of market growth
1. Overview

1.3 Survey Overview

General Survey Details

Purpose of Survey
This purpose is to do by providing data center industry statistics research:
1. Establishes the government's systematic industrial development policy
2. Provides basic data for establishing management strategies of private companies

Research subjects
Total inspection of private data centers in Korea (90 sites)
* Some data (total statistics) include government and public center data.

Survey period
From November to December 2019 (for two months)

Reference point
Current status data as January 2019 to December 2019 (one year) and forecast data compiled by March 2020

Survey system
Industrial DC (Research subject) > KDCC (Research Institution) > Expert Group (Inspection)
1. Overview

1.3 Survey Overview

Research items and methods

- **Status**
  - (Research items) General status, sales and service/customer status, facility status, and difficulties
  - (Research method) Online written investigation

- **Prospect**
  - (Research items) Location and scale of the new construction target center, expected completion time, and purpose of construction
  - (Research method) Wired and face-to-face interviews with persons in charge of new construction target center*
    
  * Investigates with a focus on member companies and institutions that have inquiries on data center construction

- **Market trend**
  - (Research items) Macro flow of the data center industry in the future in Korea
  - (Research method) Face-to-face interviews with persons in charge of building or built DC, reviewing domestic/overseas research/report
2. Data Center Market Status in Korea

2.1 General Status

2.2 Market and Service Status

2.3 Facility Status
2. Data Center Market Status in Korea

2.1 General Status

Data center (total) increase and decrease trend (2000-2019)

- The size (number) of data centers in Korea has increased by 5.9% every year since 2000 (53), reaching 158 sites in 2019.

- During this period, non-commercial data centers* increased by 5.4% per year, and 115 sites are in operation.

- During this period, commercial data centers* increased by 7.4% per year, and 43 sites are in operation.

* This data centers are for using in government, public, financial, and private (external and internal (Enterprise))

- The commercial data center market is led by telecommunications companies (Telco) combining DC+ line infrastructure and by system integration (SI) companies combining DC+IT service (ITO) (76.7% based on the number of centers)

★ Telecommunication company DC CAGR: 6.5% per year / SI and IT service company DC CAGR: 8.4%

DC Business model for Telecommunications and SI companies

KOREA DATA CENTER MARKET 2020-2023
2. Data Center Market Status in Korea

2.1 General Status

**Status of data centers in Korea (Total) (2019)**

- In 2019, data centers totaled 158 sites in Korea.
  - The number of privately built/operated centers is 90, and the government and publicly operated centers are 68.
  - Among private data centers, 47 were found in self-use centers* (Enterprise DC) and 43 in commercial centers (Co-location DC).
    * 21 of the self-use centers are financial data centers.
  - Among the government and public data centers, there are 27 central/local government operation centers and 41 public institution data centers under the government.

**Definitions:**
- **Commercial (Colocation)**: A rental center that attracts and sells to customers with goods of the space of the computer room where IT equipment can reside in the data center (for example, KT Internet Data Center (IDC)).
- **Self-use (Enterprized)**: A data center constructed and operated for the purpose of providing IT services inside and outside the company (e.g., Naver Data Center/Financial Center).
2. Data Center Market Status in Korea

2.1 General Status

Status of data centers (total/private) in 2019 in Korea (geographical distribution by center)

- (Total) About 60.1% of all data centers, including government, public and private centers, are located in the metropolitan area

- (Private DC) About 74.4% of centers are located in the metropolitan area
  - About 81.0% of commercial (co-location) data centers are located in the metropolitan area

Data center (private) distribution in Korea

KOREA DATA CENTER MARKET 2020-2023
2. Data Center Market Status in Korea

2.1 General Status

- **2019 Data Center (Private) Status in Korea (Installation space/Geographic Distribution)**
  - (Private DC) 87.9% of the total installation space is located in the metropolitan area
  - (Commercial DC) 92.2% of commercial centers are located in the metropolitan area

- **2019 Data Center (Private) Status in Korea (Building Type)**
  - (Building type) 46.3% of private data centers are in exclusive-use buildings
  - (Building ownership) 57.5% of private data centers are built in own buildings

N=90 DCs
2. Data Center Market Status in Korea

2.2 Market and Service Status

2019 Data Center (Private) Status in Korea (Market Scale)

- As of 2018, the total sales of private data centers exceeded the cloud service market with 2.424 trillion KRW in Korea (cloud market revenue 2.3 trillion KRW in 2019)
- Net sales for commercial* data center increased by 3.4% year-on-year to 724.39 billion KRW (700.5 billion KRW in 2017)

43 data center market size excluding 47 data centers that have large subsidiaries/affiliates as customers in Korea

Data center market size in Korea

N=90 DCs

2.424 trillion KRW

724.39 billion KRW

29.9%

Commercial data center market size in Korea

N=43 DCs

700.5 billion KRW

724.39 billion KRW

3.4%
2. Data Center Market Status in Korea

2.2 Market and Service Status

2019 Data Center (Private) Status in Korea
(Service status)

- Services provided by private data centers were found to be in the order of co-location (92.1%), backup (72.4%), managed (63.2%), cloud-IaaS (60.5%), and hosting (59.2%) services (duplicate response).

Co-location: 92.1%
Backup: 72.4%
Managed: 63.2%
Cloud-IaaS: 60.5%
Hosting: 59.2%
Cloud-PaaS: 28.9%

N=90 DCs

2019 Data Center (Private) Status in Korea
(Employment status)

- The total number of employees in private data centers is 10,768, with an average of 141.7 employees per center in Korea.
2. Data Center Market Status in Korea

2.2 Market and Service Status

### 2019 Data Center (Private) Status in Korea (Customer status)

- **(Type)** The customer types in the data center were surveyed in the order of IT services (21.6%), manufacturing and distribution (20.5%), finance/insurance (18.7%), telecommunications (15.1%), and government/public (10.8%).

- **(Number of customers)** The data center resident customer are total 10,140 institutions/enterprises, and the private sector occupies 97.7%, and average 134.4 customers per center reside.

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Service</td>
<td>21.6%</td>
</tr>
<tr>
<td>Manufacturing/Distribution</td>
<td>20.5%</td>
</tr>
<tr>
<td>Finance/Insurance</td>
<td>18.7%</td>
</tr>
<tr>
<td>Telecom</td>
<td>15.1%</td>
</tr>
<tr>
<td>Government/Public</td>
<td>10.8%</td>
</tr>
<tr>
<td>Education</td>
<td>11.2%</td>
</tr>
<tr>
<td>Research Institute</td>
<td>1.1%</td>
</tr>
<tr>
<td>Health welfare</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

*Average 134.4 customers per center

N=90 DCs
2. Data Center Market Status in Korea

2.3 Facility Status

Data Center (Private) Installation Space Supply Status

- The total installation space of the private data center is 367,617.6 m², and average space per center was known 4,837.1 m² in Korea.
- (Data center size classification according to the installation space) Large center 32.5%, medium center 25%, giant center 20%, small center 16.3%, and mega center 1.3% in order.

*Unidentified center: 4.9%

- Precedence case to the definition of hyperscale
  - (IDC) Center with at least 5,000 servers and a computer room space of 10,000 ft²
  - (Synergy Research Group) Center with at least 100,000 servers, more than 10,000 racks, and a computer room space of 22,500 m²
  - (Berkeley Research Institute) 400,000 ft² or more space, modular facility configuration, advanced cooling system, reserve power
- The IDC and Synergy Research Group definitions do not classify centers of any size other than hyperscale, and utilize the classification of Berkeley Labs and Strategic Directions.
2. Data Center Market Status in Korea

2.3 Facility Status

- **Status of available amount of IT power supply in data centers (private)**
  - (Available amount of IT power supply) The total amount of IT power supply available in private data centers totaled 941 MW and averaged 12.4 MW per center in Korea.
  - (Increase trend of IT power supply availability) Compared to the average IT power supply capacity by center for each 5-year since 2000, when the establishment of a Korean data center began in earnest, the current survey shows that it has more than doubled compared to 2000.

**IT power supply availability trend in private data centers**

- 1999: 9,750 kW
- 2000-2004: 9,360 kW
- 2005-2009: 9,831.9 kW
- 2010-2014: 13,627.3 kW
- 2015-2019: 20,025.7 kW

N=90 DCs
2. Data Center Market Status in Korea

2.3 Facility Status

Other facility equipment status (private DC) (equipment type/usage ratio/average replacement year)

**UPS**
- Static: 75.9% / 12.2 years
- Rotary: 24.1% / 15.9 years

**Battery**
- Lead acid battery: 67.9% / 8.5 years
  - Lithium ion: 22.2% / 9.2 years
  - Lithium-polymer: 7.5% / 9.2 years
  - Nickel-cadmium: 2.4% / 5 years

**Self-generation**
- Diesel: 87.3% / 23.7 years
  - Gas turbine: 12.7% / 27.5 years

**Cooling**
- Air cooling type: 44.0%
  - Water cooling Type: 31.0%
  - Chilled-water cooling Type: 25.0%

* Constant temperature and humidity: 12.4 years / Cooling tower and freezer: 15 years
3. Prospect of the commercial data center market in Korea

3.1 Commercial Data Center Market Growth Trend and Scale

3.2 Motive of commercial data center market growth
3. Prospect of the commercial data center market in Korea

3.1 Commercial Data Center Market Growth Trend and Scale

Future prospects (by number of centers/region)

- (Scheduled to be established*) At least 12+1 commercial (co-location) data centers planned to be built by 2023 (one site additional construction)
  - * A center that has established an internal organization with the goal of establishing a data center, or has collaborated with an external professional organization, or has completed purchasing a site.
- In addition to commercial data centers, five government and public data centers and five private data centers for providing its IT services.

(Geographical distribution)
Establishment lots for 10 centers were opened to the public, nine of which are scheduled to establish centers in the metropolitan area and one in Chungcheong, respectively.

★ Two lots for center sites are being selected or searched
Future prospects (by number of center/period)

- 2(+1) in 2020*, 2 in 2021, 3(+1) in 2022*, 5 in 2023 centers will be built
  * The same center will be expanded in two phases in 2020 and 2022.
- In the period (2020-2023), the IT power capacity of commercial data centers will increase by 20.1% per year on average.
- The global commercial data center market is expected to grow 10.92% annually during the same period. (Mordor Intelligence, 2019)
- IT power capacity will increase by 210 MW in 2023, the largest increase is expected.
- More than 23 centers are estimated to plan data center construction within the same period. Of these, 12 centers that have begun to implement concretely such as expiring a site contract or signing an external consulting contract to establish the center are inspected (may be changed later.)

3.1 Commercial Data Center Market Growth Trend and Scale
Future prospects (IT power supply capacity (IT Capacity))

- Commercial data centers are expected to grow at an annual average rate of 20.1% and form 758 MW size based on total IT power supply from 2020 to 2023.
  - Over the past 20 years (2000-2019), the amount of IT power available to co-location centers in Korea has increased by 12.8% per year, forming a total of 352.6MW size.
  - 12+1 commercial data centers are planned to be built by 2023, and when the construction is completed, it is expected to reach 758.6 MW size, which is about 2.2 times larger than the present.

In the same period, seven centers with a 154 kVA supply capacity that can be built as hyperscale* data centers will be newly built, and one existing 154 kVA supply capacity center will be expanded.

* Fine-tuning modular configuration, advanced cooling system, and redundant power are in the installation space of over 400,000ft² (Berkeley Research Institute, 2016)

- IT supply capacity was surveyed as 31.2 MW in the center constructed during the same period.

★ The average IT supply capacity of industrial data centers established in 2015-2019 was 20 MW
3. Prospect of the commercial data center market in Korea

3.1 Commercial Data Center Market Growth Trend and Scale

Future prospects (IT power supply capacity (IT Capacity) / By region)

- The new commercial data center is expected to be supplied mainly in Seoul/Gyeonggi area.
  - Existing commercial centers locate mainly in Seoul and south of Gyeonggi-do (Seongnam, Anyang, Yongin) with good accessibility to Seoul, but the new centers will be expanded to be built to the north of Gyeonggi-do (Paju, Gimpo) and Chungcheong-do (Hongseong).
  - Due to the evolution of network technology and the expansion of infrastructure, the increase in the proper land price in the metropolitan area, and the increase in demand for local governments to attract data center investment, there is a possibility that the commercial data center will continue to expand beyond the metropolitan area.

★ Gangwon-do (Chuncheon): Planning a data center industrial complex that uses deep water from the Soyang river as cold water
★ Sejong City: Planning to build a data center industrial complex near Naver 2nd Data Center
★ Gunsan City (Saemangeum): Planning a data center industrial complex in connection with a large-scale photovoltaic complex
★ Pyeongtaek City: Planning to build a data center industrial complex in connection with LNG cooling and heat recycling
3. Prospect of the commercial data center market in Korea

3.1 Commercial Data Center Market Growth Trend and Scale

Future prospects (Main Operator/Player)

- New businesses (asset managers, construction companies, etc.) besides traditional data center construction companies (Telecommunications, IT services) are expected to advance into the data center construction/operation business.

- Telecommunications that occupy more than 60% of the current commercial data center market will build four centers with a capacity of 178 MW (IT capacity) in the future.

- IT services that occupy more than 30% of the current commercial data center market will build four centers with a capacity of 46 MW (IT capacity) in the future.

- During this period, data center REITs, real estate development, infrastructure investment, and companies will build six commercial data centers with a total size of 182 MW.

- Of these, four centers are found to be built by foreign companies that enter and invest in Korea.

- 182 MW scale centers in 6 locations is built in Mapo-gu, Paju-si, etc.

- 178 MW scale centers in 4 locations is built in Yongsan-gu, Geumcheon-gu, etc.

- 46 MW scale centers in 2+1 locations is built in Yongin-si, Gwacheon-si, etc.
3. Prospects of the commercial data center market in Korea

3.2 Motive of commercial data center market growth

Increase in demand for commercial data center rentals in accordance with targeting the Korean market by global cloud service providers (hereinafter CSP)

- Global CSPs are actively entering the Korean market as Korean companies and the public sectors are expected to become active in the cloud transition.
  - IaaS market growth in Korea: 577.2 billion KRW (2018) → 1,447.5 billion KRW (2022) (Gartner, 2019)
- Global CSPs prefer to rent existing commercial data centers rather than establish their own centers to provide services in Korea.
  - Commercial DC total IT power supply trend in Korea: 352.6 MW (2019) → 758.6 MW (2023)
- As commercial data centers that generate high value-added revenue are spotlighted as a new investment, new businesses are actively entering the market.
  - In 2019, US data centers (REITs)'s ROI was 48.5%, ranking first among real estate investments (Daeshin Securities, 2019).

Increased demand for data generation/processing due to the proliferation of new ICT services (AI, big data, etc.), and social environment change (increased non-face-to-face demand)

- Mobile data traffic in Korea is expected to grow 10 times with 3.2 EB in 2023 compared to 2017 (ETRI, 2018)
- COVID-19 in February 2020 caused high data traffic due to increased untact (non-face-to-face) work and service and leisure time in the home
4. Trend of commercial data center market size in Korea

4.1 Intensifying competition due to new providers entering the market

4.2 Wholesale customer position strengthens

4.3 Increasing Hyperscale Data Center

4.4 High value-added services emerge as the core competitiveness
4. Trend of commercial data center market size in Korea

4.1 Intensifying competition due to new providers entering the market

New businesses are actively entering the market as commercial data center profitability emerges for businesses looking for new investment destinations.

- In the past, high-capital investment acted as a barrier to enter the data center industry, making it difficult to enter new markets, forming a consolidated industrial structure with few specialized companies.

- In accordance with the prospects of market growth and profitability of data center compared to other businesses, new market entrants* who can overcome absolute cost advantages such as Global data center specialized REITs, construction, and energy companies continue to increase participation.

  * Macquarie Group, G Company, E Asset Management, H Asset Management, etc.

- In the future, the market structure of the Korean commercial data center is expected to change into a fragmented industry with many operators, and the competition within the industry is expected to intensify.

4.2 Wholesale customer position strengthens

Enhance Buying Power of wholesale customers driving data center market demand.

- The commercial data center market structure is changing to a fragmented industry, and the number of suppliers is increasing, while the number of Wholesale (CSP, IT service) customers driving market demand is limited.
  
  ★ Retail customers who used existing commercial centers continue to increase their cloud service transition.

- Wholesale customers fully understand the product, price, and cost structure of the data center industry.

- In particular, CSP is expected to strengthen the bargaining power, as it has sufficient backward integration capabilities to build data centers directly.
  
  ★ Google (15), AWS (16), and MS (31) are building and operating more than 60 data centers in the world.
4. Trend of commercial data center market size in Korea

4.3 Increasing Hyperscale Data Center

- Increased demand for new hyperscale data centers to realize economies of scale
  - The data center industry is actively pursuing for establishing hyperscale data centers to reduce costs and preempt competitive advantage due to intensifying competition in the industry and increasing bargaining power of buyers.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operator</th>
<th>Business</th>
<th>Location</th>
<th>Service</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K Co.</td>
<td>Telecomm.</td>
<td>Seoul</td>
<td>Commercial</td>
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4.4 High value-added services (DC as a Service) emerge as the core competitiveness

- AI, big data analysis services, etc. are spreading, and commercial centers that have built construction/power/cooling facilities to operate high-performance computing (HPC) equipment are spreading.

- High value-added services provided by data centers such as interconnection, automation, and virtualization emerge as core competitive advantages.
  - Data center REITs companies with professional services and technological competitiveness* began to enter Korea (2019), and competition within the industry has been active.

  *Global leaders provide MMR services such as interconnection between data centers, virtual network services, business between users, and demand matching.

  - Beyond the installation space + line connection service, services such as automatic center operation and interconnection services between centers is expected to emerge as a core competitive advantage.
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