Ministry of Foreign Affairs

A Digital Twin Landscape Study South Korea

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Notitie

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1. Introduction

In the fall of 2022, TNO participated in the Smart City Mission to South Korea, engaging with key stakeholders in urban (re)development and mobility. During this visit, TNO discovered a growing demand in South Korea for advanced tools, such as predictive digital city twins, to tackle complex challenges related to liveability and accessibility.

Building on this initial engagement, TNO deepened its collaboration in 2023. The TNO CEO visited Korea, and several Memorandums of Understanding (MoUs) were signed with national and local stakeholders. These agreements focus on (re)designing urban areas to address the pressing challenges faced by large cities in both Korea and the Netherlands. A key takeaway was the recognition that predictive digital city twins are essential for analyzing high-impact urban scenarios, ensuring cities remain vibrant, accessible, and healthy.

As a logical next step, this landscape study explores South Korea's Smart City challenges and capabilities. It proposes further collaboration between Dutch and Korean partners to research, develop, and implement technologies that optimize urban (re)development. Additionally, these tools can support scenario-based planning and technology integration, such as electric and autonomous vehicles, to enhance future-ready urban environments.

This study will map Korea's most pressing urbanization challenges, including traffic congestion, affordable housing, and climate change impacts, while also assessing the current landscape of innovative solutions. While some solutions are already in place, others—particularly in sustainability and circularity—require further development.

By exploring opportunities for mutual collaboration, this study aims to highlight how both countries can benefit from shared knowledge and innovation. Many of these urban challenges are also relevant in the Netherlands, highlighting the importance of working together with Korean partners to develop and implement innovative solutions for sustainable and future-proof cities. To advance this effort, a team of scientists and business developers from TNO traveled to South Korea, engaging with key governmental stakeholders and private sector partners

The study is structured as follows: First, it provides a detailed overview of the current state of Urban Digital Twins (UDTs) in the Netherlands, highlighting key developments and applications. Next, it examines the urban challenges faced by both Korea and the Netherlands, identifying similarities and differences. This is followed by an exploration of business and collaboration opportunities, outlining potential areas for joint research and innovation. Finally, the study concludes with key insights and recommendations, offering guidance on the next steps for future cooperation.

2. The State of Urban Digital Twins in the Netherlands Anno 2024

The Netherlands possesses a robust and active **Urban Digital Twin** (UDT) ecosystem, with significant involvement from government entities, private companies, research institutes and universities. This ecosystem is supported by a strong tradition of data collection and management, exemplified by institutions like **Kadaster**. (Dutch Land Registry) The country's emphasis on open data, interoperability, and real-time analytics has further propelled UDT adoption in various domains, including city planning, environmental monitoring, and infrastructure management.

2.1. Omgevingswet as a Catalyst

The **Omgevingswet**, a new environmental code aimed at simplifying and integrating regulations, was originally set for implementation in 2021 but faced multiple delays. It was finally enacted on January 1, 2024. The law necessitates accessible and integrated data for various stakeholders, reinforcing UDTs as essential decision-support tools. Now that it is in effect, municipalities and urban planners are actively integrating digital twin solutions to comply with regulatory requirements and streamline spatial planning processes. With the implementation of the Omgevingswet, multiple datasets must now be accessible for various stakeholders, supporting decision-making processes through enhanced technical analyses

2.2. Focus on Practical Applications

Dutch UDTs continue to emphasize real-world applications, including:

- **City Planning & Infrastructure Management**: Municipalities use UDTs for urban development, zoning, and monitoring the impact of construction projects.
- **Citizen Engagement**: Emerging participatory models allow residents to interact with 3D city models, enhancing community-driven decision-making.
- **Climate Resilience & Sustainability**: Digital twins simulate climate adaptation strategies, such as flood risk assessment and energy-efficient urban development.
- **Traffic & Mobility Optimization**: AI-enhanced UDTs optimize traffic flow and public transportation planning using real-time sensor data.

2.3. Challenges and Opportunities

While the Dutch UDT ecosystem is thriving, key challenges remain:

- **Funding and Scalability**: Securing sustained investment is crucial, as many UDT projects still rely on city budgets, EU grants, and public-private partnerships.
- **Interoperability & Open Standards**: Ensuring seamless integration between different platforms and datasets remains a priority.
- **Real-Time Data & IoT Integration**: Expanding the use of live sensor data and 5G-enabled UDTs presents both opportunities and technical challenges.
- **Citizen Participation**: While progress has been made, citizen involvement in the design and implementation of UDTs is still limited.

2.4. Key Developments Since 2020

Among key developments in Dutch UDT since 2020 we mention:

1. Implementation of the Omgevingswet (2024):
    a. Municipalities are integrating UDTs for regulatory compliance and streamlined spatial planning.

2. Advancements in AI & Machine Learning:
    a. AI-powered simulations enhance predictive urban planning, climate risk assessment, and emergency response.
3. Expansion of Open Data and EU Regulations:
    a. The High-Value Datasets Regulation (2023)[1] mandates that specific categories of public sector data be made available for free, in machine-readable formats, and accessible via Application Programming Interfaces (APIs). The six thematic categories identified as high-value datasets are Geospatial, Earth observation and environment, Meteorological, Statistics, Companies and company ownership, Mobility. These datasets are expected to generate significant socio-economic or environmental benefits and innovative services
4. Real-Time & IoT-Driven Digital Twins:
    a. IoT sensor integration has improved dramatically. Live, real-time urban digital twins are now in active use, not just for city planning but also for emergency response (e.g., flooding, air pollution monitoring).
    b. Some Dutch municipalities are testing 5G-enabled digital twins for ultra-low latency applications. Is this reflected in the current ecosystem?
5. Funding through Horizon Europe (2021-2027):
    a. Large-scale UDT projects are increasingly funded by EU grants and international collaborations.
6. Growing Role of Startups and Private Sector:
    a. The rise of energy transition-focused and smart mobility startups contributes to a more diversified UDT landscape.
7. Improved Citizen Engagement Strategies: The Netherlands is actively exploring innovative methods to enhance citizen engagement in urban development, including the use of gamification and Virtual Reality (VR).

2.5. Technology and Data Landscape

The Netherlands' Urban Digital Twin (UDT) ecosystem is built upon a diverse and evolving technological landscape. The emphasis is on leveraging open standards, avoiding vendor lock-in, and ensuring long-term scalability. Key aspects include:

- **Core Technologies**: Dutch UDTs utilize a mix of platforms and tools, including Cesium, Mapbox, Unity, JMonkey, and ESRI solutions. Game engines are increasingly used for real-time visualization, while Geographic Information System (GIS) tools remain essential for spatial analysis.
- **Cloud-Based and Edge Computing**: Many initiatives rely on AWS and Azure for cloud-based storage and processing. However, there is a growing interest in edge computing to reduce latency and ensure better data sovereignty.
- **Open Standards and Data Formats**: To avoid vendor lock-in and promote interoperability, open formats such as CityGML, IFC (for Building Information Modeling), and GeoJSON are widely used. The Dutch government actively encourages open data policies.
- **Integration of IoT and Real-Time Data**: UDTs increasingly incorporate Internet of Things (IoT) sensors, remote sensing data, and live data streams from urban infrastructure, enabling real-time decision-making for smart cities.
- **Artificial Intelligence (AI) and Predictive Analytics**: AI-driven models help in scenario planning, anomaly detection, and optimizing infrastructure usage. Machine learning techniques are being tested to enhance simulations and predictive capabilities.
- **Gaia-X and Data Sovereignty**: The Netherlands actively participates in the Gaia-X initiative, which promotes a federated, secure, and interoperable data infrastructure in Europe. This ensures that UDTs benefit from standardized data-sharing frameworks, increased collaboration

[1] European Commission - High-Value Datasets

across stakeholders, and compliance with European data protection regulations while maintaining digital sovereignty.

This dynamic technological foundation enables Dutch UDTs to support real-world applications, from city planning to mobility solutions, while remaining adaptable to future innovations.

2.6. Stakeholder Engagement in the Dutch Urban Digital Twin Ecosystem

The Netherlands has developed a highly collaborative Urban Digital Twin (UDT) ecosystem, bringing together government entities, research institutions, private sector innovators, and growing citizen participation efforts. A key national initiative shaping this landscape is the **Dutch Metropolitan Innovations (DMI)** ecosystem, spearheaded by the Ministry of Infrastructure and Water Management (IenW).

1. **Government & Research Institutions**: The Backbone of UDT Development
   - **National & Local Government**: Cities such as Amsterdam, Rotterdam, and Utrecht actively use digital twins for urban planning, mobility solutions, and climate adaptation. Kadaster (Dutch Land Registry) plays a crucial role in providing spatial data, while water boards leverage digital twins for flood risk and water management.
   - **The Omgevingswet as a Regulatory Catalyst**: The Omgevingswet (2024) is transforming urban governance by requiring all relevant spatial and environmental data to be centrally available and standardized for decision-making. This has accelerated digital twin adoption, as municipalities and provinces must integrate 3D models and simulation tools to comply with the new law.
   - **Dutch Metropolitan Innovations (DMI) Ecosystem:** The DMI ecosystem, led by IenW, is a major collaborative effort aimed at integrating digital twin technology into infrastructure, mobility, and environmental planning. It brings together municipalities, research institutions (such as TNO), and private partners to create interoperable, real-time urban models. The DMI initiative fosters knowledge-sharing and pilot projects, ensuring digital twin applications align with national policy goals. The DMI initiative has secured **€85 million** from the **National Growth Fund** over its five-year duration. Additionally, **the private sector** contributes **€42 million**, bringing the combined investment to €127 million See https://dmi-ecosysteem.nl/blog/nationaal-groeifonds-investeert-85-miljoen-euro-in-dmi-ecosysteem/. Launched in 2023, the initiative is set to run for five years, concluding in 2027.
   - **Research & Academic Contributions:** Leading universities such as TU Delft, Wageningen University, University of Utrecht, University of Twente and Eindhoven University of Technology contribute through research on simulation models, geospatial analytics, and AI-driven urban forecasting. Deltares (a Dutch research institute specializing in water, subsurface, and infrastructure) integrates 3D city models, real-time sensor data, and AI-driven simulations to help cities manage flood risks, heat stress, and water infrastructure in a changing climate. TNO (Netherlands Organisation for Applied Scientific Research) plays a crucial role in developing cutting-edge UDT frameworks and tools, which help cities model complex urban scenarios. As a trusted advisor to local, national, and EU governments, TNO provides expert consultancy, helping policymakers design and implement effective digital twin strategies that drive sustainable and data-driven urban development.

2. **Private Sector Involvement**: Expanding Innovation & Commercialization
   - **Tech Giants & Software Providers** : Companies such as ESRI Netherlands provide essential GIS and 3D modeling software for UDTs. Meanwhile, cloud providers like AWS and Microsoft Azure support scalable urban data infrastructure.
   - **Startups and Niche Solutions**: A growing number of Dutch startups specialize in IoT-based urban monitoring, AI-driven simulations, and real-time data visualization. Companies like Spectral

Energy focus on digital twins for energy grids, while Argaleo develops interactive 3D city models for policymakers.

- **Public-Private Partnerships (PPPs)**: Collaborations between municipalities, research institutes, and private firms have led to the development of integrated platforms like the Amsterdam Digital Twin, where multiple stakeholders contribute data and expertise.

3. **Citizen Participation**: Closing the Engagement Gap
While the Netherlands has a strong data-driven governance culture, engaging citizens in digital twin projects remains a challenge. However, new strategies are being tested to make UDTs more accessible and interactive:

- **Gamification & VR-based Interaction:** Pilot projects in Amsterdam and Rotterdam are experimenting with virtual reality (VR) and serious gaming to make urban planning more immersive and participatory. For example, the AMS Institute is researching how digital twins can help citizens co-design their neighborhoods.
- **Open Data Portals & Dashboards:** Cities like The Hague and Utrecht are making their digital twins available to the public through open data portals, enabling residents to explore urban scenarios such as new housing developments and traffic policies.
- **Co-Creation & Participatory Planning**: Initiatives such as the Future Cities Project in Eindhoven and TNO's Urban Strategy platform involve citizens in scenario testing, ensuring that urban decisions reflect community needs and preferences.

3. Exploring the Urban Challenges Faced by Both Countries

Both South Korea and the Netherlands face urbanization-related challenges in traffic congestion, energy transition, affordable housing, and climate change adaptation. While their geographical and political contexts differ, the challenges show several key similarities and differences:

- **Traffic Congestion**
  Urban areas, especially Seoul, experience significant traffic congestion due to high population density and vehicle ownership. To address this, Seoul transformed the Cheonggyecheon elevated highway into a 3.5-mile stream for pedestrians and cyclists, improving air quality and urban mobility.
  - **Similarities**:
    - High population density in urban areas leads to traffic congestion in Seoul (S. Korea) and Randstad (Netherlands).
    - Both countries rely on public transport and cycling infrastructure to ease congestion.
    - Smart mobility solutions, such as dynamic traffic management and EV incentives, are being developed in both countries.
  - **Differences**:
    - The Netherlands has better-integrated cycling infrastructure, while South Korea is still expanding its bicycle-friendly policies.
    - Seoul has high car dependency, whereas Dutch cities encourage car-free zones.
- **Energy Transition**
  South Korea's industrial growth has increased energy consumption, leading to higher greenhouse gas emissions. The nation faces challenges in transitioning to renewable energy sources to meet climate goals.
  - **Similarities**:
    - Both countries aim for carbon neutrality by 2050 and are increasing investments in renewable energy (wind, solar, and hydrogen).

        - South Korea and the Netherlands both struggle with integrating renewables into their energy grids due to space constraints and reliance on fossil fuels/nuclear energy.
    - Differences:
        - The Netherlands is a global leader in offshore wind energy, whereas South Korea depends heavily on nuclear power.
        - The Dutch grid faces congestion issues due to rapid renewables expansion, while South Korea is scaling up nuclear to stabilize supply.
- Affordable Housing
  Despite efforts to reduce housing shortages, affordability remains an issue, particularly for newlyweds and low-income households. The social housing system struggles to meet demand, highlighting the need for inclusive housing policies.
    - Similarities:
        - Housing shortages and rising prices are major issues in both countries.
        - Governments have introduced public housing programs and regulations on speculative real estate to curb price hikes.
    - Differences:
        - South Korea has massive apartment complexes in urban centers, while Dutch cities focus more on mixed-use, low-rise housing.
        - Seoul's real estate market is highly speculative, whereas the Netherlands has stronger rent control policies.
- Climate Change Challenges
  South Korea is experiencing rising temperatures, increased frequency of extreme weather events like typhoons and heavy rains, and urban flooding. In 2022, Seoul faced record-breaking rainfall, leading to significant damage.
    - Similarities:
        - Both countries face rising sea levels and extreme weather events, requiring strong climate adaptation measures.
        - Investments in urban green spaces, flood prevention, and sustainable infrastructure are priorities in both nations.
    - Differences:
        - The Netherlands has world-leading water management systems (e.g., delta works, dikes), while South Korea is developing more urban flood prevention measures (e.g., Seoul's underground water tunnels).
        - Air pollution is a bigger issue in South Korea (due to industrial emissions and fine dust from China), while the Netherlands focuses more on nitrogen emissions and agriculture's environmental impact.
        - Landslides are a significant concern in South Korea due to the country's mountainous terrain, heavy monsoon rains, and increasing urban development. Recently (2023) Typhoon Khanun triggered multiple landslides, leading to casualties and infrastructure damage.

All the similarities and differences between the Netherlands and South Korea, along with their advanced technological maturity in Urban Digital Twins (UDTs), make collaboration highly valuable. Both countries face complex urban challenges that require integrated policies focused on sustainable urban planning, renewable energy adoption, affordable housing, and climate resilience. By working together and sharing expertise, they can enhance the quality and effectiveness of UDT solutions, ensuring more advanced, data-driven urban management. Collaborative efforts will not only improve the maturity of UDT implementations but also foster innovation, leading to more efficient, resilient, and sustainable cities

4. Business Opportunities with regard to Landscape Study Digital Twins South-Korea

In policymaking, digital twins are mainly applied in the domains of energy, mobility, climate, and spatial planning.
According to the Dutch embassy in South Korea, Mr. Cha (a recognized expert in the field), and other sources, R&D budgets for Smart Cities and digital twins in South Korea have been reduced under the current government. While business opportunities remain, they are shifting away from joint research and knowledge development toward a more business-driven approach, primarily focused on exports by South Korean companies.
South Korean companies, which are predominantly export-oriented, are actively seeking opportunities to test and scale their projects within the EU. They are looking for partners and consortia to support the international expansion of their technologies and products. However, they are generally open to joint co-creation and innovation only when it aligns with their export objectives. Their feasibility studies are primarily aimed at exploring new markets or validating their products.

While identifying significant business opportunities in the short term may be challenging, there are promising and fruitful areas worth exploring. The priority should be:

A. Strengthening Relationships with Key Governmental Institutes

a. **LH (Land and Housing Corporation Research Institute)**
   i. **Contact**: Mr Youngtae Cho
   ii. **Focus**: Digital twin applications for planning and building housing, business parks, and industrial estates. LH specializes in constructing houses and executing projects that seamlessly integrate theoretical knowledge with hands-on application. Their approach is particularly valuable to TNO, as it offers a unique opportunity to test and validate concepts in real-world environments, bridging the gap between research and practical implementation. They are highly willing to collaborate and possess advanced, valuable expertise that aligns well with TNO's interests in particular and Dutch institutes and innovative startups in general. However, their limited budget poses a challenge.

b. **KAIST (Korea Advanced Institute of Science and Technology)**
   i. **Contact**: Prof. Hwasoo Yeo
   ii. Expertise: Specializes in traffic (micro)simulation, AI applications, and large-scale mobility systems (LSMS). They are highly interested in collaborating with TNO, particularly in the domains of UDT and LSMS, starting with small-scale research projects and progressively tackling more complex challenges.

c. **The South Korea's Ministry of Land, Infrastructure and Transport (MOLIT)**
   i. **Role**: Provides subsidies for digital twin innovations in urban planning with cities. MOLIT oversees land use, urban planning, housing, transportation, and infrastructure development, making it more comparable to a combination of the Dutch Ministry of Infrastructure and Water Management (IenW) and the Ministry of the Interior and Kingdom Relations (BZK) in terms of spatial planning and housing policies. MOLIT funds various programs to advance smart city initiatives and infrastructure development. One notable program is the K-City Network: Global Cooperation Program, which supports international smart city projects by providing technical consulting and demonstrating Korean smart solutions in foreign cities. Since its

inception in 2020, this program has implemented 41 projects across 23 countries. The K-City Network Program offers support in two main categories:

1. **Smart City Planning**: Development of master plans or feasibility studies for smart city initiatives[2].
2. **Smart Solution Demonstration**: Implementation of Korean smart solutions to address urban challenges such as traffic, environmental, and energy issues.

Funding amounts up to 600 K€ per project, depending on the project's nature and scope and is typically allocated to government institutions, international organizations, or consortia.

d. Seoul Institute (SI)-TNO

The Seoul Institute (SI) serves as the official think tank for the Seoul Metropolitan Government (SMG), established in 1992 to enhance municipal administration and improve the quality of life for Seoul's citizens. SI conducts extensive research across various urban policy domains, including social welfare, culture, education, city planning, transportation, safety, and environmental management. This makes it an interesting party to collaborate with from the content point of view. The institute is organized into several specialized research divisions, one of which is the *Smart City Research Division.* This division aims for intelligent urban management by researching technologies, policies, and platforms in urban planning, transportation, energy, and environmental fields, incorporating IoT, big data, and AI.
Through its comprehensive research efforts, the Seoul Institute plays a pivotal role in shaping policies that address urban challenges and promote sustainable development within Seoul.

i. **Initiative**: Seoul Metropolitan Government (SMG) has commissioned S-Map, a 3D digital twin of Seoul with ambitions to enhance its functionality, such as enabling "what-if" scenario predictions and optimizing service and traffic management. The Seoul Institute is keen to collaborate in all of these fields mentioned above and also in the field of validation. Upon assessment, the maps were found to be inadequate in certain areas, highlighting the need for further refinement.

e. SMG – TNO (Seoul Metropolitan Government)

The Seoul Metropolitan Government (SMG) is the administrative authority overseeing Seoul, South Korea's capital and largest city. The SMG is structured with one mayor and three vice mayors, responsible for political and administrative affairs. Seoul is subdivided into 25 autonomous districts (gu) and 522 administrative neighborhoods (dong). The Seoul Metropolitan Government's (SMG) budget for 2025 is approximately €34.7 billion. The budget is roughly allocated as follows:

- Society & Welfare: €12.6 billion (40.0%)
- Culture & Tourism: €728 million (2.3%)
- Industry & Economy: €620 million (2.0%)
- Public Safety: €1.3 billion (4.1%)

[2] https://www.molit.go.kr/english/USR/BORD0201/m_28286/DTL.jsp?cate=&desc=asc&id=eng0301&idx=3030&item_num=0&key=&lcmspage=4&mode=view&old_dept_nm=&order=&search=&search1=&search_dept_id=&search_dept_nm=&search_gbn=&search_regdate_e=&search_regdate_s=&search_section=&source=&srch_mng_nm=N&srch_prc_stts=&srch_usr_ctnt=N&srch_usr_nm=N&srch_usr_titl=N

- Urban Planning & Housing Redevelopment: €337 million (1.1%)
- Transportation & Traffic: €1.6 billion (5.0%)
- Parks & Environment: €1.9 billion (5.7%)
- Office of Education & District Support: €7.6 billion (24.1%)

for comparison, the Netherlands' Ministry of Infrastructure and Water Management (IenW) has allocated €14.7 billion for its 2025 budget.

i. Context: Seoul, the capital of South Korea, is home to approximately 10 million residents, accounting for nearly 20% of the nation's 52 million people. The city's population peaked at 10.97 million in 1992 but has since experienced a gradual decline due to factors such as low birth rates and an aging population. Despite these demographic challenges, Seoul operates as a largely self-sufficient metropolis, addressing complex urban issues ranging from infrastructure development to social services. This autonomy positions Seoul as a valuable collaborator in Urban Development and Transformation (UDT) initiatives, offering insights into sustainable urban planning, innovative public policies, and adaptive strategies to demographic shifts. Engaging with Seoul in UDT collaborations can provide valuable perspectives on managing urbanization challenges, implementing smart city technologies, and enhancing residents' quality of life in a rapidly changing global landscape.

f. LX: A Key Player in South Korea's Climate-Focused Digital Twin Development
LX, the Digital Twin Institute, is a South Korean organization actively engaged in climate prediction and damage minimization through a four-year research and technology program (2024–2027), backed by €23 million in funding. The institute has a strong interest in integrating advanced modeling and simulation tools, particularly those developed by Deltares, with the digital twin (DT) platform of TNO.
One of LX's main ambitions is to enhance climate resilience by combining satellite saturation data with TNO and Deltares models, improving predictive accuracy and decision-making in urban planning. However, access to GIS, satellite, mobility, and built environment data remains a key challenge in South Korea, making international collaboration with partners like Deltares and TNO valuable.
Additionally, LX is working on a comprehensive 3D library of climate change mitigation materials and facilities, though notably without incorporating cost-benefit analyses. This unique approach presents an opportunity for further collaboration, potentially in areas such as urban resilience, infrastructure adaptation, and scenario-based planning.

g. Gyeonggi-do – Province Noord-Brabant MoU.

In October 2024, the Dutch province of Noord-Brabant and South Korea's Gyeonggi Province formalized their collaboration by signing a Memorandum of Understanding (MoU). This agreement was executed by Noord-Brabant's King's Commissioner, Ina Adema, and Gyeonggi's Governor, Dong Yeon Kim, during a meeting at the Noord-Brabant provincial house.
Key Aspects of the MoU:

- Focus Areas: The partnership emphasizes cooperation in high-tech sectors where both regions excel, notably semiconductors and battery technology. Brabant
- Strategic Objectives: The agreement aims to foster collaboration across five domains: *advanced industries, climate technology, smart agriculture,*

youth exchanges, and cultural programs.

B. Strengthening Business Collaboration with Private Parties

a. **EU-Horizon**

From January 1, 2025, South Korea has officially joined Horizon Europe, the European Union's research and innovation program.

Conditions for Participation:

i. **Focus on Pillar II(i.e. Global Challenges & European Industrial Competitiveness)**: South Korean researchers and organizations can participate in Pillar II of Horizon Europe, which focuses on global challenges and industrial competitiveness.

ii. **Equal Conditions**: Participation takes place under almost the same conditions as EU member state organizations, including direct funding from the program.

iii. **Transition Period**: This participation is part of a transitional arrangement, pending the formal signing of the Association Agreement, which is expected to take place in 2025.

With this step, South Korea becomes the first Asian country outside the European region to be associated with Horizon Europe, opening up new collaboration opportunities for researchers, organizations, large enterprises and SMEs from both countries.

b. **NAVER**

Naver is an suitable private organisation to consider in this setting. In the realm of Urban Digital Twins (UDTs), Naver has demonstrated significant advancements. The company's digital twin platform involves creating virtual models of physical objects, systems, or environments, facilitating real-time monitoring, simulation, and analysis. This technology enhances urban planning, infrastructure management, and disaster response. Their technology is quite advanced but lack reliable data and validation strategies.

Naver has also embarked on international collaborations, such as a five-year, $100 million project with the Saudi Arabian government to develop digital twin platforms for major cities, including Riyadh, Medina, Jeddah, Dammam, and Mecca. This initiative aims to create highly accurate 3D models to improve urban management, integrating services like smart city infrastructure planning and flood simulation. Naver is keen to collaborate on business opportunities in the Middle East and Southeast Asia, particularly in urban planning projects in Saudi Arabia and the Philippines, as well as traffic and mobility planning initiatives in Vietnam.

5. Conclusions and Recommendations:

The landscape study has highlighted the significant potential for collaboration between the Netherlands and South Korea in advancing Urban Digital Twin (UDT) technology. By combining South Korea's cutting-edge digital twin capabilities with the Netherlands' strong expertise in data modeling and systemic analysis, both countries can strengthen their technological leadership and tackle complex urban challenges more effectively.

During the visit to South Korea, a fundamental difference in approach to funding and collaboration became apparent. In the Netherlands, stakeholders often form consortia to jointly apply for funding and work in a federated manner. In contrast, South Korean organizations typically compete for entire funding opportunities individually, rather than pooling resources internally to optimize project financing.

Despite this difference, we do not foresee major obstacles to cooperation, as there is a strong willingness from both sides to collaborate and learn from each other. However, securing funding for joint initiatives remains a challenge that needs to be addressed strategically.

A key recommendation is to start with small, focused projects that deliver tangible, short-term results. These projects should be designed for rapid assessment and evaluation, allowing for an iterative approach: successful initiatives can be expanded and deepened, while those that do not meet expectations can be discontinued early. This practical, results-driven approach moves beyond the expression of intent and into concrete collaboration, strengthening trust and efficiency between Dutch and South Korean partners over time.

A strong recommendation for joint funding would be to develop a structured co-funding mechanism that aligns with the financial models of both South Korea and the Netherlands. Some key approaches could include:

1. **Bilateral Funding Programs**: Advocate for a dedicated funding scheme between South Korean and Dutch innovation agencies (e.g., KAIA, MOLIT, NWO, RVO) that supports joint research and development (R&D) projects in Urban Digital Twins (UDTs). Such a fund could lower financial barriers and incentivize collaboration.

2. **Hybrid Funding Model**: Encourage a hybrid model where both countries contribute funding, but with flexibility—South Korean partners could secure local funding (e.g., MOLIT smart city subsidies), while Dutch partners apply for European or national funding (e.g., Horizon Europe, RVO innovation grants).

3. **Pilot Project Co-Funding**: Start with small-scale pilots where both sides commit partial funding. This lowers risk and demonstrates feasibility before scaling up. The success of these pilots could then serve as leverage for securing larger grants.

4. **Public-Private Partnerships (PPP)**: Establish a structured PPP framework that enables private sector involvement from both countries. For example, South Korean technology firms (e.g., Naver, LX) could invest in projects where Dutch expertise (TNO, Deltares) provides the scientific and systemic foundation.

5. **EU-Korea Collaboration Mechanisms**: Explore how South Korea's new Horizon Europe association could facilitate joint applications for European funding. Many Horizon Europe calls encourage international collaboration, and Korea's participation opens new opportunities for consortia involving Dutch and Korean entities.

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