Developing a Livable Smart City for the 4.0 Economy: Thailand's EECiti

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May 2025

ABSTRACT

A location's quality of life and availability of talent have become key factors in foreign investment site selection by technologically sophisticated, knowledge-based firms that characterize the 4.0 (Fourth Industrial Revolution) economy. EECiti, located in Thailand's Eastern Economic Corridor (EEC), is a greenfield comprehensive city designed to optimize its commercial, digital, environmental, institutional, leisure, residential, and other quality of life features to make it a magnet for 4.0 multinational firms and their talented employees. How Artificial Intelligence (AI) will be used to enhance the livability and smartness of EECiti is discussed.

A new comprehensive city called EECiti, fully embracing digitization and sustainability, will play a pivotal role in Thailand's Eastern Economic Corridor (EEC) achieving its development objectives. The EEC is the country's flagship initiative for executing the government's National Strategic Plan and Industry 4.0 (Fourth Industrial Revolution) policies to restructure, revitalize, and upgrade its economy, making it more innovative, competitive, and prosperous.

Proposed in 2017 and formally launched in 2018, the initiative targets Thailand's three most industrially advanced, export-oriented provinces—Chachoengsao, Chonburi, and Rayong—spanning 13,266 sq. km. along its eastern seaboard. Over US\$60 billion has been spent or is in the pipeline from a combination of public and private-sector sources to 1. substantially improve EEC air, sea, and surface transportation infrastructure; 2. accelerate advancement of its business services and industry value chains; 3. enhance educational institutions and lifelong learning from preschool to post-doctoral programs; 4. increase the EEC pipeline of skilled domestic labor while attracting expat talent, and 5. augment entrepreneurial ventures and urban places via innovation districts and the new livable smart city.

To speed national and global connectivity, the EEC's international airport, U-Tapao (UTP), is being substantially improved, with more than US\$ 6 billion being invested in its infrastructure and facilities. UTP will be served by a high-speed rail line scheduled for operation in 2029 that will link it and major EEC urban centers to downtown Bangkok and the metropolises' two gateway airports (Suvarnabhumi and Don Mueang) within 60 minutes. This time-reducing surface connectivity will effectively make UTP, with a planned annual capacity of 60 million passengers, Bangkok's third international airport. (See Exhibit 1).

Three deep-water ports are likewise being modernized and expanded to facilitate supply chain imports and EEC exports. Dual-track freight rail and topnotch highways efficiently connect these seaports to inland ports and major EEC industry nodes for faster and more efficient supply chain management.

In addition to EECiti, four smaller innovation hubs are planned or being developed to accelerate EEC 4.0 industry growth. These are dedicated to EEC's digital (EECd), genomic (EECg), innovative energy (EECi), and medical (EECmd) advancement.

Given the talent needs of targeted 4.0 sectors such as advanced business services, aerospace, biomedicine, intelligent electronics, and next-generation vehicles, human capital development is receiving high priority. Specialized training programs at EEC technical colleges have commenced as well as initiatives to produce substantially more university STEM graduates and postgraduate degree holders. At the same time, projects are underway to create the residential, institutional, and urban environments that will appeal to skilled workers and well-educated professionals and executives from elsewhere in Thailand and abroad.

Stripped to its basics, the current strategy overlays the EEC's traditional infrastructure improvement and industrial estate promotional privileges (incentives) geared to factory recruitment with urban/institutional improvements to develop and attract talent required to staff more innovative,



Exhibit 1. Map of EEC Showing EECiti, Innovation Districts, and Key Infrastructure

technologically sophisticated, knowledge-based 4.0 economy firms. This advance in strategic thinking evolved in response to new global realities that were profoundly challenging Thailand's competitive position. These realities include 1. accelerating applied science, spawning pioneering products and services that are creating and capturing new markets, 2. rapidly changing manufacturing operations and digitized business services processes catalyzed by artificial intelligence and other breakthrough technologies, 3. growing roles of wealthgenerating entrepreneurial and innovation-based enterprises, 4. talent demands of 4.0 firms along with the digital and livability wants and needs of their employees, 5. heightened global political tensions impacting foreign investment location decisions, knowledge transfer, and trade, and 6. increasing numbers of other Asian nations aggressively recruiting the same 4.0 firms that the EEC is seeking to fuel its economic growth and prosperity in the decades ahead.

Such global realities prompted a reconsideration of EEC's industrial recruitment strategy which, as noted, was straightforward. Develop excellent multimodal transportation infrastructure offering foreign-headquartered manufacturing firms seeking lower-cost, hard-working labor with good local, national, and global connectivity, construct modern industrial estates to house and serve factories, and provide incentives that attract factories to the industrial estates and elsewhere in Eastern Seaboard provinces.

This strategy had worked well. Between 1985 and 2020, the three EEC provinces received a total of nearly US\$90 billion in investment, the vast majority by foreign-owned manufacturing firms.

Transportation infrastructure, labor costs, and incentives remain important in the foreign location decision of most traditional industries. Yet, for many 4.0 economy firms and others further up manufacturing and business services value chains, a different set of location priorities has emerged. Along with macroeconomic and political stability, 4.0 industry site selection priorities entail, among others, adequate numbers of technologically skilled labor and qualified executives and professionals; a solid pipeline of creative talent; nearby supporting research universities and institutions, intellectual property and patent protection, and livability and quality of life factors such as an attractive, clean, and safe physical environments, walkable mixed-use residential/commercial neighborhoods, excellent education and healthcare, and digital, leisure, and urban amenities.

EECiti's Talent Attraction Value Proposition

Thailand's National Strategy and Industry 4.0 Policy articulate why skills development and talent attraction are essential for the nation to fully participate in the Fourth Industrial Revolution. Focus group interviews with 4.0 firms by EEC consultants reaffirmed this. It was clear, however, that the three EEC provinces have a talent deficit in their existing labor force to appropriately staff innovative, knowledge-based firms and their supporting higher education and research institutions.

Consequently, there have been regular calls for upgrading EEC vocational schools, technical colleges, and university-based education for the 4.0 economy. These upgrades are underway. Yet, it will likely take up to a decade for their impacts to be fully felt, especially from reforms at the highest education levels. Nor is it likely that the upgraded EEC education institutions will be able to produce adequate quantities of executives, managers, scientists, and other professionals to staff the scale and scope of next-generation manufacturing and advanced business services necessary to transform the EEC. Substantial numbers of executives, professionals, and highly skilled individuals will therefore need to be recruited from the Bangkok metropolitan area and other parts of Thailand, as well as from abroad.

Meeting this need will be a key value proposition of EECiti. It is specifically designed to provide residential, institutional, digital, environmental, and urban amenities that 4.0 firms are prioritizing, and that their well-educated employees desire to live, work, create, stay, and raise and educate their families in the EEC. As just one example, innovative talent tends to be technologically savvy and environmentally conscious. EECiti has therefore been planned to offer ubiquitous state-of-the-art digitization, complemented by sustainable practices in all business, infrastructure, and residential development.

There is no city in Thailand and, in my opinion, only a select group in the world where the complete menu of knowledge workers' wants and needs is adequately served. EECiti's ambition is to be eventually counted among that group.

The new city, covering 24 sq km, is stewarded by the Eastern Economic Corridor Office of Thailand (EECO) which reports to the Prime Minister. It is located 160 km from downtown Bangkok on a greenfield site 12 km from the seaside resort of Pattaya and 15 km from U-Tapao International Airport. EECiti is situated at the center of the EEC Aerotropolis that stretches outward 30 km from U-Tapao Airport anchoring a four core city system, including U-Tapao's commercially-based Airport City, that constitutes the EEC's Middle Aerotropolis. The Inner Aerotropolis entails the area up to ten kilometers from U-Tapao while its Outer Aerotropolis extends up to 60 kilometers from the airport. (See Exhibit 2).

EECiti's distance from Bangkok could pose a barrier to innovative entities and their talented employees who require specialized interenterprise and personal contacts that allow the transfer of uncodifiable knowledge derived from face-to-face meetings. Despite improving online meetings, many executives and professionals working and/or residing in EECiti will thus routinely require faceto-face interaction with other specialized professionals who may not be present in the EEC. These significant other professionals might include patent attorneys, corporate lawyers, FinTech managers, and other high-order regulatory or financial experts, or medical specialists and scientists, along with their sophisticated equipment, only available at Bangkok's hospitals and research centers.

Once the proposed light rail link from EECiti to the Pattaya/Jomtien highspeed rail station is operating, the new city will be within a one-hour commute to downtown Bangkok's plethora of specialized enterprises, professionals, and facilities, and with quick access to Suvarnabhumi airport's extensive national and global air connections required for face-to-face interactions with those located at great distances. As U-Tapao Airport expands its route network, such speedy long-distance connectivity will be even more proximate to those residing or working in EECiti.

Given its efficient temporal access to Bangkok and its gateway airports, plus the quality of life it will offer, EECiti is anticipated to appeal to younger managers and professionals now residing in the metropolis. For instance, for



Exhibit 2. EECiti's Central Location in the EEC Aerotropolis

child-rearing and livability reasons, many young executives and knowledge professionals choose to reside in Bangkok's outer suburbs and commute more than an hour on weekdays to their downtown jobs. With 60-minute access to Bangkok, but with less congestion, cleaner air, and its planned range of commercial, housing, institutional, and leisure amenities, EECiti should attract a portion of this large, well-educated Bangkok suburban resident subgroup, especially as 4.0 firms providing appropriate employment opportunities expand in the EEC Aerotropolis. EECiti's features and their related elements, which are elaborated below, are expected to appeal to and attract expat talent, as well.

EECiti Livable Smart Features

Forecasted to accommodate 350,000 residents and employ 200,000 by 2033, EECiti will exhibit four fundamental features: livability, smartness, sustainability, and "Thainess". Livability is comprised of five elements: 1) environment, 2) education, 3) health and well-being, 4) infrastructure, and 5) safety and security. Smartness is made up of seven elements: 1) smart economy, 2) smart people, 3) smart environment, 4) smart energy, 5) smart infrastructure, 6) smart mobility, and 7) smart governance. Sustainability is characterized by low carbon-emitting utilities and mobility systems, LEED-certified buildings, green spaces, and recyclable water and waste processing systems. "Thainess" is reflected in EECiti placemaking, architecture, lifestyles, culture, and food.

Together, these four features and their elements will create an urban complex where nature, people, culture, education, business, and technology merge in a mutually reinforcing manner. (See exhibit 3).

Artificial intelligence (AI) will play a major role in generating this symbiosis through:

 Intelligent Zoning and Optimized Land Use: AI will assist in the design of urban layouts that optimize land use and balance residential, commercial, and industrial zones effectively to better accommodate a mix of uses that benefit from their proximity while mitigating adverse environmental effects. Form-based codes will be generated through AI that will add to appearance as well as functionality giving EECiti the"look and feel" of a smart, livable city. By analyzing data on projected EECiti population densities, economic activities, and environmental factors, AI will also suggest the most appropriate distributions of land use to reduce travel journeys and promote efficient mixed-use residential and business development.

Aerotropolis Business Concepts Article



Exhibit 3. Aerial Rendering of EECiti

- Transportation Networks: EECiti will apply AI to simulate traffic, leading to more efficient transportation networks that reduce travel times, traffic congestion, and pollution. This will include designing more compact areas with integrated mobility systems that encourage walking, cycling, and the use of low-carbon-emitting public transit. No intercity roadways will traverse EECiti's core areas making them more pedestrian and people oriented. In the broader EEC, AI will help design integrated transport networks connecting an EECiti ring road with other key aerotropolis transport nodes (e.g., U-Tapao Airport, Pattaya high-speed rail station), improving road layouts and public transit systems to facilitate easy and quick access to these nodes and other key aerotropolis locations.
- Adaptive Buildings: AI will contribute to the design of EECiti buildings that can mutate based on usage patterns, weather conditions, and other environmental variables. This includes buildings that adjust their form or function in response to different needs or conditions, promoting energy

efficiency and comfort. AI-based building management systems will regulate lighting, heating, ventilation, and air conditioning based on occupancy and weather conditions, reducing energy consumption and carbon emissions.

- Green Spaces and Public Areas: AI will also be used to strategically plan the placement of pocket parks, green spaces, and other public areas to mitigate environmental problems and enhance the quality of life for residents. Thirty percent of the urban complex will remain green. By analyzing large amounts of environmental data impacting EECiti, AI will help in detecting urban heat islands and the placing green spaces to maximize both ecological and social benefits.
- Disaster Resilience: By using AI to analyze historical data on natural disasters and ongoing climate data, EECiti will be designed to be more resilient to climate change and natural disasters. This will include strategic placement of buildings away from flood plains, designing water runoff systems that mitigate flooding, and provide for wind and fire-resistant landscapes.
- Smart Mobility: AI will contribute to more sustainable mobility within EECiti and the greater EEC Aerotropolis through autonomous vehicles and smart traffic management. These smart systems will optimize commuter routes and roadway safety for EECiti business people and residents, utilizing real-time data. Public transit nodes will be pervasive offering convenient low, or no emission emitting vehicles or trams connecting the transit nodes spaced throughout EECiti at no more than 400 meter intervals.
- Environmental Monitoring and Sustainability: AI will be critical to promoting EECiti and broader EEC sustainability. By analyzing data from sensors tracking air and water quality and other environmental factors, AI will help identify pollution sources and assist in the enforcement of environmental regulations as well as contribute to renewable energy integration for efficient and sustainable resource use.

- Smart Utilities: AI will help optimize EECiti utilities by improving energy, water, and waste management systems. For example, smart microgrids will balance energy supply with demand while advanced water management systems can detect leaks to reduce waste and serve the city more efficiently. Biocircular (trash to energy) processes will be implemented as will water saving technologies ranging from rain harvesting to recycling.
- Security and Safety: AI will enhance EECiti's security by providing sophisticated surveillance and rapid response capabilities. Automated facial recognition for identifying persons of interest and visual anomaly detection to detect safety and security incidents, bolster public safety by aiding in predictive policing and deployment to address emergencies.
- Healthcare Services: AI will enhance EECiti healthcare by improving disease surveillance, resource allocation, and patient management. It will be used to predict disease outbreaks from healthcare data patterns, enabling proactive responses to disease threats. Additionally, AI will be applied to improve EECiti's hospital resource management and patient flows, reducing wait times and improving the quality of care.
- Lifelong learning: AI will be instrumental to upgrading all levels of EECiti institution-based education. It will also be applied to upgrade noninstitutional education through home schooling as well as lifelong learning well into retirement through virtual libraries and information centers, all contributing to smarter people.
- Governance and Civic Engagement: AI will augment EECiti's smart governance by streamlining administrative processes. Many routine tasks will be automated, allowing human resources to focus on complex issues. AI-enabled communication platforms will facilitate better problem reporting and feedback between EECiti residents and officials, thereby enhancing citizen engagement and residents' satisfaction.
- Economic Development: By analyzing EEC and national market trends, consumer behavior, and investment opportunities, AI will derive insights

that help EECiti's officials make informed decisions and identify the best types of businesses to recruit. The application of AI can also help EECiti remain economically vibrant and adaptable to changing local, national, and global market conditions.

EECiti AI-assisted planning and operational activities will be supported by a smart city data platform. This big data platform will connect information and data across all public and private sector entities in the new city, contributing to its seven elements of smartness.

Utilities and Infrastructure

Pivotal to EECiti livability, smartness, business/institutional, and urban development are its utilities and infrastructure. These will be provided through six public-private partnership (PPP) arrangements with EECO and other Thai government agencies. The PPPs include:

- 1. Power and energy provision through constructing and operating the EECiti's power plant, powerlines, gridlines, EV chargers, and renewable energy facilities
- 2. Water management, including water supply, pipelines, treatment, and recycling systems.
- 3. Solid waste management, such as waste treatment at source, solid waste recycling, and Bio-Circular-Green (BCG) waste-to-energy use.
- 4. Public transportation such as EECiti trams, light rail, buses, and public service electric vehicles.
- 5. Digital infrastructure including 5G and eventually 6G networks, fiber optics and cloud systems, along with EECiti's smart data (AI) platform.
- 6. General utility duct, which will contain all EECiti underground utility systems.

The PPPs' terms of reference documents for private sector bidding entities are expected to be released in 2026, with selection and contracts awarded by the end of that year. Land for infrastructure and utilities will be delivered by the government to the awardees in 2027, with all infrastructure and utilities expected to be completed and operational by 2029.

Business and Institutional Development

To achieve its objectives, having a commercially prosperous and institutionally rich EECiti is as important as being smart, livable, and environmentally friendly. In fact, successful business and institutional development are the foundation for most other key EECiti features and elements.

The EECiti is implementing a 5+1 model with five targeted business or institutional zones and one that is represented throughout much of the EEC. These are the 1. Central Business District (CBD) 2. Health and Medical District, 3. Education and R&D Hub, 4. Sports District, and 5. Bio-Circular-Green (BCG) Industrial Park, plus Mixed-use Residential/Commercial (see Exhibit 4). All are guided by the 7 elements of smartness.



Exhibit 4. ECCiti Functional Zones and 7 Elements of Smartness

The CBD will house local corporate headquarters and administrative staff of larger firms across all sectors operating in the EEC. It will also contain commercial banks and other financial institutions supporting EEC businesses, residents, and capital investment; insurance, brokerage, and commercial real estate firms, and a planned trade center.

The medical and healthcare district will host hospitals, wellness, and precision medicine facilities. Also being targeted are firms conducting clinical trials, traditional Thai medicine, and telemedicine. Given EECiti's proximity to Thailand's seaside resorts and excellent access to international airports, medical tourism functions are anticipated along with healthy lifestyle and anti-aging spas, as well as regenerative medicine clinics.

The Education and R&D hub will house branches of Thai and international universities offering undergraduate and graduate education plus doctoral and post-doctoral research programs, an advanced manufacturing research center, a center for innovation in future foods, start-up incubators, and early-stage business accelerators. The hub will also have K-12 international schools.

The Sports and Recreation district is largely being developed by the Sports Authority of Thailand. It will contain Thailand's International Sports Park, anchored by a proposed 80,000-seat stadium for major sporting events to boost sports tourism and an Olympic-grade aquatics center, along with recreation fields and sports medicine clinics. A feasibility study is currently underway assessing a variety of other sports-related facilities and programs such as multisports training facilities, human performance academies that integrate education with sports training to develop the minds and bodies of young elite Thai and other Asian athletes, and a sports science center.

The BCG industrial park is being developed in partnership with the Industrial Estates Authority of Thailand. It will focus on sustainable industrial practices, recruiting green manufacturers and establishing centers for sustainable industrial practices such as low-carbon manufacturing, material recovery systems, and waste as resource systems.

Mixed-use residential/commercial development will not be a single district but distributed in multiple EECiti locations to provide appropriate housing, shopping, dining, and entertainment in these districts. This will range from highrise luxury condominiums with nearby upscale retail, fine dining, and nightlife, plus four and five-star hotels in the CBD, to single-family housing developments in EECiti's residential zone with small neighborhood commercial areas within walking distance.

EECiti Development Timeline

Exhibit 5 presents the timeline for EECiti's development plan. It is divided into two phases: the five-year site preparation phase from 2023 through 2027 and the five-year development phase from 2028 through 2032. Overall development cost is estimated to be approximately US40 billion dollars, with the private sector contributing the majority of investment.



Exhibit 5. Planned Timeline for EECiti Development

EECiti land acquisition by the government from former property owners has been completed, as have master plans and business, industry, and institutional validation studies. As I noted, PPP documents for private sector bidding for infrastructure and utilities contracts have been drafted and will be released by the end of 2025. Both bidding and selection of the firms to construct and operate the infrastructure and utilities will be done in 2026, with land leases completed and construction commencing in 2027. Simultaneously with the completion of the high-speed rail system and U-Tapao Airport's first-phase modernization and expansion in 2028, EECiti land will be delivered for business and residential development by private sector investors. All infrastructure is scheduled to be ready by 2029, and the EECiti first phase buildout in 2032.

This timeline assumes all components of EECiti development proceed on schedule. If unanticipated negotiation or financial issues arise with the PPPs, or land provided for infrastructure and utilities has construction problems that must be addressed, or important supporting projects such as the high-speed rail line are delayed, EECiti development will also be delayed.

Such issues are being considered by EECO, which they will address as they arise. My experience with large, complex megaprojects like EECiti is that delays occur more frequently than not. If so, 2035 (or even later) may be a more likely date when full phase 1 development is completed. This is still a reasonably fast development schedule for a project as large and complex as EECiti.

Concluding Remarks

EECiti is designed for people, enhanced by modern technologies, education and research institutions, and sustainable practices that characterize the 4.0 economy. It has two overarching, functionally interdependent goals: 1. to create a fully-digitized, low carbon-emitting urban environment that offers high-quality living and working conditions while promoting innovation in manufacturing and business services processes that will help position the EEC at the forefront of Thailand's Fourth Industrial Revolution, and 2. offer an appealing complement of commercial, institutional, leisure, residential, and related urban amenities that will attract the skilled labor and executive and professional talent required by 4.0 economy firms to locate, grow, and prosper in EECiti and beyond.

The city builds on prior smart, sustainable city platforms, seeking to learn from and improve upon them. This is no small challenge given the complexity and costs of developing a comprehensive, technologically advanced, sustainable city from scratch. Numerous initiatives around the world with similar ambitions to EECiti have failed including Forest City in Malaysia, Lavasa smart city in India, the Kilamba sustainable city in Angola, and Dongtan ecotopia outside of Shanghai, to name a few.

Other initiatives such as Abu Dhabi's zero-carbon Masdar City in the United Arab Emirates has struggled with limited development on its 5.2 square kilometers of land since the project was initiated over 20 years ago. In Saudi Arabia, the incredibly ambitious and futuristic Neom project called "The Line" has an expanding cadre of skeptics. This linear city is 170 kilometers in length but only 200 meters wide with no streets or cars. In 2023, the Line's complete build-out budget was estimated to be just under US\$9 trillion by 2080, unless dramatically scaled back.

While EECiti is ambitious, its planning objectives are not so unrealistic as to be considered financially or technologically unachievable. Nevertheless, administrators at EECO are being careful to conduct appropriate demand and cost analyses to bridge the planning idealism-market reality gap that has plagued many smart, sustainable urban developments to date.

Sometimes, though, planning/design ideals are not possible to reconcile with market realities. For example, in May 2020, US Tech giant Alphabet Inc. (Google's parent company) abandoned its "Quayside " project on Toronto, Canada's waterfront that emphasized sidewalk environmental sensors, walking and biking over vehicles, and green building construction. The company concluded that it was not possible to achieve financial viability without sacrificing the core sustainability concepts and ideals of the project. Later that year, Cisco, which had been a global leader in providing smart city technologies, shut down its smart city division (Kinetic for City) when it could not align its planning goals and investment strategy with evolving markets.

To mitigate government risk and accelerate development, EECO is emphasizing public-private partnerships where the private sector will play a lead role even with EECiti infrastructure and utilities as discussed above. EECO will award the land for PPPs and the private sector with 50-year + 49 -year renewal concessions, and provide data for more sophisticated private-sector investment-grade analysis. In addition, EECO is partnering with other pertinent government agencies, such as the Industrial Estates Authority of Thailand for EECiti's Bio-Circular-Green (BCG) industrial district, as well as with the Sports Authority of Thailand for the development of the Sports District. All of this should make EECiti projects more financially feasible while reducing risk and jumpstarting development.

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