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# The Incheon Aerotropolis:

An Exemplar of 21st-Century Airport-Centric Development

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## Introduction

South Korea's Incheon Aerotropolis leads the world in the combined magnitude, range, and quality of commercial investment in both its airport city core and peripheral business and urban clusters. Its planning and development epitomize the principles of “thinking big, acting fast, and doing it right”.

The aerotropolis is anchored by dual central business districts: “Air-City” and Songdo International Business District (Songdo IBD). Incheon International Airport (ICN) hosts Air-City, an impressive array of office, convention, hospitality, shopping, leisure, and logistics complexes. A 21.4-kilometer, US\$2.3 billion bridge links ICN and Air-City to Songdo IBD (formerly New Songdo City), a US\$35 billion aviation-oriented smart city built on land reclaimed from the sea that cornerstones the much broader Incheon Free Economic Zone (IFEZ).

Together, ICN, Air-City, Songdo IBD, and the IFEZ represent a paragon of airport, airport city, and aerotropolis development. Though not without challenges and critiques (that are discussed herein), their development paths and accomplishments can serve as models for successful airport, airport city, and aerotropolis initiatives elsewhere. ICN routinely ranks at the top in airport-industry surveys, lauded for its passenger experiences and services as well as its operational efficiency. Its Air-City is unmatched in its range of high-end commercial facilities and appeal to affluent tourists. The IFEZ has arguably been more successful in attracting modern businesses than any other airport-area economic zone while Songdo IBD has evolved into a hyperconnected airport edge city (and precursor of many other smart city initiatives) that limits sprawl, mitigates the effects of human activity on the environment, and addresses growing demand for sustainable development.

## Case Background

In 2000, a year before ICN opened, the South Korean government and the new airport's planners invited me (John Kasarda) to discuss airport city and aerotropolis development principles. During the following years, I periodically met with Stan Gale, CEO of New York's Gale International, who was principal developer of Songdo IBD, with 61% equity at the time (see Chapter 1 of

*Aerotropolis: The Way We'll Live Next* for a discussion of this)<sup>1</sup>. I also kept in touch with ICN's operators (serving for a period as a consultant), South Korean academics, and Incheon development organizations for updates on infrastructure and commercial/industrial projects at ICN and its Air-City as well as Songdo IBD and the IFEZ.

During our trip to the Incheon Aerotropolis in October and November 2019, Michael Chen (my research associate and coauthor of this case) and I visited a series of sites at ICN, Air-City, Songdo IBD, and the IFEZ to collect additional information. Throughout 2020, we communicated with ICN officials, Stan Gale, and researchers at the Incheon Institute (the Incheon government's think tank for economic development) to update the information reported herein. Michael Chen further conducted a literature review of scholarly and media reports on various components of the Incheon Aerotropolis, much of which is incorporated into the case.

This research report reflects the cumulation of our work, but more importantly, it is a testament to the accomplishments of the developers of four primary components of the Incheon Aerotropolis: ICN, Air-City, the IFEZ, and Songdo IBD. We elaborate each and draw lessons for planning and development of other airports, airport cities, and aerotropolises around the world.

## **Incheon International Airport**

ICN is expansive, covering 5,840 hectares. It opened in March 2001 on Yeongjong Island in the municipality of Incheon 70 km southwest of Seoul. The new airport replaced Gimpo International Airport as South Korea's main international airport. Closer to downtown Seoul than ICN, Gimpo now primarily serves domestic flights.

ICN has been planned, built, and managed by the Incheon International Airport Corporation (IIAC). IIAC was inaugurated on February 1, 1999 as a state-owned corporatized entity operating as an independent public authority under the Incheon International Airport Corporate Law that enabled it to flexibly function like a private-sector enterprise. Its overarching mission was to make ICN the world's premier international airport while contributing to South Korea's

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<sup>1</sup> Kasarda, J.D. & Lindsay, G. (2011). *Aerotropolis: The way we'll live next*. New York: Farrar, Straus and Giroux.

competitiveness and economic growth. IIAC adopted five strategies to accomplish its mission, each supported by associated objectives:

- 1 Establish airport-based commercial and logistics zones (i.e., an airport city).
  - Develop international business centers and a Free Trade Zone.
  - Construct integrated resorts and other attractions to draw affluent international tourists.
- 2 Secure and advance ICN's position as the leading aeronautical hub of Northeast Asia.
  - Boost ICN's airline connectivity and air traffic demand (both passenger and cargo).
  - Improve surface transportation access between the airport and key outlying areas.
- 3 Enhance the passenger experience.
  - Offer differentiated passenger services centered on convenience, speed, and value.
  - Provide sophisticated terminal retail, leisure, and cultural venues.
- 4 Construct, manage, and operate ICN with optimal efficiency.
  - Continuously upgrade airport technology, facilities, and infrastructure.
  - Maintain state-of-the-art facility management systems and airport operations.
- 5 Realize a low-carbon, ecofriendly engine for the Incheon-region economy.
  - Ensure sustainable growth through innovation.
  - Create social value through inclusive business practices and community outreach.

IIAC's concrete actions to achieve these strategic objectives are a) vigorously recruiting new airlines to expand ICN's route network; b) constructing cutting-edge aeronautical infrastructure and facilities (four phases to be built out by 2030); c) developing Air-City's terminal commercial and leisure functions, Free Trade Zone, and three substantial on-airport business centers; and d) contributing to and capitalizing on the advantages of the entire Incheon Aerotropolis, in particular the Incheon Free Economic Zone (IFEZ).

These actions helped advance ICN's air traffic to 71.2 million passengers and 2.76 million tonnes of cargo in 2019 (carried on 88 airlines serving 173 cities in 53 countries that year). In so doing, ICN cemented its premier airport hub status and worldwide prestige with record consecutive wins of awards for customer

satisfaction and airport operations. For example, in 2015, ICN won Best Airport in the World by *Global Traveler* magazine for the eleventh year consecutively (alongside 32 other awards that year). In Airports Council International's 2017 Airport Service Quality awards, ICN ranked as the world's best airport in customer experience for an unprecedented twelve years in a row. 2018 was the airport's sixth consecutive win as Best Airport in the *Travel Trade Gazette's* Travel Service Awards.

IIAC's actions have likewise been pivotal to the airport's impressive record of profitability; ICN registered a net profit of US\$726 million in 2019 – its seventeenth consecutive year of profitability. This winning streak was broken by the collapse of international aviation beginning in February 2020 caused by the Coronavirus pandemic. As a result, IIAC recorded a loss of US\$384.9 million in 2020 as ICN's passenger numbers shrunk by roughly 80% compared to 2019.

The dedication of IIAC to full air traffic recovery and airport profitability bolstered the airport's resilience. By the fourth quarter of 2020, ICN's air cargo volumes had rebounded to the previous year's monthly levels. Given the ubiquity and intensity of the pandemic and its effects on international business and leisure travel, ICN's passenger volumes are not expected to completely recover until 2022 at the earliest. Nevertheless, despite modest construction slowdowns in 2020, airport infrastructure and commercial development projects are proceeding much as planned since IIAC considers these crucial to actualize ICN's commercial opportunities that will further enhance passenger experiences and airport profit while meeting forecasted long-term passenger and cargo growth demands.

## ***ICN Infrastructure and Facilities***

ICN's infrastructure and facilities have routinely expanded and improved to keep ahead of its rapidly growing air traffic demands. So too have its internal operations and smart airport technologies for fast and convenient passenger arrivals and departures. The initial-phase development, including Terminal 1 and two runways supporting 30 million passengers along with a cargo complex, concluded with the airport's opening in March 2001 at a cost of US\$4.8 billion.

A little over a year after opening, a US\$2.6 billion second phase of construction commenced in May 2002 on 956.8 hectares and was completed 6

years later in June 2008. Second-phase construction updated Terminal 1 with new technologies and added a 30-gate, 166,000-square-meter midfield concourse (Concourse A) along with a modern control tower and apron renovations. Other improvements included a 4,000-meter third runway (completed between 2005 and 2007). ICN's second-phase improvements expanded capacity to 54 million passengers per annum in mid-2008.

Design and planning for the third phase began in June 2009 to address growing air traffic demand and improve the airport's competitiveness as a premier international gateway. The third phase was completed on 110 hectares in January 2018 with a total investment of US\$3.9 billion raising ICN's annual passenger capacity to 87 million. The main component of Phase 3 construction was ICN's 38.8-hectare second passenger terminal. Terminal 2 broke ground in September 2013 and opened with an initial investment of US\$2.5 billion in January 2018, marking the end of the third phase.

Terminal 2's classic Korean design elements establish a tangible sense of place. Its wing-like architecture drew inspiration from the Bonghwang (a chimeric bird of East Asian mythology) while the flooring was built with locally quarried granite and traditional Korean woods. Passengers may visit sixteen sculpture and art exhibition centers, relax in spacious indoor gardens, or enjoy aviaries and koi ponds – all of which add to airport tranquility and placemaking. In 2019, IAC allocated an additional US\$34.1 million for expansion works to Terminal 2 scheduled for completion in 2022.

Other third-phase additions included a 5-star hotel and conference center, 11.2 km of new access roads, and expansion of ICN's logistics parks. At a cost of US\$220 million, an 18.4-hectare multimodal transportation center connected to Terminal 2 was finished in October 2017 and is complemented by the airside Intra Airport Transit underground automated people mover linking Terminal 1 with Terminal 2. During Phase 3, ICN also became a leader in smart airport technologies as well as the first airport in the Asia Pacific to earn ISO 20000 certification for its information technology service management system.

Planning for the fourth phase of airport expansion began in May 2017 as the third phase was ending. The fourth phase includes a fourth runway as well as new aprons and a 124-hectare maintenance, repair, and overhaul complex as an extension of ICN's Free Trade Zone. Two wings (each with an enclosed outdoor garden park at the far end) will be added to Terminal 2 to complete its H-shaped

**Exhibit 1: AIRSTAR Robotic Assistant at ICN's Terminal 1**

*Credit: Yonhap News Agency*

design incorporating enriched passenger amenities and leading-edge smart airport technologies to speed terminal passenger flows. Airport access roads will be further upgraded as will long-term parking facilities. The groundbreaking ceremony for these improvements took place in November 2019 and are slated for completion by December 2024 with US\$4.4 billion to be invested.

An important lesson for airport development elsewhere is ICN's emphasis on passenger services and amenities. ICN differentiates itself from many other airport hubs competing to attract passengers in three ways: 1) seamless integration of smart airport technologies, 2) superior shopping, and 3) cultural and leisure amenities that contribute to its passengers' experience as well as a sense of place.

IIAC's Smart Airport Plan accelerates passenger flows through technology-driven operational innovations. For departing passengers, biometric authentication eliminates the need for multiple passport verifications. Computer vision algorithms reduce security processing time for X-ray scans while improving security. ICN's self-service bag drop stations automatically measure

**Exhibit 2: ICN Terminal Retail**

Credit: Michael Chen

luggage weight and dimensions and can deliver baggage directly to passenger aircraft while self-driving indoor vehicles enhance personal mobility and wayfinding. Travelers can also ask ICN's team of more than a dozen "AIRSTAR" robotic assistants (Exhibit 1) for directions. Powered by artificial intelligence, AIRSTAR robots can speak four languages (Chinese, English, Japanese, and Korean) while visualizing fourteen human emotions and are equipped with touchscreen monitors, embedded microphones, cameras and barcode scanners, touch-free hand sanitizer spray dispensers, and thermal imaging sensors for temperature checks. A separate fleet of autonomous cleaning robots enforce higher standards of airport cleanliness. The Smart Airport Plan further implements smart airport technologies for smarter and safer parking management and air traffic control systems.

ICN's retail offerings (see Exhibit 2) – especially its high-end duty-free outlets catering to affluent Chinese visitors – also improve passenger experience while substantially increasing non-aeronautical (commercial) revenues. ICN officials noted that Terminal 1's Louis Vuitton shop sold over US\$100 million of luxury goods in 2019 alone, mostly to Chinese retail tourists who fly to ICN just for the upscale shopping experience. Terminal 1 also contains the 2,800-square-meter Airstar Avenue praised by *Business Traveller* magazine as the World's Best

### Exhibit 3: ICN Terminal Cultural Experiences



Credit: Michael Chen

Duty-Free Shop for four consecutive years. *Business Traveller* Asia-Pacific further extolled ICN as the world's best place for duty-free shopping for the ninth year in a row in September 2019. That year, ninety duty-free stores offered more than 700 store brands to post US\$2.4 billion in sales, ranking ICN first in the world in duty-free sales (a position it has held since 2016).

Placemaking experiences and amenities include Korean Traditional Culture Centers (see Exhibit 3) that offer hands-on arts and crafts activities, welcoming about 440,000 visitors annually. Amongst other airport cultural experience areas, ICN's Museum of Korean Culture contains artifacts recognized by the UNESCO World Heritage Centre. In addition, the Haneul (Sky) Garden outside Terminal 1 features a panorama of seasonal Korean flowers (visible during descent on some flights) complemented by seven indoor gardens: the Cactus,

Flower, Flowering Tree, Four Gracious Plants, Pine Tree, Rock, and Water Gardens. Other terminal amenities include free showers, two movie theaters, five pharmacies, and even an ice-skating rink in the transportation center. ICN's 24/7 luxury Spa on Air offers traditional Korean body scrubs, a sauna, and massages along with private sleeping rooms. In efforts to boost medical tourism, a 250-square-meter cosmetic surgery center was also planned, but although a tender for service providers was issued in September 2017, this project was terminated in 2019 amid controversy from Korean medical associations.

As noted, to stay ahead of and leverage long-term upward trends in aviation, ICN strategically builds in advance of forecasted demand. Thus, based on projected air traffic, a fifth phase will add a fifth runway and third passenger terminal (78,000 m<sup>2</sup>), increasing ICN's capacity to 130 million passengers per annum. ICN proactively develops its commercial and logistics facilities based on forecasted demand as well. Exhibit 4 provides an aerial overview of ICN's aeronautical infrastructure and facilities. This exhibit also shows the airport's existing and planned commercial and logistics facilities, which we discuss in the section on Air-City.

### Exhibit 4: Aerial Overview of ICN Infrastructure and Facilities



Credit: Incheon International Airport Corporation

## *Environmental Issues and Corporate Social Responsibility*

The airport has not been without critics. For example, its environmental critics point to the significant destruction of buffer ecosystems and tidal flats during land reclamation as well as fluorine pollution caused by Terminal 2 construction. Notwithstanding, after Terminal 2 opened in 2018, it achieved Green Standard for Energy and Environmental Design Grade 1 (the highest rating possible) from the Korean Green Building Council's certification system, earning perfect scores in the materials, resources, and maintenance categories. Other international standards achieved include Level 3 certification by Airport Council International's Airport Carbon Accreditation system, the Carbon Trust Standard, ISO 50001 certification for its energy management system, and ISO 14001 certification for its environmental management system. In fact, IAC and ICN have received numerous awards for its green practices from institutions such as *Asia Cargo News*, the Green Logistics Research Association, and the Green Organisation (amongst others).

Similarly, in the Korean Standards Association's annual ISO 26000 Performance Assessment of IAC's corporate social responsibility (CSR), the airport scored 93 out of 100 possible points in this category for 2019, with special credit given for its community engagement and social value creation efforts. In addition to providing over 70,000 jobs on airport property, ICN also gives back to the local community by providing financial support and training for small aviation-related businesses (selected through competition). Other community outreach initiatives include IAC-sponsored scholarships for low-income students and local festivals organized by IAC that celebrate environmentally friendly practices; IAC also planted Sky Garden's 3.6 hectares of flowers near ICN for public enjoyment. Furthermore, IAC consults government leaders of outlying areas to ensure that the airport is a good neighbor while striving to incorporate CSR into all its business practices. In addition to operating daycare centers for its employees, IAC regularly implements employee training and education programs to promote ethical management, human rights protection, and diverse and equitable talent recruitment.

## **Air-City**

ICN's airport city, branded "Air-City" by IIAC, establishes the world's highest standard for airport-property commercial real estate development. It hosts a plethora of Grade-A office buildings, upscale retail and dining venues, 4-star and 5-star hotels, conference and exhibition centers, luxurious integrated resorts, health and wellness complexes, championship golf courses, and other recreation areas as well as logistics parks located in the airport's Free Trade Zone that contain cold-chain, e-commerce, and light manufacturing facilities. Air-City's commercial facilities not only generate substantial non-aeronautical revenue for IIAC but also make the airport a more attractive destination for business travelers, retail tourists, and affluent leisure travelers. Moreover, its modern cargo and logistics facilities within its Free Trade Zone contribute to the airport's position as a leading cargo hub (ranking it third worldwide in international cargo volume in 2019) while improving the supply chain efficiencies of industries throughout the Incheon Free Economic Zone and beyond. In 2019, 53.7% of IIAC's revenue was generated by airport commercial and logistics activities (equivalent to 80% of non-aeronautical revenue that year). The vast majority of non-aeronautical revenue originated from Air-City's International Business Centres, its airport Free Trade Zone, and leisure and recreation complexes along with terminal retail discussed above.

Before elaborating the primary commercial components of Air-City, let us point out that some of its developments (especially International Business Centres 1 and 3) were enabled by large greenfield tracts of ancillary land within ICN's substantial landmass (5,840 hectares). Therefore, the same scale of commercial development may be infeasible for airports with limited land for non-aeronautical facilities. Such development may nonetheless be appropriate for areas outside the airport fence that are readily accessible to those airports.

### ***International Business Centre 1 (IBC-1)***

ICN's International Business Centre 1 (IBC-1) was designed to reinforce air traffic demand, boost airport commercial revenues, and improve the operational efficiencies of businesses throughout the broader Incheon Aerotropolis. Located in the southeast portion of the airport as illustrated in Exhibit 5, this business center is quickly connected to Terminal 1 by a Maglev train.

### Exhibit 5: International Business Centre 1 (IBC-I) at Incheon International Airport



*Credit: Incheon International Airport Corporation*

IBC-I's 16.5-hectare first phase of development began in 1999 during ICN's initial construction. It was completed in 2014 at a project cost of US\$1.2 billion with private-sector investors operating commercial facilities after construction under concessions lasting up to 50 years. Developments completed in IBC-I Phase 1 included 4-star and 5-star hotels, the 64,700-square-meter Airport Royal Plaza (a 12-story retail and entertainment complex), and four "officetel" (mixed-use office/residential) complexes: World Gate (34,000 m<sup>2</sup>), Sky World (25,400 m<sup>2</sup>), LG Eclat (35,600 m<sup>2</sup>), and D. O. Ville (39,700 m<sup>2</sup>). Completed between 2002 and 2004, these four buildings house 114 retail shops on the ground floors as well as 1,930 officetel suites used primarily by aviation-oriented businesses and their employees.

The 1.2-hectare Inha International Medical Center (owned by Korean Air) was also completed during IBC-I Phase 1 and has been instrumental in attracting medical tourists. The 20,900-square-meter facility offers a diverse array of in-transit medical services including acupuncture, checkups, dental services, mammograms, Botox injections, spa treatments, and even brain MRIs. Since it

caters to foreign travelers, the medical center is additionally staffed with professional interpreters. Outpatients fresh from surgery may choose to recover at over a dozen hotels in IBC-I or elsewhere at ICN.

Along with serving airport visitors and transit passengers, hotels in IBC-I host conventions, exhibitions, trade shows, and business meetings as well as entertainment and foreigner-only gaming venues. For instance, the 5-star Grand Hyatt Incheon was named Best Hotel for Meetings, Incentives, Conferences, and Exhibitions (MICE) in 2014 and 2016 by *Global Traveler* and similarly named the top MICE hotel in Incheon by the Incheon Tourism Organization in 2018. 147,000 m<sup>2</sup> of hotel facilities include 26 event spaces totaling 4,600 m<sup>2</sup>, two ballrooms, outdoor theaters, eight award-winning restaurants, and a 24-hour foreigner-only casino along with 1,022 business-class guest rooms and luxury suites. Routinely acclaimed as one of South Korea's top luxury hotels, it won *Global Traveler's* Best Airport Hotel Award for three consecutive years from 2012 to 2014 and again in 2016. The hotel's west tower, which opened in 2014 (adding 500 rooms linked via covered Sky Bridge to the east tower's previously constructed 522 rooms), is LEED-certified at the Gold level.

### **Paradise City Integrated Resort**

IBC-I's second phase of construction ushered in South Korea's first casino integrated resort – a complex designed for both business and leisure tourism showcasing various amenities such as performance halls, convention and exhibition facilities, hotels, gaming venues for foreigners, fine restaurants, upscale shopping, nightclubs, and an indoor theme park. A joint venture between Tokyo-based Sega Sammy Group (45%) and South Korea's Paradise Group (55%) established Paradise Segasammy Co. to launch the development of the 5-star Paradise City Resort complex in 2012. The Paradise City project established ICN within the Yeongjong Integrated Resort Cluster (also comprised of the Inspire and Caesars resort complexes, discussed later) to generate premium-fare aviation demand and attract affluent tourists.

### **Exhibit 6: Paradise City Integrated Resort at Air-City's International Business Centre 1**



*Credit: Small Luxury Hotels of the World*

While Paradise City's first phase focused on the hotel, casino, and convention space, the second phase (operational since September 2018) introduced the Chroma nightclub, Art Paradiso (a 103-room boutique hotel), the WonderBox indoor theme park, the 1.3-hectare CIMER spa with capacity for 2,000 simultaneous patrons (modeled after Venice's Piazza San Marco), an art museum (plus 3,000 pieces of original art on exhibit throughout the complex), restaurants, kids' play zones, a bowling alley, a duty-free shopping plaza, and more. After the second phase finished in March 2019, groundbreaking took place a month later for an 18-hole golf course scheduled to open in 2021 adjacent to the Paradise City Resort (Exhibit 6) at the southern end of ICN's third runway. Buildout is expected by 2022 with more than 278,700 m<sup>2</sup> of floor space. Total investment for the entire Paradise City project is estimated to surpass US\$1.4 billion.

### ***International Business Centre 2 (IBC-II)***

International Business Centre 2 (IBC-II) serves as the commercial support zone for Terminal 2 with developments geared towards airport employees, flight crews, and long-term guests. Of ICN's International Business Centres, it is the

smallest in land area at 16.1 hectares. Facilities built or planned in IBC-II include four hotels occupying 5.2 hectares with 1,588 rooms and floor space of 108,900 m<sup>2</sup>, four office buildings occupying 1.8 hectares with 1,293 units and 29,400 m<sup>2</sup> in floor area, and three residential/extended stay facilities on 2.5 hectares with 1,257 rooms and 51,700 m<sup>2</sup> of floor area, all with retail on the lower levels. 6.6 hectares of public-use green space and pedestrian walkways are planned as well.

### *International Business Centre 3 (IBC-III)*

International Business Centre 3 (IBC-III) is on the west side of the airport within 10 minutes of passenger terminals and is expected to be operational in 2022. As one of Air-City's premier development projects, IBC-III has attracted an overall investment of US\$6 billion, mostly foreign derived. Together, IBC-III's 327 hectares and the adjoining 150-hectare North Water Basin district total 478 hectares in land area. In addition to the international business area (occupied mainly by aviation-oriented private-sector firms), its leisure and entertainment venues are comprised of theme parks, hotels, convention centers, shopping, and casinos primarily targeted at tourists from China and Japan.

### **Inspire Integrated Resort**

The mainstay of IBC-III (and a key component of the Yeongjong Integrated Resort Cluster) is the Inspire Integrated Resort. Project Inspire is planned for phased development in accordance with demand. IIAC, KCC Corporation (a Korean conglomerate), and US-based Mohegan Gaming & Entertainment (renamed from Mohegan Tribal Gaming Authority in June 2017) jointly agreed in 2016 to design, build, and operate the integrated casino/hotel/entertainment complex, although Mohegan Gaming & Entertainment (a Native American-owned corporation that accumulated billions of US dollars through government-granted casino rights) obtained 100% ownership in May 2018. IIAC agreed to lease operation of the integrated resort to Inspire Integrated Resort Co., Ltd. (controlled by Mohegan) for 50 years.

### Exhibit 7: Rendering of the Inspire Integrated Resort at Air-City's International Business Centre 3



*Credit: Pulse News*

The Inspire Integrated Resort will offer a multitude of shopping, dining, and entertainment venues providing more than 300,000 m<sup>2</sup> of entertainment and gaming space including 22,000 m<sup>2</sup> of foreigner-only casino floor space with 150 gaming tables and 700 slot machines catering to affluent international visitors. A multitower luxury complex housing several hotels of various sizes is planned for an eventual total of 11,300 rooms including 1,256 rooms in 5-star hotels. 9,000 m<sup>2</sup> of dining (40+ options), entertainment, and shopping options are also planned with 18,500 m<sup>2</sup> of retail space (offering more than sixty global luxury brands) along with traditional Korean and Native American cultural experience venues and a 4,500-square-meter K-beauty complex. Exhibit 7 provides a rendering of the Inspire Integrated Resort under construction.

A 40.4-hectare, US\$140 million Paramount Studios indoor-outdoor theme park with integrated dining and retail is scheduled for opening at IBC-III in 2025, featuring a K-pop entertainment zone as well as themed attractions derived from its studio productions such as “The Italian Job”, “Mission Impossible”, “Star Trek”, and “Tomb Raider”. The Paramount theme park will be complemented by a hemispherical domed indoor water park with 4,500 m<sup>2</sup> of climate-controlled

pool space as well as the 33,000-square-meter Eco Adventure Park featuring indoor rock climbing, an indoor rainforest, and an archaeology experience.

A US\$320 million indoor entertainment arena with capacity for 15,000 audience members was planned to complement 19,000 m<sup>2</sup> of convention space (including a 11,000-square-meter ballroom). Other planned leisure and tourist attractions include an experiential aquarium, marinas, beaches, wedding chapels, theaters, shopping malls, and an outdoor garden theater. Interestingly, the Inspire Integrated Resort would be the first destination resort in the world to have its own private business jet terminal dedicated to the resort, costing approximately US\$35 million. To achieve LEED certification, geothermal and tidal power would be implemented for renewable energy generation and at least 30% of the project site is planned as greenspace.

The first phase of construction is divided into two subphases. The consortium allocated US\$1.3 billion for the initial subphase of construction consisting of 348,000 m<sup>2</sup> of facilities on 50.7 hectares; groundbreaking took place in June 2019 and completion of the initial subphase is set for 2022. Total investment for the next subphase is set at US\$1.1 billion with completion anticipated by 2025. A total investment of US\$5 billion is projected for the development of the entire Inspire site area of 437 hectares with buildout anticipated by 2031.

## *South Water Basin*

The South Water Basin area is located at the southern tip of the airport. Developed in two phases, it serves as a water sports and leisure center. The 9.7-hectare first phase was completed in 2011 with an investment of US\$21.9 million, including a 23,000-square-meter powerboat racing center. Operated by the Korea Sports Promotion Foundation, the center has hosted international water sports events but now primarily serves as a water racing training facility. The second phase, which broke ground in 2013 and was finished in September 2014, added 5.4 hectares to the southwest of the first phase area for a total of 15.1 hectares.

Supplemented by nearby retail and dining, the main addition of the second development phase is the 368-room, 4.5-star Nest hotel showcasing nature-inspired modernist design. Providing total capacity for 1,000 occupants, meeting spaces include garden areas and two banquet halls. Along with standard

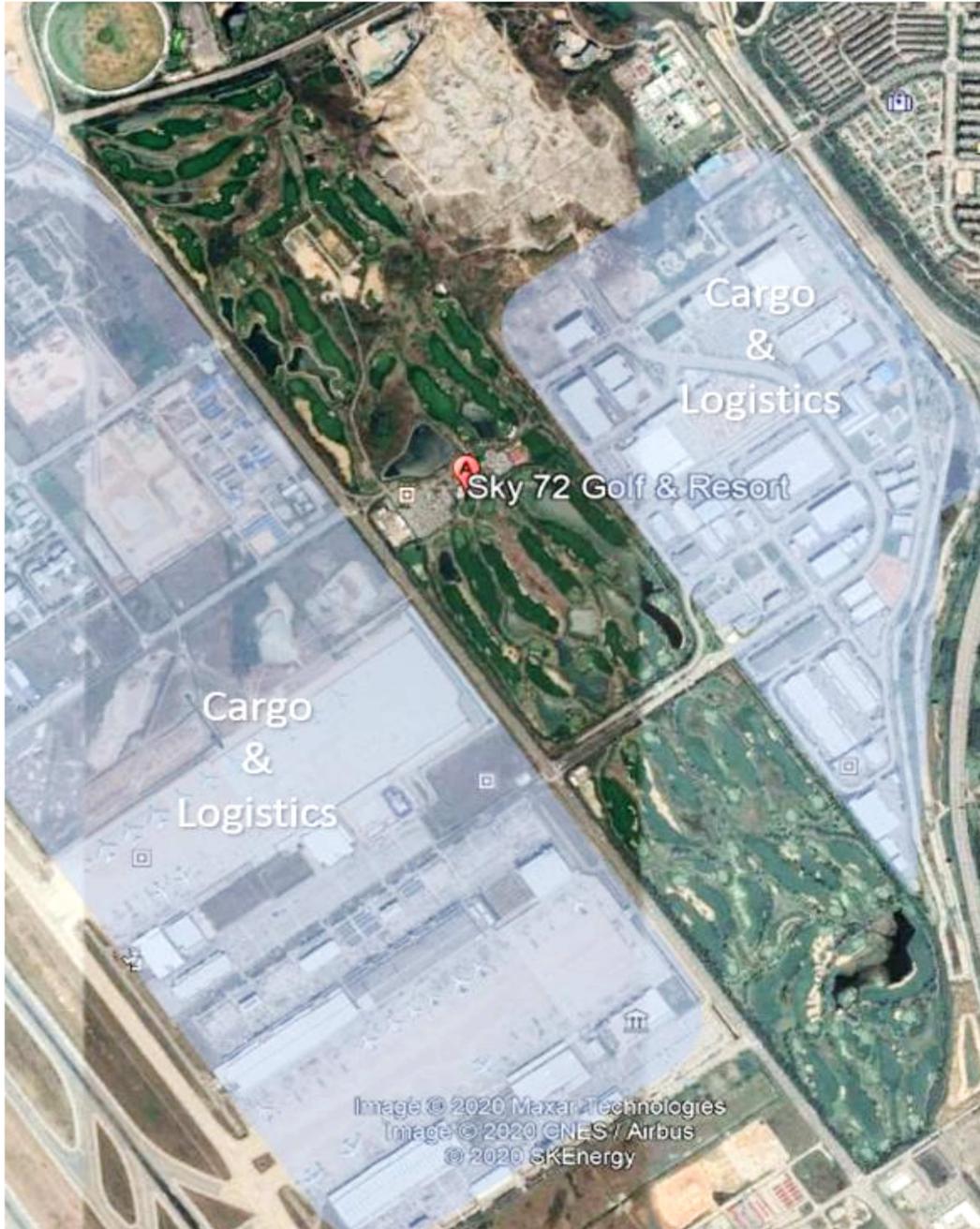
equipment like exercise machines and weights, the Nest's fitness center is uniquely outfitted with a sparring center complete with punching bags and gloves. This boutique hotel is further differentiated by special features like its library café, mini-theater, outdoor heated infinity pool, and an open-air spa and sauna as well as scenic footpaths and facilities for "glamping" (glamorous camping). Such facility differentiation helps attract tourists seeking distinctive stopover or destination experiences.

## ***SKY72 Golf Club***

SKY72's golf courses further differentiate ICN leisure offerings and serve as an important land bank for the airport's future aeronautical needs. As shown in Exhibit 8, the golf courses, located between ICN's cargo and logistics areas, are being reserved for ICN's fifth runway when needed.

These courses, which opened throughout 2005, have hosted numerous international tournaments since then. SKY72 is a premier golf club spanning 400 hectares with 69,300 m<sup>2</sup> of facilities and four 18-hole courses (72 holes): the Hanul, Ocean, Lake, and Classic courses. The Bada Ocean Course (opened in October 2005) was designed by American golfing icon Jack Nicklaus while the Hanul course (opened in July 2005) was named Best Course in South Korea in the 2018 Asian Golf Awards. SKY72's Dream Golf Range debuted with 300 individual driving bays; the circular driving range (planted with Kentucky bluegrass) is 400 yards (370 m) in diameter and was the world's largest driving range upon opening in September 2005. Other amenities include 36 putting holes, restaurants, a guest business center, a pro golf retail shop, 1,000 guest golf lockers, shower rooms, and two clubhouses.

### Exhibit 8: SKY72 Golf Courses and Resort between ICN's Cargo/Logistics Areas



Credit: Google Earth

### *BMW Driving Center*

The BMW Driving Center opened in 2014 at the airport's eastern corner with investment of US\$75.5 million. Along with a service center, bars and restaurants, a training academy (including a Kids' Driving School), and automobile

showrooms, the 236,000-square-meter facility offers test drives of performance vehicles in its 2.6-kilometer closed-circuit racetrack. The BMW Driving Center also provides an ecofriendly park with facilities for outdoor recreation and cultural events that was completed in 2019.

## *Fashion Island*

As has been the case with numerous airport city and aerotropolis developments around the world, not all projects succeed as planned. The proposed Fashion Island project south of Terminal 1 was originally slated to debut in 2011. Fashion Island was to be developed through a partnership between IIAC and the French fashion federation (La Fédération de la Haute Couture et de la Mode). It was envisioned as a fashion mecca composed of a trade and convention center for clothing and accessories, a fashion academy, hotels, a shopping complex, luxury outlets, restaurants, cinemas, and a water park, garnering investment estimated between US\$1 billion and US\$3 billion. Four separate leisure villages were planned, each themed to one of the four seasons. Universal Studios also had announced plans to develop a US\$2 billion amusement park nearby. However, the Fashion Island project was canceled in 2010 when consensus could not be reached among IIAC, the French fashion federation, and other investors; so too was the adjoining Universal Studios project. This area has since been subsumed into IBC-I.

## *ICN Free Trade Zone*

Air-City's 338-hectare Free Trade Zone officially opened in September 2006. It is composed of two main sections divided by SKY72's golf courses. The Airport LogisPark, an international logistics and manufacturing complex, is located on the northeastern side while the cargo terminal area is located on the southwestern side as are future Airport LogisPark facilities. Exhibit 9 shows ICN's Free Trade Zone including the Airport LogisPark Phases 1, 2, and 3 and the cargo terminal area.

### Exhibit 9: ICN's Free Trade Zone Including LogisPark and Cargo Terminal Area



*Credit: Incheon International Airport Corporation*

The cargo terminal area spans 113.6 hectares. Companies with operations in the Free Trade Zone's six cargo terminals include Asiana Airlines, Atlas Air, DHL, FedEx, Korean Air, Polar Air, and UPS, amongst others. In addition to a 3.4-hectare international express mail center and a 2,000-square-meter US military mail center, these facilities cover 26.2 hectares and provide 328,700 m<sup>2</sup> of floor space.

The Free Trade Zone's LogisPark, which also commenced operation 2006, covers 99.2 hectares of facilities offering 482,400 m<sup>2</sup> of leasable space. When completed in February 2013, a second phase added 65.1 hectares and 443,200 m<sup>2</sup> of leasable space used primarily for manufacturing where promoted qualifying firms will enjoy complimentary use into the 2020s. The first two phases cost

US\$154 million and the third phase of the LogisPark's expansion is scheduled to add 32.6 hectares for a total of 197 hectares. Third-phase facilities are planned for small-and-medium-sized enterprises in express delivery and global logistics centers, including an e-commerce distribution center and specialized cool-chain facilities for high-value perishables. An average business occupancy rate of over 90% was attained by 2019 with 300 companies operating in the Airport LogisPark that year.

The airport's Free Trade Zone was instrumental in establishing ICN as the leading air logistics hub of Northeast Asia as well as the regional leader in air cargo volume. To increase airport non-aeronautical revenues while attracting firms in air logistics-oriented industries that augment ICN's air cargo, Air-City grants a host of tax and tariff benefits to companies operating within its Free Trade Zone along with various incentives to entice investment. Land rent is reduced by 50–100% for manufacturing and logistics companies that make qualifying investments while tariffs on the import and reexport of foreign goods are waived as well as taxes on manufacturing-related raw materials and machinery. These benefits are further reinforced by additional reductions and exemptions of business and income taxes conferred by the broader Incheon Free Economic Zone (discussed later) for companies in targeted industrial sectors.

## **The Incheon Free Economic Zone and Greater Aerotropolis**

After a period of rapid economic growth from the 1960s through the 1980s as one of the Asian Tiger Economies, South Korea's GDP growth rate slowed in the 1990s. The national economy took a major hit during the 1997–1998 Asian financial crisis. In exchange for a US\$58 billion bailout loan, the International Monetary Fund pressured South Korea to liberalize international trade policies, reform the domestic labor market, and restructure corporate governance of major conglomerates (chaebol). In response, South Korea adopted a more market-oriented investment model and export-focused trade strategy, which allowed the nation to repay its loans in August 2001 (nearly three years ahead of schedule) and spurred the growth of its high-tech electronic industries. As a result, South Korea emerged as a global leader in exports of smartphones, liquid crystal display devices, and other advanced electronics devices – high-value/low-weight goods

that are exported predominantly by air. ICN and later the encompassing Incheon Free Economic Zone (IFEZ) played vital roles in this high-tech electronics export strategy.

The IFEZ was established in 2003 (along with its governing body, the IFEZ Authority). With a landmass of 182.4 km<sup>2</sup>, the IFEZ contains the bulk of significant commercial development in the 1,061.9-square-kilometer Incheon municipality that can be treated as a proxy for the broader Incheon Aerotropolis. As shown in Exhibit 10, the IFEZ is composed of three main districts linked by expressway bridges: Yeongjong (where the airport is), Cheongna, and Songdo. Respectively, they serve as the greater Incheon Aerotropolis's hubs for foreign tourism and air logistics, international finance and high-tech R&D, and global business as well as information technology and biotechnology. The last of these contains Songdo International Business District (Songdo IBD), the IFEZ's global business center, which complements Air-City as the Incheon Aerotropolis's second growth pole.

**Exhibit 10: Incheon Aerotropolis and Incheon Free Economic Zone (in Color)**



*Credit: Incheon International Airport Corporation*

The economic advantages of the IFEZ together with its airport proximity attract aviation-oriented firms to the Incheon Aerotropolis that contribute to ICN's passenger and cargo volumes. Air-City's leisure and convention complexes generate tourism demand and non-aeronautical revenue while efficient airport-linked surface transportation infrastructure expands the airport catchment area, thereby reinforcing the air passenger market, which attracts airlines that increase ICN's route connectivity and belly cargo volumes. The IFEZ was initially scheduled for buildout in 2022 (with allowances for extension) with a planned population of about half a million; in 2019, approximately 340,000 were living in the IFEZ.

The IFEZ was originally promoted as a "Pentaport" – a combined airport, business port, seaport, teleport, and leisure port. Although the IFEZ Authority later shifted to a "tri-port" strategy emphasizing the airport, seaport, and teleport, Songdo's Pentaport Park and its annual Pentaport Rock Festival reflect the previous strategy. These strategies increase aviation demand and local revenues by attracting global business investment, boosting tourism, facilitating an advanced manufacturing and R&D base for high-tech industries, and leveraging ICN and Incheon's ports to improve supply chain efficiencies for the Incheon Aerotropolis and the nation. The strategic goals of the IFEZ Authority are as follows:

- Foster a combined sea-and-air logistics cluster with affiliated hinterland support complexes.
- Vitalize tourism and business attraction resources, including expanding cultural facilities and the meeting, incentive, conference, and exhibition industry.
- Construct shopping malls, hotels, recreation, and leisure venues to complement business investment and draw visitors.
- Attract regional headquarters of international corporations.
- Recruit firms in the information technology, financial services, and logistics sectors.
- Facilitate new-generation industry clusters such as autonomous vehicles, biotechnology, and robotics.

- Cultivate and construct a comprehensive producer services sector to bolster innovative manufacturing and R&D.
- Establish a medical hub by developing international hospitals and other medical organizations equipped with world-class clinical research and medical service facilities to attract overseas patients.
- Create an education hub by recruiting leading institutions of higher education to help meet the talent needs of targeted industries.
- Generate academic-industrial synergies to catalyze innovation and induce foreign investment.

In pursuit of its goals and to balance the national economy's high dependence on manufacturing and exports, the IFEZ Authority promotes service sectors such as entertainment, healthcare, tourism, and education. The IFEZ Authority also provides other incentives such as deregulation of land use policies – for example, rent and property fee reductions for up to 50 years on public land – to accelerate inward investment to the Zone. The IFEZ Authority further offers administrative support such as financial or ombudsman services to make it easy to do business in the IFEZ. Similarly, national and local taxes are substantially reduced or eliminated for targeted businesses, ranging from 50% to 100% reductions for 3 to 15 years depending on industry and investment amount, whereas IFEZ tenant firms importing capital goods are exempted of tariffs for up to 5 years.

Within the first decade from opening (excluding Songdo IBD), the IFEZ had attracted over US\$3.6 billion of foreign direct investment (FDI). By 2014, 1,000 business were active in the Zone, 72 of which were funded by foreign investment and by the end of 2017, foreign-owned firms supported 29.5% of jobs in the IFEZ (23,839 out of 80,724 total). An added US\$1.3 billion raised cumulative FDI to US\$12 billion in 2018. By 2027, the IFEZ Authority hopes to attract additional investment of US\$71.5 billion from both domestic and foreign firms while creating 270,000 jobs.

## *Smart City Applications*

The IFEZ possesses superb digital connectivity. Construction of smart city infrastructure for the IFEZ began as early as 2003 with many new technologies implemented over the years following. The primary project partner for the IFEZ's

smart-city technologies was Cisco, who outlined a multiyear, US\$2 billion commitment in 2009 to develop its South Korean operations. Other smart city partners (e.g., 3M Worldwide, the DQ Institute, GE, LG, Microsoft, and United Technologies) have been involved and new partners and initiatives are routinely announced. For instance, SK Telecom signed a memorandum of understanding with the IFEZ Authority in April 2019 to leverage fifth-generation (5G) cellular networks and real-time road observation data from advanced driver assistance systems to develop 5G infrastructure for Level 4 self-driving cars. All these multinational companies are also contributing in one way or another to smart city development in the IFEZ.

Although there are various specific definitions, the term “smart city” generally refers to an urban complex with a ubiquitous computing environment that freely connects networks regardless of specific location. The Internet of Things is built directly into everything. Computers and network access are purposefully embedded into all aspects of urban functions, facilitating the convergence of major government, business, and institutional information systems – including telecommunication, transportation, business and finance, utilities, health and medical services, real estate, education, etc. Smart city technologies enable an amazing variety of uses. While in different stages of implementation throughout the IFEZ, the supporting technologies are all in place with most already active in Songdo IBD.

With a complex wide-area network enveloping the entirety of the IFEZ, resident’s lives are technologically integrated. For example, home functions can be controlled remotely. A kettle left on the stovetop could be addressed with a tap of a screen. Many residents unlock their front doors with a fingerprint reader on the handle and can re-lock them with their phones. In addition to enabling facetime with distant friends and family, telepresence technologies provide access to over twenty remote learning courses with face-to-face instruction as well as remote medical checkups and health consults via telemedicine; between 2011 and 2018, 10,000 teleconferencing units were estimated to have been installed in Songdo IBD alone. Moreover, radio frequency identification (RFID) chips (embeddable in devices, accessories, vehicles, or even clothing) can make quotidian transactions – checking out a library book, riding a bus or subway, renting a movie, paying for lunch, or clocking in for work – as easy as swiping a smartcard on a scanner.

The IFEZ's armada of sensors has been called its central nervous system, enabling responsive automation for a wide range of scenarios including environmental monitoring, first-responder dispatch, infrastructure maintenance, or inventory management. Sensors everywhere can measure anything from the amount of CO<sub>2</sub> or ambient light in a room or building to the working status of infrastructure and public fixtures like fire hydrants or electric vehicle charging stations. Traffic lights can adapt their algorithms to detected vehicle volumes while digital billboards broadcast local weather, time, and public service announcements. Environmental sensors can monitor atmospheric visibility, fine dust and particulate matter composition, humidity, ozone levels, rainfall, solar insolation and ultraviolet radiation levels, temperature and air pressure, wind direction and velocity, and other such measures. Motion detectors can switch off LED lighting to conserve electricity when no one is around or conversely, the air conditioning might be turned up for a room if many personal mobile devices are detected there. Residences for the elderly could be outfitted with pressure-sensitive flooring attuned to sudden shifts in weight distribution that automatically notify emergency services in the event of a fall.

Closed-circuit television (CCTV) cameras provide full-coverage, real time surveillance and store footage for up to 30 days. As many as fifty staff members monitor 24-hour video feeds relayed to the G-Tower's IFEZ Smart City Operation Center in Songdo IBD, which is monitored by over 1,000 cameras dedicated to the subregion. The Smart City Operation Center (Exhibit 11) is wallpapered by its situation board – 85 display cubes arrayed in five rows and seventeen columns with separate LED displays for emergency messages. The main control room can seat 22 operators plus 24 spectators in a viewing area. Smart feedback from Yeongjong and Cheongna's systems are routed here along with Songdo's and plans have been made to extend the IFEZ's smart city surveillance capabilities to all of the Incheon Aerotropolis.

### Exhibit 11: IFEZ Smart City Operation Center in Songdo IBD



*Credit: Michael Chen*

Automatic number-plate recognition technology integrated with the CCTV system can report criminal history associated with any license plate it reads; for example, a single car could be tracked from point of entry at any one of the Songdo district's five road access points to point of departure. Drivers that mistakenly park illegally could be notified right away and guided to available public parking spaces. Automatic image and sound recognition systems can alert control center staff of suspicious behaviors (e.g., possible trespassing or theft) or determine the origin points of irregular sounds like shouts or screams. A single jaywalker could be followed from street to street. If even a utility access hole cover is jostled out of place, authorities could be notified right away. When a person enters certain buildings, one's location can be pinpointed from room to room in real time, enabled by such technologies as biometric identification, RFID broadcast, and mobile networks. In missing person cases, last-known locations and travel vectors can be traced on an aerial map in seconds. If a fire breaks out or someone suffers a heart attack in a public space, first responders may be deployed immediately to the specific location of occurrence.

Although we present only a handful of examples, these are precisely the types of ubiquitous technologies that planners and developers of any smart city must consider (irrespective of aerotropolis location). As artificial intelligence and the Internet of Things continue to foster novel applications of emerging technologies,

they will make regions smarter and significantly advance the operational efficiencies of airports, airport cities, and their greater aerotropolises.

## *Major Aerotropolis Developments Beyond ICN*

Having described the main components of ICN and its Air-City as well as attributes of the IFEZ, we now detail the major aerotropolis developments outside the airport fence, most of which fall in the IFEZ. The majority of Incheon Aerotropolis projects were executed smoothly and completed on time, but economic downturns and other financial problems (including bankruptcies and partnership disputes) disrupted some ventures. Moreover, overly ambitious visions were drastically scaled back to match market realities. Major delays ensued in some cases while in others, projects were canceled entirely.

Only time will reveal the full impact of the Covid-19 pandemic on Incheon Aerotropolis projects under development and those planned, but the pandemic's effects on a number of projects will likely be experienced through 2022 at least. Below, we organize discussion of major aerotropolis developments by the three main districts that constitute the IFEZ: Yeongjong, Cheongna, and Songdo.

### *Yeongjong International District*

Yeongjong district, the home of ICN, was formed through the merging of Yongyu, Sammok, and Sinbul Islands with the former Yeongjong Island through land reclamation. The Yeongjong area of the IFEZ encompasses most of Yeongjong Island and parts of neighboring Muui Island for a total of 52.7 km<sup>2</sup>, not counting ICN's 5,840 hectares. Over 90% of construction was completed by 2020 with total project costs of roughly US\$11.3 billion, not including the cost of airport construction. Full buildout of subsidiary developments is anticipated by 2022. Yeongjong was planned for 183,762 residents (more than 70,600 families) and 91,287 people were living here by February 2020. As the Incheon Aerotropolis aviation center, the ICN Aviation Academy is also located on the island, offering certification courses developed by both Airports Council International and the International Civil Aviation Organization.

Whereas Air-City is the centerpiece of Yeongjong commercial development, other noteworthy commercial developments on the island as shown in Exhibit 12 are described below.

**Exhibit 12: Yeongjong International District Land Use Plan**



Credit: Incheon International Airport Corporation

## **Midan City**

Midan City is located on 271.1 hectare near the northeastern corner of Yeongjong Island about a 15-minute drive from ICN. It contains a large integrated resort and affiliated commercial complexes being developed via public-private partnerships. Facilities include retail areas, boutique hotels, an international healthcare center, an international school, a golf course, a landmark tower, food and beverage outlets, and other commercial facilities along with 53,553 housing units. The total development cost for Midan City was estimated at US\$838.8 million and floor area at buildout is projected to reach 1.2 million m<sup>2</sup>. After planning began in August 2003, the first phase concluded in December 2011, the second in December 2016, and the third in June 2018. Almost all development was slated for completion in 2021, but construction halted in February 2020 because of difficulty securing project capital during the Covid-19 pandemic, which may extend final buildout by a year or more.

## ***Caesars Korea Integrated Resort***

The Caesars Resort Complex is one of the Yeongjong Integrated Resort Cluster's three anchor projects along with the Paradise City (IBC-I) and Inspire (IBC-III) integrated resorts located in ICN's Air-City. Its 720-room hotel will host a large casino. Other planned amenities include a shopping mall, a spa and fitness center, an indoor-outdoor swimming pool, convention facilities, serviced residences, an amphitheater, boutique shops, bars, restaurants, and performance halls. Ground was broken in September 2017.

The joint venture responsible for undertaking construction and operation of this integrated resort was first established as the LOCZ Korea Corporation in December 2012 in a roughly 40:60 split between key stakeholders including Caesars Korea (a wholly owned subsidiary of US-based casino operator Caesars Entertainment) and a Hong Kong subsidiary of the Lippo Group (a multinational conglomerate headquartered in Indonesia), amongst others. In December 2014, the consortium made a US\$95.9 million conditional deal to purchase a portion of the land required for development.

The integrated resort project has since faced several delays, such as the withdrawal of the Lippo Group from the consortium in August 2016. In

December 2016, the joint venture was restructured to equal interest between Caesars Korea (who acquired Lippo's former stake) and R&F Properties, the Hong Kong subsidiary of a real estate developer based in Guangzhou, China. Subsequently, the consortium was renamed the RFCZ Korea Corporation in April 2017, the same year Caesars Entertainment filed for bankruptcy. By June 2018, RFCZ Korea had completed payment for land acquisition.

The project was further delayed when Eldorado Resorts, another US-based casino operator with minimal interest in international operation, agreed to acquire Caesars Entertainment Corporation for over US\$17.3 billion in August 2019; the acquiring company changed its own name to Caesars Entertainment, Inc. when it finalized the deal in July 2020. After rescheduling, the Caesars Korea Integrated Resort is anticipated to open in mid-2021 at a cost of US\$735 million. Gross floor area at buildout is expected to range between 172,200 m<sup>2</sup> and 376,900 m<sup>2</sup>. Construction was 20% complete by November 2019.

## **Dream Island**

One of the latest integrated resorts to be built in Yeongjong will be spearheaded by South Korea's Ministry of Oceans and Fisheries. Many attractions are planned for the Dream Island project – including a water park and theme park, an aquarium, a shopping mall, and golf courses – in addition to hotel, education, and research facilities. Ground was broken in June 2019 and about 332 hectares around the Yeongjong Bridge will be reclaimed for estimated buildout in 2022. With total projected investment of US\$1.7 billion from the private sector, the IFEZ Authority forecasts Dream Island to generate an economic ripple effect of US\$12.2 billion plus 18,000 new jobs.

## **Sky City**

Sky City is a multipurpose site in the eastern corner of Yeongjong Island being developed via joint venture between the government-owned Korea Land & Housing Corporation (70%) and the municipal Incheon Development and Tourism Corporation (30%) for convention/exhibition, industrial, logistics, and residential functions. Sky City has plans for over 430,000 m<sup>2</sup> of logistics and aviation industry facilities as well as an 85,600-square-meter international school. Other planned developments include medical, sports, and cultural

facilities as well as offices, an outdoor amphitheater, and a public spa (amongst others). With an expected population of 130,000 people, Sky City contains nearly 54,000 residential units.

Initial planning of the 600-hectare first phase of Sky City commenced in August 2003 and construction was completed in December 2012 (with residential sales commencing in 2009). The second phase finished in December 2018, adding 960 hectares. The third and final phase was projected to achieve buildout with 794,300 m<sup>2</sup> of floor space by December 2020, adding 370 hectares for a total project area of 1,930 hectares, but is facing delays related to the Covid pandemic. The initial project cost was estimated at US\$191.5 million, but total investment will no doubt be considerably higher by final buildout.

### **Yeongjong Aviation Cluster**

A 49.5-hectare aviation cluster is being developed in the northern portion of Yeongjong. Targeted aviation-related functions include aviation training, aerospace, and satellite defense-related industries. Planning for this cluster began in 2008 with all developable land expected to be leased out by the end of 2020.

In partnership with Korean Air, Boeing started planning for its 32,600-square-meter flight training center in 2010. Construction occurred between November 2010 and the second half of 2016 at a cost of US\$121.3 million. Capable of training 3,500 pilots annually, Boeing's training center features twelve full-flight simulators and is among the largest and most sophisticated of its kind in Asia.

Also in this cluster, the Incheon Aviation Tech Company was formed via joint venture between Korean Air (90%) and United Technology's Pratt and Whitney (10%) in late 2010 to develop a 69,200-square-meter maintenance, repair, and overhaul (MRO) facility. Construction on the aircraft engine maintenance and test center finished in 2015 (with official opening in June 2016) at a cost of US\$97 million.

## **Yongyu/Muui Coastal Area**

Other sub-districts within Yeongjong are undergoing or being planned for aerotropolis development as well. In the Yongyu/Muui coastal area at the southern end of Yeongjong Island near the formerly planned site of the canceled US\$1.1 billion Eight City project, six sub-districts are in various phases of development. Facilities including an art museum, a botanical garden, convention areas, education and research facilities, housing, a marina complex, and a resort have been slated for completion by December 2022.

The 124.6-hectare Muui LK marina resort complex with investment of US\$173 million and the US\$241 million Yongyu Ocean View integrated resort located on 12.5 hectares were both scheduled for completion in 2020 while the US\$1.4 billion Muui Solaire Resort Complex occupying 44.5 hectares is scheduled for opening in 2022. In addition, Eurwangsan Mountain IFUS HILL (marketed as a Korean-style Hollywood theme park that could draw millions of ICN's annual transit passengers) will be constructed on 80.8 hectares by 2024 for US\$189.8 million. Combined, the developed area would total 320.1 hectares at a project cost reaching US\$1.8 billion with a planned population of 3,410 persons.

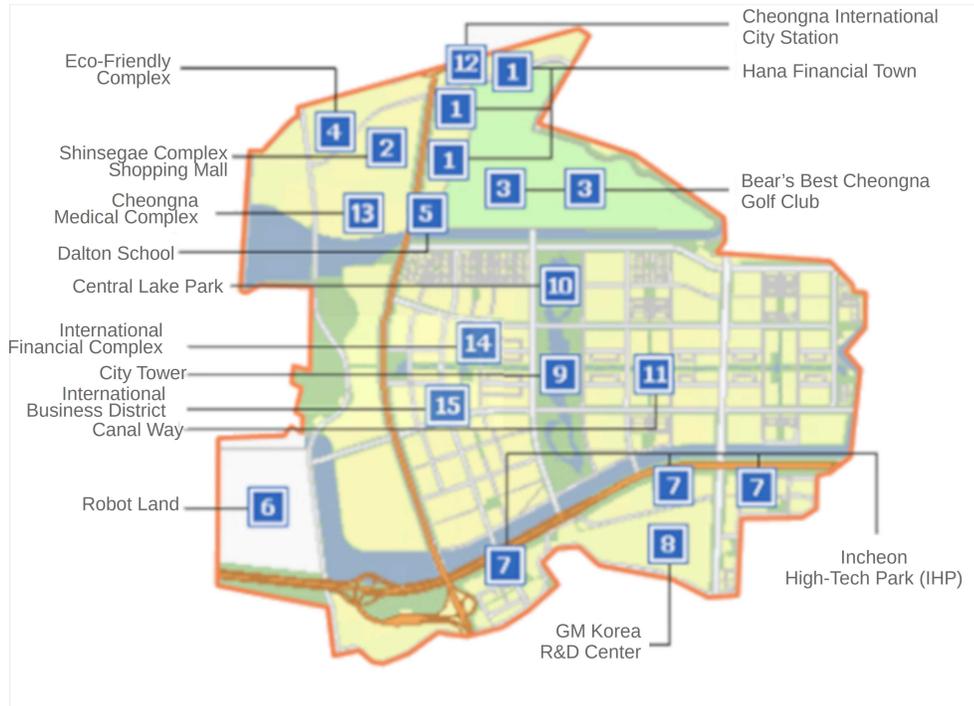
During Yeongjong's development process, extensive efforts were made to preserve local historic areas, villages, farms, and beaches (e.g., Eurwangni and Wangsan Beaches). Even at ICN, over 40% of Air-City's land-use planning was green space. For eventual restoration and preservation purposes, the Yeongjong Seaside Park opened in April 2017 at 176.5 hectares, featuring rehabilitated salt flats, a 6-kilometer coastal walkway with cycling paths, campgrounds, athletic facilities, an outdoor swimming pool, and an observation platform alongside the historic Yeongjong Fort and Fortress. This area also features a 2.8-kilometer length of railbike trails that stretches along the northeast coast of the island.

## ***Cheongna International District***

At 17.8 km<sup>2</sup>, Cheongna is the smallest international district within the Incheon Aerotropolis triad. Its planned population of 90,000 (over 33,000 families) was 90% achieved (81,270 people) by July 2015 and was actually exceeded by February 2020, when its population was estimated at over 108,000. As the closest of the three districts to Seoul, Cheongna is located east of Yeongjong and north of Songdo. Its commercial developments are geared

towards international business and finance, leisure and tourism, robotics, and high-tech component manufacturing. Total development costs have been estimated at US\$6 billion. Exhibit 13 provides a functional map of Cheongna International District.

### Exhibit 13: Functional Map of Cheongna International District



*Credit: Incheon Free Economic Zone Authority*

### Hana Financial Town

Situated on 24.8 hectares at the north point of Cheongna, Hana Financial Town (sometimes called Hana Dream Town) serves as the center of operations for the Hana Financial Group. Groundbreaking for the first phase of construction took place in the second half of 2014. The three phases of development include corporate housing, several office buildings, training centers, a call center, and a distribution center as well cultural and recreational facilities catering to local communities. The project was estimated to cost US\$680 million.

Groundbreaking for the Hana Financial Town's Integrated Data Center in June 2015 was a major milestone of the first phase as was its dedication ceremony, which officially concluded the first phase in June 2017. IT infrastructure and personnel of all the Group's subsidiaries, previously scattered amongst thirteen facilities in various locations, are consolidated at the Integrated

Data Center to optimize data management and interactions of IT personnel to foster innovation in financial technology sectors.

The second phase kicked off in May 2017 with the construction of the 176,100-square-meter Hana Global (corporate) Campus comprised of three educational and training buildings, green space, a dormitory, and an indoor sports stadium. The second phase included groundbreaking on the Hana Global Talent Development Center (located directly across from the Integrated Data Center) that serves as a training center for Hana employees. The building completion ceremony for the Hana Global Campus was held in May 2019, marking the end of the second phase. The third and final phase will construct the corporate headquarters for 5,600 employees of the Hana Financial Group.

### **Central Lake Park and Cheongna City Tower**

The Central Lake Park stretches north-south across 69.3 hectares in the center of Cheongna. Construction commenced in June 2012 and finished in December 2015 at a project cost of US\$71.2 million. Just east of Cheongna's Central Lake Park is the Cheongna Canal Way and Park. The Canal area spans 4.5 km and offers scenic bike and pedestrian trails as well as canoe rentals. Other features include a large musical fountain, an underwater plaza, and the Outdoor Digital Aquarium, a transparent wall display composed of glass and LEDs.

While Cheongna Central Lake Park contains mostly green spaces, pedestrian pathways, and water features, it has also been selected as the site of what may be Cheongna's most iconic landmark: the Cheongna City Tower. The design proposed by GDS Architects was selected through competition in 2012 and ground was broken in November 2019; construction is estimated to be completed in 2023 at a project cost of US\$344.4 million.

The City Tower will be built amidst landscaped gardens on 3.3 hectares on an island within Central Lake Park. The exterior of the 450-meter landmark will be paneled in three sections, each with 500 rows of LED displays in diamond-shaped nets. Based on readings from eighteen external high-definition cameras, the surrounding environment will be projected onto the diaphanous surface of the Tower to create an illusion of transparency in real time. Ironically, it will establish its presence through self-effacement.

The steel skyscraper will contain 29,300 m<sup>2</sup> of gross floor area and provide 2,000 parking spaces. The Tower's 28 floors above ground and its two underground levels function as a leisure and entertainment complex, including shopping areas, a movie theater, wedding venues, a water park, a rollercoaster, and restaurants. The upper floors are comprised of a sky deck (28<sup>th</sup> floor), observation decks (25<sup>th</sup> and 26<sup>th</sup> floors), a sky walk from the 20<sup>th</sup> to the 24<sup>th</sup> floors, and a glass-floor photo zone on the 20<sup>th</sup> floor.

## **Robot Land**

Since 2007, the Incheon municipality has pushed to build Robot Land about 15 minutes from ICN on 76.7 hectares in the southwestern corner of Cheongna but revised its plans over several iterations. At one point, it was planned as a multifunctional park for all things robot related. A robotics research institute would recruit R&D firms while a robotics industry support center would target venture companies and startups. Plans were also made for exhibition halls, museums, a convention center, shopping malls, a water park, training facilities, post-graduate robotics schools, hotels, condominiums, and even an aquarium filled with robotic sea life.

The main theme park was planned to be divided into four colorfully named areas: Fun City, Kidbot Village, Robot Kingdom, and Robotopia. A 110-meter landmark statue of Taekwon V (Voltar the Invincible), over twice the height of the Statue of Liberty, would watch over the theme park. However, due to a decline in municipal real estate revenue, plans for Robot Land were scaled back significantly, especially the leisure and entertainment functions.

Although the groundbreaking ceremony was held in September 2013, the completion date has seen several adjustments. With construction still ongoing in 2020, the project schedule has been adjusted for gradual rollouts that may later introduce a theme park. The main public facilities were completed in July 2017 at a cost of US\$92.6 million and development was expected to continue into 2021 with a final budget of US\$609 million.

## **GM Daewoo R&D Center and Proving Grounds**

In the southeastern part of Cheongna, the 508,000-square-meter GM Daewoo automotive R&D center began construction in 2005. A 30-year, rent-free

lease was granted to GM Daewoo by the Incheon municipality. The initial project was completed in October 2007 with a 477,000-square-meter proving ground for automobile testing at a cost of over US\$93 million. The testing facilities include a climate-controlled wind tunnel that simulates different weather conditions as well as an anechoic chamber for noise and vibration tests. The subsequent addition of other research facilities brought the total project cost to over US\$140 million.

### **Cheongna Medical Complex Town**

In August 2015, the CHA Medical Group signed a memorandum of understanding with the IFEZ Authority to construct a medical complex on 26 hectares in the northwest of Cheongna. 215,300 m<sup>2</sup> of facilities planned facilities include general and specialty hospitals, pharmaceutical firms, medical schools, clinical research institutes, and training and support functions. Hotels, cultural venues, and residential developments are planned as well to support the nation's prominent medical tourism industry. Although the groundbreaking ceremony has seen delays, the project is still targeted for completion in 2022 at an estimated cost of approximately US\$410.9 million.

### **Cheongna Dalton School**

Highly rated international schools are important for many Asian aerotropolises to attract top foreign talent with children. In this regard, Cheongna Dalton School is one of the IFEZ's two Western-oriented flagship institutions (the other being Chadwick International School Songdo) providing international primary and secondary education. Located on 4.6 hectares near the Yeongjong Bridge, Cheongna Dalton School is a private college preparatory school offering education in an English-only setting from pre-kindergarten through the 12<sup>th</sup> grade; students must have at least one parent with a foreign passport or have resided outside of South Korea for three years at the time of enrollment.

With a project budget of US\$35.3 million, planning began in September 2009, construction commenced in August 2010 on 2.6 hectares, and opening took place in September 2011. School facilities include a concert hall, dance room, dormitory, gymnasium, heated swimming pool, and horse-riding track in

addition to classrooms, science labs, soundproof practice rooms, and two libraries. Curricula are formulated according to the Dalton Plan of educational philosophy, an American-style method of education in which pupils work at their own pace.

### **Incheon High-Tech Park**

The Incheon High-Tech Park is under construction on 113.2 hectares along the southern edge of Cheongna's borders. Construction began in February 2014 with an estimated total project cost of US\$450 million. Firms specializing in R&D and manufacturing of next-generation vehicles, especially electric and autonomous vehicles, are being recruited to this area. For instance, Hyundai Movex (a logistics automation subsidiary of the Hyundai Group) constructed a 6,700-square-meter facility for research and development between March and October 2019 at a project cost of US\$18.3 million. In addition, a memorandum of understanding was signed between the IFEZ Authority, Japan-based Eurus Energy, and South Korea's DKL to establish a GM vehicle logistics center for delivery of new cars and to build a 90,000-square-meter photovoltaic park of solar panels here. In a similar agreement signed between the IFEZ Authority and ACE Construction in April 2019, the latter pledged to invest US\$124.5 million to build a 15,800-square-meter Knowledge Industry Center with space for over 460 firms by May 2021; it is projected that 2,600 jobs will be created as a result.

### ***Songdo International District***

The district of Songdo (meaning "Pine Island") is bookended by the Golden Harbor area to its north and the New Port area to its south. As its heart, Songdo International Business District (Songdo IBD) (elaborated later) was master planned to be an ultra-connected, sustainable urban center equipped with cutting-edge green and digital technologies to capture sustainable smart city objectives.

The Songdo district is approximately a 20-minute ride away from ICN and a 45-minute drive to Seoul's fashionable downtown Gangnam district. Its 53.4 km<sup>2</sup> of land has a planned population of 265,000 (about 104,100 families); its residential population surpassed 270,000 by 2020. By 2019, about 80% of development had been completed. Land reclamation was 75.4% complete in 2019

with the Songdo Landmark City, Incheon New Port (and hinterland), and High-Tech Industrial Cluster project sites still undergoing reclamation. A functional map of Songdo International District is provided in Exhibit 14.

**Exhibit 14: Functional Map of Songdo International District**



*Credit: Incheon Free Economic Zone Authority*

## Golden Harbor and New Port

The Incheon Aerotropolis is quadrimodal, integrating airports, highways, rail, and seaports. The Incheon Port Authority oversees two port developments in Songdo: the Golden Harbor and New Port projects. While New Port focuses on cargo and logistics, the Golden Harbor development is a mixed-use passenger vessel port targeting tourism, entertainment, and retail. These areas are developed by the Incheon Port Authority in partnership with the Ministry of Maritime Affairs and Fisheries.

The 42.9-hectare Golden Harbor project area juts out from the coast at Songdo's north tip. In partnership with the South Korean government, the Incheon Port Authority began planning for Golden Harbor in 2012, which is

anchored by International Passenger Terminal 3. International Passenger Terminal 3 completed construction with investment of US\$147.4 million in June 2019 on 6.6 hectares adjacent to Golden Harbor's Phase 1 construction area. Phase 1 included 21.3 hectares for a resort complex, business hotels, shopping malls, condos, and mixed-use facilities. With 21.6 hectares allotted for Phase 2, second-phase construction will bring a marina, water park, and additional resort hotels and condos. Final project cost could reach US\$553.4 million financed in a roughly 80:20 distribution between the IFEZ Authority and Incheon Port Authority.

Just east of and adjacent to the Golden Harbor site is the second Aam Distribution Complex (also called the Ah-am Logistics Complex 2), which provides logistics support. Development is taking place in several stages. Construction on the first stage began in 2014 on 92.2 hectares and was finished in 2017. Additional land reclamation was still taking place in 2019. The next stage would add 66.1 hectares to the project area and the third stage would add 104.2 hectares for a full project area of 262.5 hectares by 2022. The estimated project cost is US\$304 million.

The New Port project is located approximately 30 minutes from ICN. This area overlaps and extends from a large portion of Songdo's southwestern corner. Development on the New Port project began in 2007. Phase 1, which commenced construction in 2009, concluded in 2017 with total investment at US\$2.3 billion. Two 480,000-square-meter cargo terminals were finished in 2012 as part of the first phase: the HJIT and SNCT terminals each have an annual handling capacity of over 1 million TEUs and 800 m of berth length each for a total of six berths. Land was still being reclaimed for Phase 2 in 2019, which would add 100 m of quay for a total of 1,700 m as well as 60,000 m<sup>2</sup> of terminal space for a total of 1 million m<sup>2</sup>, expanding berthing capacity to three 10,000-TEU and one 8,000-TEU vessels. A tentative third phase may add 760 m more in quay length and 456,000 m<sup>2</sup> in terminal area, bringing maximum berthing capacity to five 16,000-TEU vessels.

The Incheon Port Authority also operates three other major ports in the greater Incheon Aerotropolis. These include the North, Inner, and South Ports as well as International Passenger Terminals 1 and 2 and the domestic Coastal Passenger Terminal. North Port is a bulk port specializing in handling industrial raw materials such as lumber, steel, and oil; it is capable of berthing 17 vessels

with 50,000 deadweight tons of capacity. Inner Port primarily handles precision machine parts, semiconductor equipment, and vehicles as well as fruit, grain, steel, and sundries; its eight piers can accommodate concurrent berthing of 48 vessels with 50,000 deadweight tons of capacity. South Port is geared to small-and-medium-sized containers and as the smallest of the three primary ports, its seven berths can handle seven 4,000-TEU vessels concurrently. These three port areas are augmented by 8.6 million m<sup>2</sup> of logistics and support facilities in various stages of construction near the ports.

In 2019, over 1 million international and 1 million domestic passengers plus 12,342 cruise passengers were processed in International Passenger Terminals 1 and 2, the Coastal Passenger Terminal, and cruise terminals. International Passenger Terminal 1 covers 35,000 m<sup>2</sup>, International Passenger Terminal 2 covers 40,800 m<sup>2</sup>, and the Coastal Passenger Terminal covers 13,000 m<sup>2</sup> for a total of 89,000 m<sup>2</sup>. International Passenger Terminal 1 has three wharfs with a combined length of 690 m while International Passenger Terminal 2 has four wharfs with a combined length of 680 m and berthing capacity of 37,000 gross tons. International Passenger Terminal 3 completed construction in June 2019 and was scheduled for opening in 2020. In April 2019, the 7,400-square-meter Incheon International Cruise Terminal opened with handling capacity for 1,200 passengers per hour.

### **Songdo Landmark City**

The area on the Songdo side of Incheon Bridge is also notable as the former site of the 151 Incheon Tower, so named after the number of floors in its original plan. This plan called for 506,500 m<sup>2</sup> of retail, 102,700 m<sup>2</sup> of office, 256,700 m<sup>2</sup> of hotel, and 13,200 m<sup>2</sup> of restaurant space as well as an 11,000-square meter observatory to be ready for opening by 2025. After groundbreaking in June 2008 with an estimated budget of US\$11 billion, construction halted in 2009 in the wake of the global recession. Plans were adjusted to 102 stories (as well as the tower's name) when construction resumed in 2013, but the project was ultimately canceled in 2016. The tower was intended as the centerpiece of a grander 607-hectare development called Songdo Landmark City (now tabled) with 2,000 residential units, green spaces, underground parking, retail and office facilities, and an 18-hole golf course. While portions of this site were still awaiting land

reclamation in early 2020, residential development had begun on other parcels within the Songdo Landmark City site.

## **Knowledge & Information Industry Complex**

The Knowledge and Information Industry Complex is a 240-hectare site for multinational high-tech industrial manufacturing and R&D firms. These companies include A-1 Engineering Korea, Bystronic, Cisco, Cotech Inc., Fibox, Güdel Lineartec Inc., HellermannTyton, Huneed Technologies, IBM, Kortek, Kyobo Data Center, Kyungshin, Mando Hella, Piolax, Rittal, Sanil Tech, and Yujin Robot; facilities for these firms were variously constructed between 2001 and 2015. Developments here have garnered FDI from companies based in England, Finland, Germany, Hong Kong, Japan, Switzerland, and the United States. The cost of overall development of the Knowledge and Information Industry Complex was estimated at US\$1.1 billion.

### *Incheon Technopark*

One of the Songdo Knowledge & Information Industry Complex's most significant developments, Incheon Technopark is based in the northeast portion of the Songdo Knowledge & Information Industry Complex. Incheon Technopark is a nonprofit incubator offering one-stop business services for small-and-medium-sized technology startups focused on eight strategic industries: automotive components, aviation, biotechnology, cosmetics, green finance, logistics, tourism, and robotics.

The foundation was established in June 1998 together by Inha University, the Korea Institute of Industrial Technology, and the University of Incheon to improve the technological competitiveness of firms in those sectors. Construction on its 454,000-square-meter complex in the Songdo Knowledge & Information Industry Complex was carried out between 2001 and 2005 and financed by the city of Incheon and the Ministry of Knowledge Economy. The complex includes business research centers, an Automotive Technology center, and a pilot production factory for models and prototypes, amongst other facilities. By 2009, the park hosted 124 companies in addition to 19 other organizations supporting more than 4,000 jobs in the area.

Among the Technopark complex's main features is the 21-story Tidal Tower, a mixed-use building housing sixty venture companies and research firms. Another is the Get Pearl Tower (whose name sounds like the Korean word for mudflat), which hosts the Incheon Technopark's Aviation Center and its Bio Center as well as a promotional hall for the Korea Polar Research Institute on the first floor. The quaintly named Meet-You-All Tower (whose name is derived from the phonetic pronunciation of Incheon's Michuhol District) houses the Incheon Technopark's Corporate Support Center, Finance Support Center, Export Support Center, Beauty Convergence Center, ICT Center, and Industrial Complex Support Group as well as a branch office of the Asian Federation of Biotechnology.

### **Bio Complex and Bio Cluster**

Located between the Knowledge and Information Industry Complex and the New Port development area is the Bio Complex, an industry cluster primarily geared towards manufacture and R&D of biopharmaceuticals and medical equipment. Structures here were built between 2002 and 2014 on 130 hectares for over US\$725 million. The US\$497.3 million Celltrion biomedicine manufacturing and research facilities were constructed here on 190,700 m<sup>2</sup> between 2002 and 2011. Daifuku Korea, Enviro Technology, EONE Life Science Research Institute, i-SENS, Janssen, and KD Corporation are among other firms who have located in the Bio Complex. By 2014, 24 biotechnology companies had already located in the broader Songdo International District. Notable foreign investors include Arkray (Japan), Johnson & Johnson (US), and Temasek (Singapore).

The Bio Complex is being developed in tandem with a larger Bio Cluster occupying much of southeastern Songdo; the Ministry of Trade, Industry, and Energy expanded the Bio Cluster to 182.9 hectares from 175 hectares in June 2019. The IFEZ Authority aims to recruit 300 firms (including 90 small-and-medium-sized enterprises plus 150 startups) employing 15,000 in this cluster by 2030. By 2018, 64 bioscience companies were operating in the Bio Cluster, supporting 4,500 jobs.

Songdo Science Village, which contains many facilities operated by Incheon Technopark, was constructed between 2008 and 2013 at a project cost of US\$3.7 billion and occupies 6.6 hectares here plus a gross area of 2.5 million m<sup>2</sup> containing officetel, commercial, and educational facilities. A 205,800-square-

meter Bio Research Complex was constructed between 2009 and 2013 at a project cost of US\$331.6 million, which included the 6.7-hectare Smart Valley Knowledge Industrial Center with 291,200 m<sup>2</sup> of floor space. New facilities were completed in July 2015 and in January 2018 as part of the Gachon Gil Foundation's 320,700-square-meter Brain Valley biomedical research hub set for buildout in 2022. Brain Valley is also being developed as part of the Songdo Medical Town project in tandem with a 13.9-hectare Science Park as well as Yonsei University International's Songdo Severance Hospital, which began construction in 2019 with opening targeted in 2024. GE Healthcare announced completion in 2016 of its 2,200-square-meter bioprocessing technology and training center at a cost of US\$7.4 million. Merck finished construction of its US\$22.7 million Korea Life Science Operation Center on 10,100 m<sup>2</sup> in 2019, marking the conclusion of second-phase construction of a project including the 1,900-square-meter M Lab Collaboration Center completed in October 2016. Celltrion announced plans in May 2019 to invest US\$20.6 billion to build out its operations in the Bio Cluster by 2030. Other firms established in the Bio Cluster include Ajinomoto Genexine, Berna Biotech, BINEX, Charles River Laboratories, the Dong-A Socio Group, Olympus, Osstem Implant, Saint-Gobain Performance Plastics, and Samsung Bioepis.

## High-Tech Industrial Cluster

Many developments in the broader Songdo district outside Songdo IBD fall within the High-Tech Industrial Cluster where 354 hectares are being developed at an estimated project cost of US\$4.1 billion. Construction began in 2008 and buildout was scheduled for late 2020, although the cluster continued to develop in conjunction with the Songdo Bio Complex (previously discussed). Two developments in the Cluster have project costs exceeding US\$1 billion: the Samsung BioLogics manufacturing facilities and Amkor K5.

Samsung BioLogics' three large processing facilities produce therapeutic substances such as vaccines and related drugs derived from biological sources (typically proteins). Biologics are expensive and highly perishable, requiring special handling, preservative temperature-controlled equipment, and usually rapid delivery by air to distant locations. Development of the 274,000-square-meter site began in 2011. The first biologics processing facility, which began operation in June 2013, contains six bioreactors with 5,000 liters (L) of capacity

for a mammalian cell culture capacity of 30,000 L annually. The second bioprocessing facility added 150,000 L more in annual capacity with ten 15,000-liter bioreactors upon opening in 2016 (and later added two more 1,000-liter bioreactors). Ground broke on the third bioprocessing plant in December 2015 and construction was finished in November 2017, making Samsung BioLogics' biomedical processing complex the largest single-site biopharmaceutical processing center in the world (see Exhibit 15).

**Exhibit 15: Samsung BioLogics Processing Complex in Songdo District**



*Credit: Samsung BioLogics*

The third facility is capable of 180,000 L in annual production, nearly doubling combined annual production capacity to 362,000 L. After one to two years of testing, the third biologics plant was slated to begin production in 2020 and employ an additional 700 people. The total project cost reached US\$2 billion, with US\$740 million invested by Samsung BioLogics in the third plant alone. By December 2017, contracts with ten different pharmaceutical firms to manufacture fifteen different biologics were already signed; in fact, the value of backlogged order volume was estimated at US\$3.3 billion, even before the plant commenced operations. After at least one full year of testing, production was expected to begin in late 2020 with annual operating profits and sales forecasted to reach US\$940 million and US\$1.9 billion, respectively. The company announced plans for a fourth facility in March 2020.

Amkor Technology's semiconductor packaging and R&D facility in the High-Tech Industrial Cluster is called Amkor K5. At an estimated project cost of US\$1 billion, Amkor K5 spans a project area of 18.6 hectares and offers semiconductor packaging and test services for over 25 billion units per year, creating over 3,000 new jobs as well. The project was completed between 2012 and 2020 costing US\$952.7 million. Exports from Amkor K5 were predicted to add US\$1 billion to South Korea's economy on an annual basis. Amkor K5 was also notable for being the first plant to manufacture Amkor's Silicon Wafer with Integrated Fan-Out Technology, which won Device of the Year at the 2016 3D InCites Awards ceremony.

There are several other notable developments in the High-Tech Industrial Cluster. POSCO's US\$231.9 million Global R&D Center was built between June 2008 and August 2010 on 8.3 hectares with 98,600 m<sup>2</sup> in gross area. Constructed between May 2010 and April 2012, the 44.1-hectare Mando Brose automotive research and production facility cost US\$156.4 million and the semiconductor production and R&D facility of TOK Advanced Materials cost US\$164.5 million to construct on 28.3 hectares between August 2012 and October 2013. Japan-based Ajinomoto (75%) and South Korea-based Genexine (25%) established a joint venture in November 2012; Ajinomoto Genexine's 1.1-hectare R&D and production facility (plus regional headquarters) cost US\$29.8 million to construct between 2013 and 2014.

Samsung Bioepis is a biosimilar-focused joint venture formed between US-based Biogen and Samsung BioLogics established in 2012. (Biosimilars are generic versions of biologic products that are basically copies of them.) Its 12-story, 10,200-square-meter headquarters building was targeted for completion on 4.3 hectares in December 2020. Also part of the High-Tech Industrial Cluster, Henkel Adhesive Technologies invested US\$39 million for a 9,500-square-meter production facility with 10,100 m<sup>2</sup> in floor space that broke ground in November 2019 with opening (after testing) set for early 2022. Other companies locating in this industrial cluster include Dong-A Socio, Mitsubishi Electric, Olympus Korea, and Otis Elevator. Together, these other projects cover at least 80.6 hectares and cost well over US\$1.3 billion to construct.

## **Songdo International Complex**

At a project cost of US\$2.6 billion, Phase 1 construction for the Songdo International Complex (not to be confused with Songdo International Business District) took place between 2008 and March 2010 over 91.7 hectares with 614,700 m<sup>2</sup> of gross area. With construction on Phase 2 85% complete in 2015, full buildout of all 141.7 hectares planned is expected by 2021. Planned as a hub for the intersection of industry, academia, and R&D, the Songdo International Complex will have about 3,000 residences for 7,200 people in addition to a Global Academic Village and an R&D park for science and engineering. The International Complex is also notable as the location of the Incheon Global Campus (overlapping part of the High-Tech Industrial Cluster in the broader Songdo district).

### *Incheon Global Campus*

Providing facilities for several foreign universities, the Incheon Global Campus at the edge of Songdo IBD (see Exhibit 16) completed Phase 1 construction between 2008 and 2015 at a cost of US\$488.7 million. Phase 2 commenced in 2016 and is expected to be completed by 2021. The site area is 29.5 hectares while constructed floor space amounts to 650,900 m<sup>2</sup>. In addition, an expansion project adding a 4,300-square-meter Global Startup Campus is also slated for completion in 2021 with total expenditure projected at US\$10.5 million. Shared campus facilities include classrooms, an auditorium, faculty housing, a guesthouse, a gymnasium (and swimming pool), a library, a multipurpose student support center, a performance hall, and student dormitories.

**Exhibit 16: Incheon Global Campus with Songdo IBD in Background**

*Credit: Mooyoung A&E*

The State University of New York (Stony Brook) joined the Incheon Global Campus in March 2012 while Belgium's Ghent University, US-based George Mason University, and the University of Utah opened their campuses in 2014. New York's Fashion Institute of Technology followed in September 2017 offering Associate of Applied Science degrees in fashion design and in fashion business management. Students earn the same degrees through the same curricula as the home campus in programs supporting Songdo's knowledge-intensive focus industries. The SUNY campus offers both graduate and undergraduate programs in computer science, technological systems management, mechanical engineering, and applied mathematics and statistics while George Mason University grants graduate degrees in public health and biomedical informatics. Collectively, other undergraduate programs offered at the Incheon Global Campus include accounting, civil and environmental engineering, communications, computer game design, conflict analysis and resolution, economics, environmental technology, film and media arts, finance, food

technology, global affairs, management, molecular biotechnology, psychology, and urban ecology.

Located elsewhere in broader Songdo are the Incheon Catholic University Songdo Campus, Incheon National University, and Yonsei University's International Campuses. Memoranda of understanding have been signed with other educational institutions as well, such as the St. Petersburg (Russia) State University and the University of Illinois at Urbana-Champaign. The IFEZ Authority hopes to continue to attract universities from around the world with specialties in information technology, biotechnology, and nanotechnology to create innovation-oriented education and research clusters through industrial-academic cooperation.

### *City Construction Complex & Fishermen Living Countermeasure Complex*

As with other countries in Asia, aerotropolis development resulted in displacement of native residents. In 2006, the Fisherman's Living Land Policy guaranteed each displaced resident an allocation of 165 m<sup>2</sup> living space in greater Songdo. The city of Incheon led construction on the City Construction Complex and the Fishermen Living Countermeasure Complex, a block of land just east of Songdo IBD and a corresponding strip along the area's northwestern edge. Combined, the City Construction Complex and the Fishermen Living Countermeasure Complex cover 161.7 hectares. Both were constructed between 2003 and 2009 for an aggregate project cost of US\$149.3 million.

The City Construction Complex cost US\$123 million and was intended to establish an urban living environment with residential and commercial facilities. Spanning 130.3 hectares, this area contains 48 hectares of housing, 44.7 hectares of mixed-use residential/commercial space, 28.8 hectares of roadways, and 36 hectares of parks along with 2,000 m<sup>2</sup> of plazas. There are also two elementary schools, one middle school, and one high school in the City Construction Complex occupying 5.3 hectares.

The Fishermen Living Countermeasure Complex was developed as a social remediation and amenities complex as well as an urban revitalization project at a cost of US\$26.4 million. Covering 31.4 hectares, this area contains 21.2 hectares

of residential and commercial development as well as 8.8 hectares of roadways complemented by 5,300 m<sup>2</sup> of plazas and 8,900 m<sup>2</sup> of parking.

### **Songdo American Town**

Development of the Songdo American Town Complex (also known as the Songdo Korean-American Village Development) was led by a company created by the IFEZ to build a large-scale complex targeted towards South Korean nationals and Korean Americans living in the US to return to South Korea in a milieu similar to the US. The first phase of construction concluded in October 2018, eventually selling out 830 apartment units, 125 officetel units, and 113 retail units. A second phase is to add 498 apartment units, 674 officetel units, and 20,000 m<sup>2</sup> of commercial space. At buildout, Songdo American Town will also include 312 hotel rooms along with a mall featuring American goods and services.

### **Songdo Waterfront**

The Songdo Waterfront project began planning in 2012 as a recreational development containing an artificial beach, ferry docks, marine facilities, outdoor stages, and parks while doubling as a reservoir reducing inland flood risk. The area would be connected by a system of canals regulated by sluices and joined to other parts of Songdo via four bridges (two pedestrian and two for vehicles): the Anchor, Moonlight, Sunrise, and Wave Bridges. After some delays, ground broke on the US\$215.8 million first phase in May 2019. The second phase was projected to cost US\$29.9 million and the third phase (the final phase) to cost US\$319.4 million. Buildout is anticipated in 2027 at a cumulative cost reaching US\$566.4 million.

### ***Songdo International Business District (Songdo IBD)***

The core business district of greater Songdo and the Incheon Aerotropolis is Songdo International Business District. As was noted, while ICN's Air-City is the Incheon Aerotropolis's airport city core, Songdo IBD is the Aerotropolis's main peripheral business district. See Exhibit 17 for a functional map of Songdo IBD.

**Exhibit 17: Functional Map of Songdo IBD**

*Credit: New Songdo International Development City LLC*

Songdo IBD (Exhibit 18) was planned from the start as an environmentally sustainable, ubiquitously connected smart city with 40% of its 607 hectares designated as green space. Its construction commenced in 2004 on 5.8 km<sup>2</sup> of reclaimed land led by Gale International and South Korea's leading steelmaker, POSCO. Songdo IBD's first phase was completed in December 2014 at a cost of US\$19.6 billion. The overall investment in Songdo IBD is expected to surpass US\$35 billion at buildout, making the IBD the most expensive private real estate endeavor of its time. Much of Gale International's and POSCO's financing for the vertical (commercial) infrastructure came from US-based Morgan Stanley and

South Korean banks supplemented by FDI while the South Korean and Incheon governments provided the public infrastructure (e.g., roads, bridges, and utilities).

**Exhibit 18: Songdo IBD Skyline with Bridge to Incheon Airport in Background**



*Credit: Gale International*

Nearly 80% complete in 2020, Songdo IBD is planned to contain 3.7 million m<sup>2</sup> of office space, 3.3 million m<sup>2</sup> of residential development, 929,000 m<sup>2</sup> in retail, 464,000 m<sup>2</sup> in hospitality, and 929,000 m<sup>2</sup> of civic space. Targeted buildout has been extended to 2023 after some project delays and the Coronavirus pandemic as well as a dispute between Gale International and POSCO that resulted in litigation.

Until 2017, the project had been developed as a joint venture. Gale International, POSCO Engineering and Construction (E&C), and Morgan Stanley Real Estate held 61%, 30%, and 9% stakes (respectively) in the New Songdo International City Development LLC (NSIC). These percentages are currently in legal dispute after a hostile takeover of the project by POSCO in mid-2017. Gale International is a major commercial real estate developer headquartered in New York City while Morgan Stanley (also headquartered in New York) is among the largest multinational financial institutions. POSCO E&C, which handles much of

Songdo IBD's construction, is a subsidiary of South Korea's POSCO conglomerate, the world's fifth-largest steelmaker by crude steel production (42.9 million tonnes) in 2019.

Songdo IBD's master plan, which received a World Award from the American Institute of Architects, was led by Kohn Pederson Fox Associates (KPF), likewise headquartered in New York City. Planners at KPF were deliberate in drawing inspiration from the most iconic elements of other major cities. In many ways, Songdo IBD is an amalgam of cities admired around the world. The Convensia convention and performance center is reminiscent of the Sydney Opera House. The seawater canal (first of its kind in South Korea) was directly inspired by those of Venice. The Central Park's etymology and function stem from New York City's own. The system of pocket parks is modeled after London and Savannah, Georgia (USA) while wide, Parisian-style sidewalks make the IBD walkable. Designers took note of considerations of scale by planning for mixed-income housing and the impact of walkability and open spaces on urban living. In fact, part of the design process for the layout of Songdo IBD's core involved literally superimposing overlays of classic downtown urban forms – from Chicago, London, New York City, Paris, Philadelphia, Savannah, Sydney, and Venice – on top of that of the IBD.

## **Central Park**

Covering 40.9 hectares, the Songdo Central Park (Exhibit 19) is one of the IBD's more sizeable developments, representing about 6.7% of Songdo IBD's land area of 607 hectares. Opened in August 2009, the US\$163.7 million park features Songdo's main saltwater canal. From here, all major portions of the IBD are within a 15-minute walk. Alternatively, travelers can catch a ride on a 12-passenger water taxi (from the West Boat House) to the Arts Center Incheon at one end of the canal, to the Convensia exhibition center at the other, or elsewhere in the IBD.

**Exhibit 19: Songdo IBD's Central Park**

*Credit: Gale International*

As the IBD's green lung, Songdo Central Park implements several sustainable technologies. Through rainwater collection and deliberate landscaping, net-zero irrigation is achieved in Central Park. Utilizing tidal hydropower, seawater is filtered for large objects and particulates before a wind-powered pipe carries it 4 km, replenishing the canal with fresh seawater every 24 hours. Due to its lower freezing point, saltwater allows water taxis to continue operation in winter.

Central Park contributes to the livability and social density of the IBD. Cafés and restaurants at the east side of the Park provide food and beverage offerings. Visitors can handfeed wildlife in the deer and rabbit enclosures (see Exhibit 20), rent bikes or watercraft (canoes, rowboats, kayaks, and stand-up paddle boats from the East Boat House adjacent to the Seawater Foot Bath), or throw a picnic in the themed Hobbit Land campground. Those who do not wish to camp can go 5-star in one of the 71,000-square-meter Central Park Hotel's 300 rooms or in the Songdo Hanok Village – comprised of shops, restaurants, and the Gyeongwonjae Ambassador Incheon, which offers 30 traditional rooms.

**Exhibit 20: Wildlife Enclosure in Songdo IBD Central Park**

*Credit: Joyce Sim*

In addition, there are several cultural and educational venues in Central Park. The Songdo International Museum, established for the preservation and documentation of a permanent art collection, is located here as well as the Incheon Metropolitan City Museum (formerly the Compact Smart City exhibition venue) and the Incheon Urban History Museum (opened in August 2009), which sees about 100,000 visitors annually. In February 2019, the IFEZ Authority granted the Incheon city government a permit to construct the three-story National Museum of World Letters by 2021 in accordance with plans laid by the Ministry of Culture, Sports, and Tourism on 1.9 hectares in Central Park. Amongst the most architecturally distinctive cultural developments is the Tri-Bowl Arts Center (discussed in a separate section below).

**Office Developments**

Although most of the IBD's office towers were built as speculative buildings with bold architectural vision, they were grounded by solid market-based demand analyses. This is an important lesson for aerotropolis investment anywhere: Without appropriate demand analyses, the risk of insufficient

occupancy rates will jeopardize the commercial viability of virtually all aerotropolis developments. Based on such analyses, several buildings in the IBD that primarily host office spaces also serve “officetel” (mixed-use office/residential), retail, or residential functions. For example, the IBD’s POSCO Tower contains serviced residences above its 35 floors of office and ground-floor retail functions.

### *POSCO Tower*

POSCO Tower (formerly the Northeast Asia Trade Tower) is located just west of Convensia on 2.4 hectares in the IBD’s east corner. Construction was initiated in August 2006 and the building was operational by October 2010. The project was nominally completed with a cost of US\$587.5 million in June 2014; further renovations were finished in 2017. Exhibit 21 and Exhibit 22 illustrate different views of POSCO tower.

#### **Exhibit 21: Songdo IBD POSCO Tower**



*Credit: Gale International*

**Exhibit 22: View of Songdo IBD's POSCO Tower from Central Park**

*Credit: Gale International*

Over 300 m high with 68 stories, POSCO Tower is one of South Korea's tallest towers and contains gross floor space of 202,400 m<sup>2</sup>. The mixed-use skyscraper accommodates 80,000 m<sup>2</sup> of office space from the 3<sup>rd</sup> to 35<sup>th</sup> floors; 57,000 m<sup>2</sup> from the 36<sup>th</sup> to 63<sup>rd</sup> floors for a 423-room, 5-star serviced residence called Oakwood Premier Incheon with a top-floor penthouse; and 2,200 m<sup>2</sup> of retail space. One of the main business tenants is POSCO Daewoo (a subsidiary of the POSCO conglomerate), whose headquarters occupy the 9<sup>th</sup> to 21<sup>st</sup> floors. Other uses include an observatory on the 65<sup>th</sup> floor plus restaurants and meeting space on the 36<sup>th</sup> and 37<sup>th</sup> floors.

***POSCO Office Complex***

The POSCO Office Complex consists of two towers built from September 2007 to July 2010 on 11.3 hectares at a project cost of US\$338.4 million. Although it primarily serves as POSCO E&C's headquarters, other tenants (including an office of the World Bank) reside there as well. Its layout offers 148,800 m<sup>2</sup> of gross floor space.

## *G-Tower*

G-Tower (formerly I-Tower) is built on 2.4 hectares at the north corner of Central Park. The “G” stands for “green”, “global”, and “growth”. The 150-meter tower was built between July 2010 and May 2013 at a project cost of US\$174.4 million. Its architecture is notable for the triangular cutout that reveals an open-air terrace (see Exhibit 23). As one of Songdo’s landmark structures, it serves as a base for the IFEZ Authority’s public relations offices with the IFEZ PR Center exhibition on its top (33<sup>rd</sup> floor) opened in March 2015. Along with its Sky Garden observation deck (also on the top floor), G-Tower’s 85,900 m<sup>2</sup> of gross floor area contain bank branches, restaurants, and a post office as well.

### **Exhibit 23: View of Songdo IBD G-Tower (Center) from Central Park**



*Credit: Chris White*

In addition, G-Tower houses the branch offices or headquarters of fifteen international organizations whose executive officers and professional staff depend on ICN to connect with their clients throughout Asia and around the world. These include the Association of World Election Bodies Secretariat, the East Asian-Australasian Flyway Partnership, the Global Green Growth Institute, the UN’s Green Climate Fund Secretariat, the North-East Asian Subregional Programme for Environmental Cooperation, the UN Asian and Pacific Training Centre for Information and Communication Technology for Development, the UN Commission on International Trade Law Regional Centre for Asia and the Pacific, the UN Depository Library, the UN Economic and Social Commission for Asia and the Pacific Subregional Office for East and North-East Asia, the UN

International Strategy for Disaster Reduction Northeast Asia Office (plus Global Education and Training Institute), the UN Office for Sustainable Development, the UN Project Office on Governance, the World Bank Group Korea Office, and the Yellow Sea Large Marine Ecosystem Conservation Office.

### *Songdo International Business Square Tower*

At a project cost of US\$225.6 million, the Songdo International Business Square Tower was constructed between October 2007 and August 2011 on 1.4 hectares. In June 2012, the building attained LEED certification at the Gold level. Its building space holds 123,200 m<sup>2</sup> of gross floor area, 77,200 m<sup>2</sup> of which is office and 7,700 m<sup>2</sup> of which is retail.

### *Centroad*

The Centroad complex is located on 1.8 hectares in the northwest arm of the IBD. The developments comprise 202,000 m<sup>2</sup> of gross floor area consisting of two office towers and one 45-story mixed-use tower with 264 officetel units and 294 retail units. Construction occurred from March 2008 to October 2011 with an investment of US\$304.4 million.

## **Residential Developments**

Many of the residential developments in Songdo IBD are also mixed-use developments containing officetel units with retail the lower floors. Several are branded as “The #” (symbol for sharp from musical notation): for example, The # Expo, The # Green Walk, Songdo The # Green Avenue, Songdo The # Harbor View, Songdo The # Master View, The # Central Park I and II, The # First Park, and The # First World. In addition to several Prugio-branded residential complexes – such as Artwin Prugio, Central Park Prugio, Songdo Prugio Harbor View, and Songdo Prugio Worldmark – other primarily residential buildings include Incheon Songdo Hill State, Songdo Kolon Frau, and Songdo Xi Harbor View I and II. Thanks to Incheon city government allowances in adapting development plans to permit more housing projects in response to measured demand, Songdo IBD offers over 20,000 residential units in total (not including those built into mixed-use office towers such as POSCO Tower), many of which

are visible in Exhibit 24 and Exhibit 25. Two of the more notable residential developments are discussed below.

#### **Exhibit 24: Residential Towers in Songdo IBD — Evening Shot**



*Credit: Gale International*

#### ***The # First World***

The First World Towers were home to Songdo IBD's first 7,800 residents. Located just northeast and adjacent to the Northeast Asia Trade Tower, the Convensia center, and the Sheraton Grand Incheon Hotel, the First World complex consists of four main 65-story buildings and auxiliary facilities containing gross floor space of 531,600 m<sup>2</sup>. Its layout is divided into four courtyard communities, each further subdivided into three neighborhoods of about 200 households each. This amounts to 272,400 m<sup>2</sup> of residential space and 77,400 m<sup>2</sup> for a total of 1,596 residential and 1,058 officetel units. 24,400 m<sup>2</sup> are occupied by 294 ground-level retail units.

Work on the project began in 2005 on 10.3 hectares. Leasing to prospective tenants began in 2006, nearly two years ahead of the project's opening in late 2008. Buildout was achieved by January 2009 with an estimated budget of over US\$1.1 billion and new tenants moved in later that year. Among them was Stan Gale, the CEO of Gale International, who lived part-time in one of the penthouses.

**Exhibit 25: Residential Structures in Songdo IBD — Daytime Shot**

*Credit: Michael Chen*

***The # Central Park I & II***

High-rise residential complexes are popular urban housing options in South Korea. Two of the more prominent residential towers are Central Park I and Central Park II, whose exterior lattices of cast stone, glass façades, and curvaceous aluminum add contours to the Songdo skyline; respectively, they have affectionately been referred to as the “basket weaves” and the “dancing ladies”. Both three-tower complexes began construction in 2007 on 3.9 hectares and 3.4 hectares respectively for a combined land area of 7.3 hectares bordering Central Park on its northeast side.

Central Park I was completed in November 2010 and Central Park II was completed in August 2011. Central Park I (205,000 m<sup>2</sup>) provides 729 units while Central Park II (185,000 m<sup>2</sup>) provides 632 units. Together, this amounts to 1,361 units and 320,000 m<sup>2</sup> of gross building area. In their lower levels, both complexes respectively house 24,500 m<sup>2</sup> and 37,000 m<sup>2</sup> of retail (61,400 m<sup>2</sup> total).

## **Chadwick International School Songdo**

For many aerotropolises in Asia, accredited and internationally oriented K–12 academies like Chadwick International School are essential to attract and retain the talent to staff Songdo’s knowledge-intensive business sectors. Chadwick International School is one of South Korea’s top ten K–12 international schools and therefore appealing to younger South Korean professionals and expatriate executives with children. As a sister school to Chadwick School in Palos Verdes, California, Chadwick International School Songdo operates under best practices recommended by the US-based National Association of Independent Schools. Furthermore, Chadwick International is accredited by the US-based Western Association of Schools and Colleges and an authorized International Baccalaureate school as well as a certified Foreign Educational Institution. To recruit foreign talent, qualified students from expatriate families living in South Korea are treated as preferential candidates for admission and may enroll at any time of the year (although nearly 80% of students have been South Korean nationals).

Chadwick International was built between 2006 and 2009 at a project cost of US\$141 million; after it formally opened to lower grade levels in September 2010, the first class of 68 seniors graduated in May 2016. Chadwick International’s 7.1-hectare campus contains 52,600 m<sup>2</sup> of facilities surrounded primarily by residential developments (The # Expo, The # Green Avenue, The # Green Walk, and The # Harbor View). The school’s arts facilities include two indoor performing arts theaters, an outdoor amphitheater, a dance studio, art rooms, and fine art studios. Its athletic facilities include the aquatics center and swimming pool, playgrounds, two gymnasiums, an athletic field, tennis courts, a climbing wall, and a weight training room. Technical education facilities include a robotics room, makerspaces (fostering creativity and entrepreneurship), and a television studio in the basement. Other campus facilities include a library, a telepresence conferencing room, 74 classrooms, nursing offices, administrative offices, two cafeterias, a school store, and outdoor gardens.

As Songdo IBD’s premier K–12 academy, tuition ranges from US\$31,200 to US\$36,700 per year (depending on grade level). Over 80% of Chadwick International’s 200 faculty members hold advanced degrees, the majority at master’s level or higher. With roughly 1,200 students enrolled in the 2018–2019 school year, the average class size is twenty students with a 1:8 faculty-to-student

ratio. In addition to Chadwick International, public elementary schools and high schools operate in Songdo IBD along with the Incheon POSCO high school academy.

### **Jack Nicklaus “Signature” Golf Club Korea**

Songdo IBD’s golf club is 1 of 25 Jack Nicklaus “Signature” Golf Clubs in the world and the only one in Asia. A residential fairway community with 168 detached single-family villas was planned within the golf course (under construction in late 2019). The full course is divided between the Urban Course going out and the Links Course coming back. Each of these feature 9 holes and about 3,735 yards (3,415 m) at par 36 for a total of 18 holes, 7,470 yards (6,830 m), and a par of 72 strokes. This championship-level course (shown in Exhibit 26) has hosted numerous major international golf tournaments since opening in October 2010, including the PGA Champions Tour in 2010 and 2011, the Korea Women’s Open in 2012 and 2013, the Shinhan Donghae Open each year from 2011 to 2014, the Chosunilbo-POSCO Championship in 2014, the President’s Cup in 2015, the Asia-Pacific Amateur Championship in October 2016, the Genesis Championship in 2017, the UL International Crown in 2018, and others.

#### **Exhibit 26: Jack Nicklaus Signature Golf Club Songdo**



*Credit: Gale International*

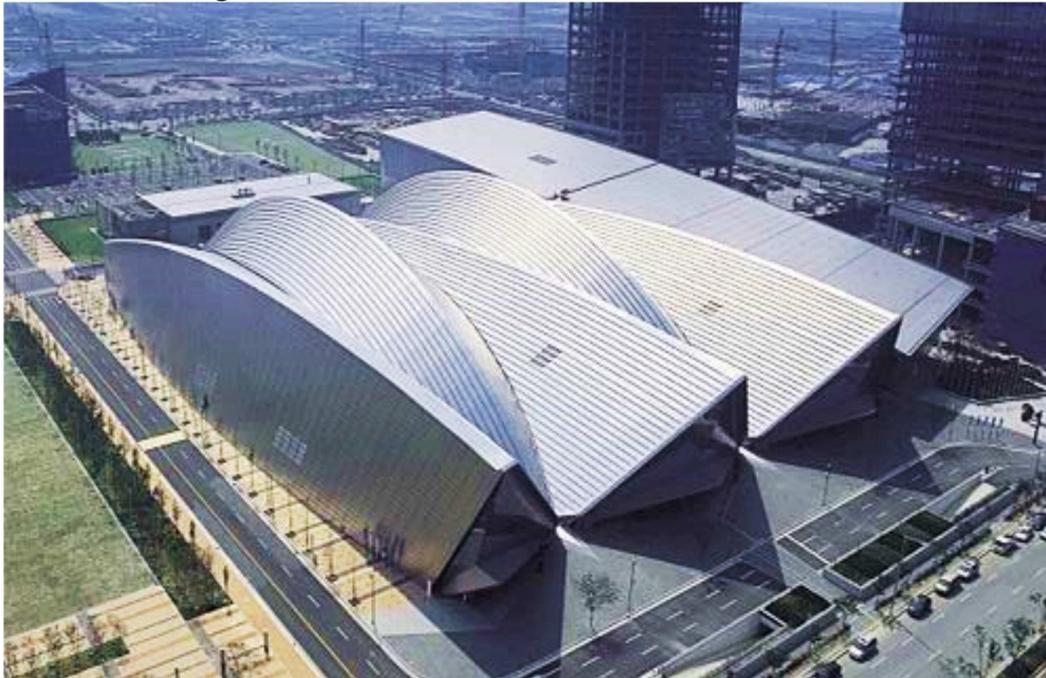
## Convention, Performance, and Arts Centers

Like Central Park, the convention, performance, and arts centers are important parts of the civic fabric and livability of Songdo IBD. In addition to providing meeting space, they showcase art and culture while hosting venues for live performances bringing social vibrancy to the smart city. Three of the most prominent are Convensia, the Tri-Bowl Arts Center, and the Arts Center Incheon.

### *Convensia*

Songdo Convensia Center is the IBD's main facility for conventions and performances, hosting around 500 meetings and performances each year. As another example of Songdo's iconic architectural designs, the structure was awarded Architizer's A+ Award for Theatre and Performing Arts Centers in 2013 (see Exhibit 27). Although often compared to the Sydney Opera House, Convensia's angular archways were actually inspired by the Taebaek Mountains that span North and South Korea. From afar, the building's 35-meter-tall profile resembles the hulls of upturned boats. The 11.7-hectare site is located at the IBD's eastern side just 15 minutes away from ICN by car, making Convensia the closest exhibition center to an international airport in South Korea.

#### **Exhibit 27: Songdo IBD Convensia Center**



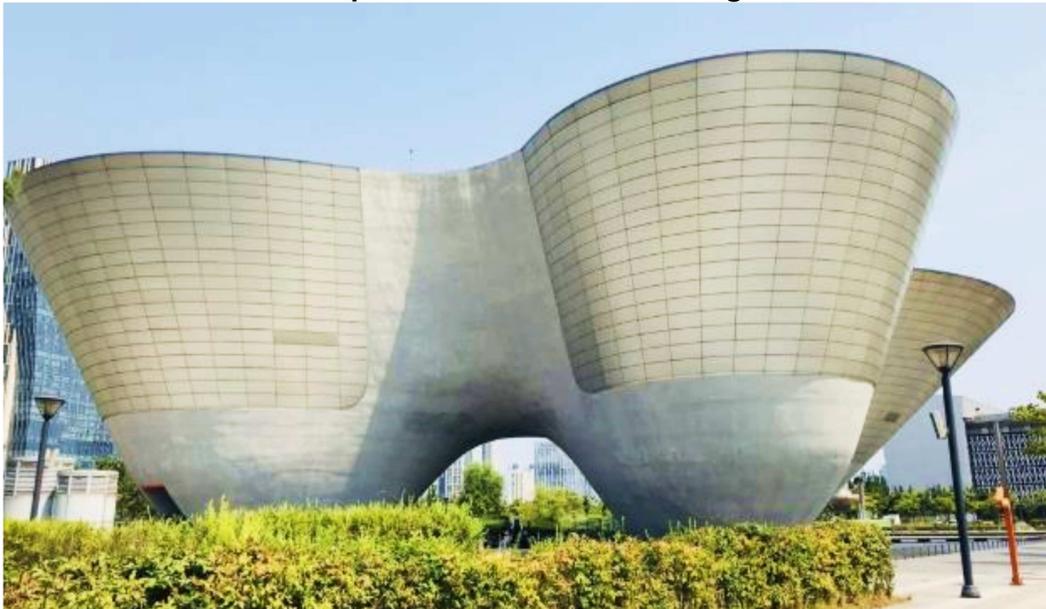
*Credit: Kohn Pederson Fox (KPF) Associates*

Convensia began construction in March 2005 and opened in October 2008 at US\$157 million. Phase 1 completed with 54,000 m<sup>2</sup> of gross building area, enough space to accommodate 2,000 people and 450 exhibition booths. The main exhibition hall features 8,400 m<sup>2</sup> of pillar-free space (the largest in the nation), which is complemented by a 4,300-square-meter ballroom, 23 conference rooms (1,700 m<sup>2</sup>), and other spaces. As part of the IFEZ Authority's broader plan to strengthen its MICE industry, Convensia's Phase 2 facilities were completed in December 2015 and opened in July 2018 at a project cost of US\$126.3 million, doubling total booth capacity to 900 and adding a new ballroom with additional capacity for 2,000 attendees.

### *Tri-Bowl Arts Center*

The Tri-Bowl Arts Center (Exhibit 28) for performance, exhibition, and education in culture and the arts was completed in 2009 with over US\$23.5 million in investment. With a land area of 2.8 hectares in Central Park, the Tri-Bowl's four levels of pillar-free space (three above ground and one underground) contain a multipurpose hall, an event hall for up to 400 people, and a digital library. In 2010, it was granted the Architecture Culture Grand Prize in the Korean Architecture Awards.

### **Exhibit 28: Tri-Bowl Multiplex Cultural Center in Songdo IBD**



*Credit: Korean Dramaland*

The Tri-Bowl was designed to resemble three swooping bowls floating on water. To enter, visitors cross a footbridge that spans a 90 m x 50.5 m pool. At night, this pool (0.3 m deep) reflects colorful LEDs embedded in the building's aluminum façade irradiating the Tri-Bowl. Each of the three neo-futuristic bowls embody dual symbolism; collectively, they simultaneously represent the harmony of earth, sea, and sky – in Cheongna, Songdo, and Yeongjong.

### *Arts Center Incheon*

The Arts Center Incheon is found at the western end of Songdo IBD's Central Park. This seven-story culture and leisure complex (plus two underground levels) was planned to house a museum, an opera house with 1,400 seats, and a concert hall with 1,322 seats along with multipurpose space. After experiencing some financial delays, the concert hall (Exhibit 29) was opened in November 2018. A second stage of construction is expected to add the opera house and the Asia Museum of Contemporary Art. Other potential future facilities include retail outlets, a library, a design school, a music conservatory, and student dormitories.

#### **Exhibit 29: Arts Center Incheon Concert Hall in Songdo IBD**



*Credit: Junckers Industrier*

## Retail Developments

As with many other developments in Songdo IBD, some large retail developments also contain officetel units. Notable among such projects is the NC Cube Canal Walk – a dynamically textured, mixed-use shopping arcade covering 7.6 hectares constructed between January 2008 and October 2009. On the ground and second levels are 340 retail outlets along with international eateries and a fitness club while townhouse-style residences and office spaces occupy the upper levels. The US\$331 million development stretches along a 740-meter-long ornamental canal and is divided into four blocks of five-storied structures. Each block is themed to one of the four seasons. The Spring block is the smallest with a site area of 11,000 m<sup>2</sup> and gross building area of 16,400 m<sup>2</sup>, including 3,700 m<sup>2</sup> of officetel (39 units) and 7,300 m<sup>2</sup> of retail. The Summer, Autumn, and Winter blocks are each close to 22,000 m<sup>2</sup> in site area and 34,000 m<sup>2</sup> with about 12,500 m<sup>2</sup> of officetel (135 units) and 9,500 m<sup>2</sup> of retail space each. This amounts to gross floor area of 120,000 m<sup>2</sup>, 41,000 m<sup>2</sup> of which is officetel space (445 units) and 36,200 m<sup>2</sup> is retail.

The 413,700-square-meter Songdo Lotte Mart hypermarket complex is another of the IBD's main retail developments; opened in December 2013 next to the POSCO Tower (discussed previously) at a project cost of US\$826 million. Across the street, a companion 21-story Lotte Mall with a 305-room hotel and eight cinemas (1,600 seats total) along with extensive shopping is scheduled for completion in 2022. In addition, South Korea's Shinsegae Group together with Singapore's GIC sovereign wealth fund are investing over US\$197 million to construct the Songdo Shinsegae Mall on just under 6 hectares located near the Knowledge and Information Industry Complex; completion was rescheduled for 2021 with an estimated project cost of US\$500 million. Triple Street, a popular tri-level, shopping and entertainment complex opened in April 2017 that borders Songdo IBD, directly connects its four structures with the Hyundai Premium Outlet Mall (opened nearby in April 2016).

## Hotels and Serviced Apartments

The quality of hotels (including physical appearance, guest services, and amenities) are key elements of the first and last impressions of tourists and business travelers (including potential future investors) visiting an aerotropolis. Moreover, hotel services and amenities such as meeting rooms and restaurants

are frequently utilized by both residents and commuters for business and social purposes. Songdo IBD receives high marks in both favorably impressing visitors and serving local communities.

The 5-star Sheraton Grand Incheon Hotel (Exhibit 30) is located on 1 hectare less than 5-minute walk from Convensia and POSCO Tower. All standard 5-star amenities are available at the Sheraton Grand Incheon.

**Exhibit 30: Sheraton Grand Incheon Hotel in Songdo IBD**



*Credit: Starwood Hotel Group*

The Orakai Songdo Park Hotel was constructed in 2009 just across the corner from POSCO Tower and the Lotte hypermarket. With 275 rooms, restaurants and bars, a sauna and 24-hour gymnasium, a business center, and both an indoor and outdoor pool, the Orakai is a full 5-star facility with business meeting rooms, ballrooms, and boardrooms.

Opened in 2014, the 5-star Songdo Central Park Hotel offers 300 en-suite rooms with all expected amenities. Staff fluent in Chinese and Japanese in addition to English and Korean are on call to assist guests. In terms of meeting space, its ballrooms can accommodate up to 730 guests at once. Because of its

central location, it is a short walk to Central Park, the Convensia center, POSCO Tower, and the NC Cube Canal Walk.

There are several other hotels within Songdo IBD, including the 5-star, 30-room boutique Gyeongwonjae Ambassador Incheon in Songdo's Central Park. In addition, 4-star hotels include the 202-room Holiday Inn Incheon Songdo Hotel and the 241-room Hotel Skypark Incheon Songdo.

As noted, executive housing and other high-quality residential options are instrumental to attracting top international managers, executives, and professionals. Thus, as also noted, 28 floors of POSCO Tower are occupied by the Oakwood Premier Incheon, a 5-star serviced apartment complex containing 423 units.

## **Sustainability**

In our discussion of the IFEZ, we discussed smart city technology applications operating in Songdo IBD and other parts of the IFEZ. Songdo IBD is also highly regarded for its sustainability and green attributes. The IBD's greenhouse gas emissions are two thirds less relative to other urban centers of comparable size. Its G-Tower, as noted, is also a hub for environmentally focused organizations: the East Asian-Australasian Flyway Partnership (whose goal is to protect migratory waterfowl), the Global Green Growth Institute's Incheon branch, the UN's Green Climate Fund headquarters, the UN North-East Asian Subregional Programme for Environmental Cooperation, the UN Office for Sustainable Development, and the Yellow Sea Large Marine Ecosystem Conservation Office.

About 40% of land in Songdo IBD is reserved green space. Natural irrigation and strategic landscaping enable net-zero water usage in Central Park; irrigation for the area is supplied through rainwater collection alone. Wind turbines power a 4-kilometer pipe that refreshes the canals' seawater every 24 hours while a double filtration process fueled exclusively by tidal hydropower removes large objects and particulates. The choice of saltwater instead of freshwater for the canals not only eases Songdo's water burden, but also provides the added benefit of a lower freezing point so that water taxis can still operate in colder months.

In addition to the water taxis, bus and subway options are available for public transport. The IBD's walkable Parisian avenues were designed wide enough to

easily accommodate future potential bus and light rail expansions, reducing resident reliance on cars. Residents in Songdo IBD are further encouraged to make use of even more sustainable means of transit. Songdo IBD features 25 km of bike paths, connecting to a larger 145-kilometer network in greater Songdo supplemented by ample pedestrian walkways. Electric vehicle charging stations are distributed throughout the area while parking lots reserve preferential spots for fuel-efficient vehicles and are kept underground to minimize and contain carbon emissions.

There are no garbage trucks in Songdo IBD. All trash is sucked into a single-stream waste processing system. Inlets (see Exhibit 31) are accessible to anyone with a resident card and can be found outside most residential structures as well as public spaces. 55 km of pneumatic pipes roughly 0.75 m in diameter carry deposited waste to seven aggregation sites. Sensors ensure proper sorting of recyclables while organic waste is incinerated to salvage the inherent energy. The automated system functions so well that only seven workers are employed in Songdo garbage processing. A similar pneumatic sewage system delivers blackwater to an anaerobic digester that harvests the resultant methane for additional electricity. The original goal was to achieve 40% water and 76% waste

**Exhibit 31: Pneumatic Waste Receptacles in Songdo IBD**



*Credit: Linda Kronman & Andreas Zingerle*

recycling by 2020, but by 2012, Songdo IBD had already surpassed the waste recycling goal at 76.3%.

Every development site in the IBD has a storage tank for reclaimed water. Rain capture is used for irrigation, landscaping, and gardening while treated greywater is used for toilets, street cleaning, and other non-potable applications. Such greywater recycling has saved over US\$40 million in water-related costs. Even heavy water (deuterium oxide) has been used for landscaping, toilet flushes, and cleaning; according to POSCO's 2012 sustainability report, Chadwick International attained a 30% reduction of its water bill in this way. Most buildings (e.g., POSCO Tower and others) also utilize low-flow plumbing fixtures to reduce water consumption.

Buildings in Songdo IBD use 30% less energy than traditional buildings of similar function. Most implement solar passive design for heating while vegetation on some rooftops provides natural insulation from the summer sun to help lower the overall carbon footprint. Certain facilities even produce a portion of their own electricity using solar, wind, or geothermal sources; the G-Tower uses all three to cover 17.8% of its energy consumption while windows of the First World residential towers provide both insulation and solar generation for air conditioning. Songdo's district-wide energy center recaptures waste heat from power distribution and applies it to water, which can be circulated through houses to warm them up in the winter. Through absorption refrigeration, whereby a heat source is used to power the cooling process, the reverse is possible as well. In addition, ubiquitous smart city technologies reduce average power consumption per person by an estimated 40% compared to other urban centers.

Songdo IBD's planners aimed for all buildings to be certified by the US Green Building Council at the Silver level or higher through the Leadership in Energy and Environmental Design (LEED) program for buildings. LEED certification for nearly all Songdo's buildings was indeed achieved (some up to the Gold level) except for some of the most recent developments for which certification is still pending. In addition, over eighteen buildings received the LEED New Construction certification for their design and construction process, including the Convensia center, the Chadwick International academy, the Sheraton Incheon Hotel, Jack Nicklaus Golf Course Korea, and others. In May 2015, Gale and POSCO completed the 106<sup>th</sup> LEED-certified building in the IBD. In sum, Songdo IBD contains over 2 million m<sup>2</sup> of LEED-certified space, which, accounted for

40% of South Korea's LEED-certified space in 2017, making it one of the largest LEED-certified developments in the world. Additional certification by the Korean Green Building Certification System for all buildings is being pursued as well.

The LEED certifications mark many firsts for South Korea. Respectively, The # Central Park I, Sheraton Incheon Hotel, and Chadwick International are the first LEED-certified residential tower, hotel, and school in the nation. Songdo Convensia is the first LEED-certified exhibition hall in all of Asia and Songdo IBD was the first in Asia to receive certification under the LEED for Cities pilot program. Moreover, in June 2017, Songdo IBD became the first ever to earn LEED for Communities precertification.

### **Degrees of Smart City Success**

Songdo IBD's foresight in smart city development is evidenced by the fact that when planning began in 2000, smartphones were not in use. Although Blackberry and other texting devices became available in the early 2000s, Apple did not release its first iPhone until 2007, fostering the mobile revolution. Songdo IBD project endured through a burgeoning revolution in mobile technology as well as the global financial crisis of 2008–2009. Planners were able to design an urban center that is not only sustainable but also viable as a platform for varied and evolving technologies. Instead of condemning the project to technological obsolescence before construction even finished, the advent of the mobile revolution and Internet of Things actually enhanced the smart capabilities of Songdo IBD.

One of the factors that contributed to Songdo's successes was strong national policy support for Songdo IBD and the broader IFEZ. As noted, funding for infrastructure of Songdo and the IFEZ (including the Incheon and Yeongjong Bridges) was provided mostly by public sources, freeing up private capital for other developments. In fact, Songdo IBD's land reclamation in the IFEZ began in the late 1990s, several years before IBD planning began in the early 2000s. The incentives and bureaucratic preparations already in place in the IFEZ attracted initial foreign investment and paved the way for the formation of the New Songdo International City Development LLC joint venture (with Gale International and POSCO E&C as the main equity holders). The governance structure of the IFEZ helped modulate the scale and scope of many projects during the 2008–2009 financial crisis; for example, adjustments to Songdo IBD's master plan allowed

traditional “danji” apartment developments to be built in place of more ambitious (and expensive) designs. The value of ongoing partnerships between the government (both national and municipal) and major private-sector developers in Songdo and the IFEZ cannot be overstated.

### *Attracting People and Businesses*

Songdo IBD’s population growth began with a fast start when leasing commenced in 2006 for Songdo’s initial block of residential developments (First World Towers). Demand drastically outpaced supply with an oversubscription ratio of 8:1; in fact, all 1,596 units were sold out in two days. In May 2009, 45,000 potential tenants visited model residences for five new residential complexes in just a single weekend. As noted, many of Songdo IBD’s past and ongoing developments, such as Central Park I and II as well as the First World Towers, are primarily residential (although most are mixed-use), totaling some 3.3 million m<sup>2</sup> of floor space.

By February 2020, Songdo IBD’s population (originally planned for 75,000 but increased thereafter to 100,000) had exceeded 80,000 with the total population of the greater Songdo district surpassing 270,000. The number of daily commuters to Songdo IBD was around 70,000. In 2019, approximately 80% of all construction in Songdo IBD was completed, 15 years since building commenced.

Businesses are also locating in Songdo but are arriving at a modestly slower pace than originally anticipated. Only about 20% of new commercial space was occupied in 2013, but by 2015, it was estimated that about 70% of finished offices were occupied. 1,600 domestic and global companies were operating in greater Songdo in 2017, with 60,000 employees. Most residents of the IBD are South Korean families attracted to its excellent schools, POSCO employees, and retirees rather than expatriate executives and knowledge workers of multinational corporations initially envisioned.

Some lags in population and business occupancy growth have been attributed to corresponding delays in construction timelines, such as those unexpectedly caused by the 2008–2009 global financial downturn and disagreements between the developers and the Incheon municipality regarding the ratio of residential to commercial construction. On the other hand, Songdo IBD may yet reach its

forecasted population growth and business occupancy by proposed buildout in 2024 (or shortly thereafter). Ongoing residential and commercial growth will likely be catalyzed by Great Train Express's B Line when it is completed in 2027 since it will connect Songdo IBD directly to downtown Seoul in 25 minutes. Time may be just what Songdo IBD needs to attain its originally targeted levels of population and commercial development.

### *Development Comparisons and Critiques of Songdo IBD*

Songdo IBD has prevailed whereas many other master planned sustainable smart cities on greenfield sites reaped limited success or collapsed. Cautionary examples abound, such as Lavasa smart city in India, the Kilamba sustainability city in Angola, or Dongtan ecotopia outside of Shanghai (to name a few). Abu Dhabi's zero-carbon Masdar City in the United Arab Emirates appears to be dying, with minimal development on its 5.2 km<sup>2</sup> of sand 15 years after initiation in 2006. In Saudi Arabia, the huge, incredibly ambitious and futuristic NEOM megacity is just getting started on 26,500 km<sup>2</sup> but not without skeptics of its viability as envisioned.

More encouragingly, some smart city projects around the world have successfully emulated Songdo IBD's accomplishments. Lake Nona, Florida (USA) is just one example of a large greenfield urban development incorporating sustainable smart city principles that has been remarkably successful. Being near Orlando International Airport has also enabled the 28-square-kilometer Lake Nona community to leverage aerotropolis principles in attracting investment.

Yet, while Songdo IBD is referred to as an "instant city" since it has been built from nothing so quickly on reclaimed land, there may be no universal recipe for developing sustainable smart cities rapidly. Even so, transferrable lessons can be tailored to special circumstances and refined through experience. Equipped with lessons learned at Songdo IBD, KPF (its lead design firm) drew up master plans for the 11-square-kilometer Meixi Lake smart city project in Changsha, China. Whereas Songdo IBD's planning took place over nearly four years, the Meixi Lake master plan was ready in just six months with considerable development occurring soon thereafter. KPF also carried over design principles tested in Songdo IBD to the redevelopment of Boston's Seaport Square, a major urban success story in the US.

Environmental critiques of Songdo IBD have persisted, though, despite its commitment to green initiatives. Land reclamation throughout the IFEZ entailed the destruction of marine ecosystems that served as a natural purification system. Before land reclamation, the tidal flats around Songdo were a well-known habitat for vulnerable avian species like the relict gull, Saunder's gull, and Chinese egret or endangered ones including the black-faced spoonbill and the great knot. To reclaim land for construction, over 90% of greater Songdo's original tidal flats were repurposed and filled with 455 million tonnes (500 million tons) of sand; in the process of reclamation, local fishing industry workers were displaced. Reclamation also involved mining rock material from Munhak Mountain in southern Incheon, stressing local mountain ecosystems.

As for energy consumption, Songdo IBD's conservation efforts are evident. The IBD produces a large part of its own electricity through biofuel combustion and renewable sources like wind, solar, and geothermal generation while, as noted previously, its greenhouse gas emissions are a third of that of other urban centers of similar scale. However, Songdo IBD still receives a portion of its electricity from the national grid, which is significantly dependent on coal-burning power plants.

Many smart city projects with hyper-sustainable visions have sought to minimize dependence on automobiles (with some seeking to eliminate them entirely) in favor of low-carbon or zero-carbon mobility modes. There are bus and rail connections to Songdo IBD and its wide streets were designed for expanded bicycle and bus lanes or light rail lines as well as broad sidewalks to promote walkability. Whereas Songdo IBD's planning goal was to reduce its carbon footprint via decreased reliance on automobile transit and easy walkable access to most key facilities, analyses indicated resident demand for personal automobiles and ample parking under constructed buildings and that much of Songdo IBD's commuter workforce, forecasted to reach up to 100,000, would arrive by car. Consequently, Songdo IBD contains tens of thousands of parking spots occupying hundreds of thousands of square meters (mostly underground to help contain emissions) compared to just a couple thousand bike spots. This altered course of action was a response to balancing sustainability goals with market realities.

The lesson here is that to protect the commercial viability of sustainable smart city projects, their planners must conduct appropriate demand and market

analyses that will enable developers to bridge the theory–practice gap. Compromises of theoretical ideals, conceptual urban visions, and planning goals may be necessary to adjust to marketplace realities.

The incongruity between market realities and Songdo IBD’s original urban vision and development goals led to disagreement between its developers and the Incheon municipality regarding the ratio of commercial to residential development. In establishing these ratios, the Incheon municipal government prioritized commercial construction especially office buildings to attract multinational corporate headquarters functions. But the market revealed clear demand for more residential options and less for corporate offices. In compromise, many residential units were incorporated into plans for office towers and retail complexes (as described previously) and the Incheon government allowed the developers more flexibility in the amount and type of residential structures they could construct.

Sometimes compromises are not possible. Cisco (a Songdo IBD telecommunications partner and former global leader in smart city technologies) decided in December 2020 to shut down its smart city software services line (Kinetic for City) and essentially withdraw from the smart city product business when it could not align its investment strategy with evolving market realities. Similarly, in May 2020, US tech giant Alphabet Inc. (Google’s parent company) abandoned its “Quayside” smart city project on Toronto’s waterfront that emphasized extensive sidewalk data sensors, walking and biking over vehicles, and green building construction, stating that it was too difficult to achieve financial feasibility without sacrificing core concepts of the plan. Again, without adjusting theoretical ideals and planning goals to market realities, the viability of any project will be in doubt.

Social critiques leveled at Songdo IBD echo those directed at today’s smart cities in general and at suburbs in decades past. Some see places like Songdo IBD as socially isolating, impersonal enclaves for the well-off that lack urban ambience, street life, and neighborhood vitality with a technological propensity for the establishment of a surveillance state. Critics also see such places as contributors to socioeconomic marginalization where only those able to afford and fully capitalize on personal gadgets like smartphones and laptops (as well as comparatively high housing prices) can participate in the omnipresent technological ecosystem. The Canadian Civil Liberties Association, for example,

called the cancellation of Alphabet's Quayside smart city project in Toronto a victory for privacy and democracy. Conversely, it could be argued that ubiquitously integrated and increasingly affordable digital technologies can enhance economic efficiency, environmental sustainability, and safety while simultaneously creating new jobs and fostering new forms of connectivity for those at nearly all rungs of the socioeconomic ladder.

Finally, it must be appreciated that Songdo IBD is a brand-new city built completely from scratch in less than 15 years. All new cities require time to cultivate urban ambience, social vibrancy and neighborhood character. Many renowned and currently admired older cities around the world suffered ridicule or disdain in their early years. Architecturally acclaimed St. Petersburg was once scorned as "Peter the Great's Folly" but is today the cultural capital of Russia, internationally lauded for its physical splendor as well as cultural richness. London's nickname, "The Big Smoke", refers to the thick industrial smog that enveloped it in the 1800s while Toronto was once called "Muddy York" for its unpaved roads during its formative century. Nevertheless, both London and Toronto were rated as Alpha-level cities in 2016 by the Globalization and World Cities Research Network. Given time, Songdo IBD and other sustainable smart cities it has inspired may well attain similar global acclaim.

### **About the Authors**

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