



# The Rise (and Risk) of Data Center: Implications and Consequences to Thai Economy

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ข้อคิดเห็นที่ปรากฏในบทความนี้เป็นความเห็นของผู้เขียน  
ซึ่งไม่จำเป็นต้องสอดคล้องกับความเห็นของธนาคารแห่งประเทศไทย

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## The Rise (and Risk) of Data Center: Implications and Consequences to Thai Economy

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"Data centers play a crucial role in supporting Thailand's infrastructure for the future."

### Abstract

Data centers serve as the backbone of the digital economy by providing storage, computing, and networking infrastructure. While not directly generating substantial economic gains, their true value lies in enabling Thailand's economic growth through government digitization, boosting domestic business productivity, and preparing the nation for the future of high-tech industries. Therefore, promoting the continued use of data centers for these purposes is critical in propelling Thailand's digital transformation.

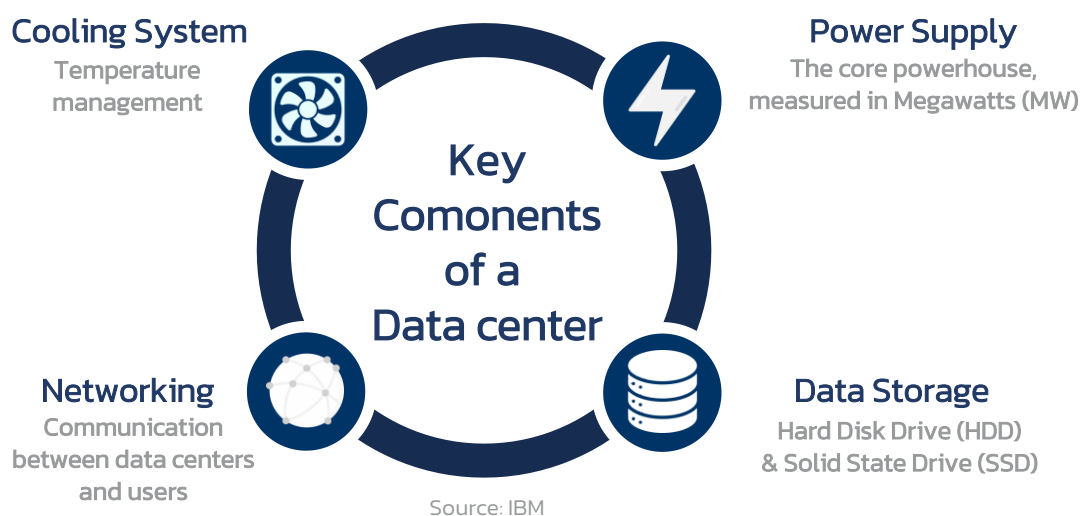
Recently, the digital transformation of Southeast Asia has become a formidable force, reshaping economies, societies, and individual lives. As technology continues to evolve, the demand for data centers—a critical infrastructure for managing digital information—has never been greater. Singapore, which is traditionally known as the data center hub in the region, is now encountering challenges due to limited space and energy capacity.

This situation has opened opportunities for neighboring countries to become a new destination for data center investments. Thailand has capitalized on its government support, domestic demand, and strategic location, making it an attractive destination for global investors. Notably, Amazon Web Services (AWS), Google, and CtrlS Data centers have initiated their projects in the country in 2023–2024. Thus, understanding its nature and potential benefits of data centers on the Thai economy is crucial. The rest of the article is arranged as follows. First, definition, types and functionality of data center will be explained in detail, followed by

a discussion regarding recent development of data center investment in Thailand. Lastly, impacts and benefits of data centers are examined with conclusion in the final section.

## 1. What is data center?

According to the International Business Machines (IBM), A data center is a physical room, building or facility that houses IT infrastructure for building, running, and delivering applications and services, and for storing and managing the data associated with those applications and services. (IBM, 2024)

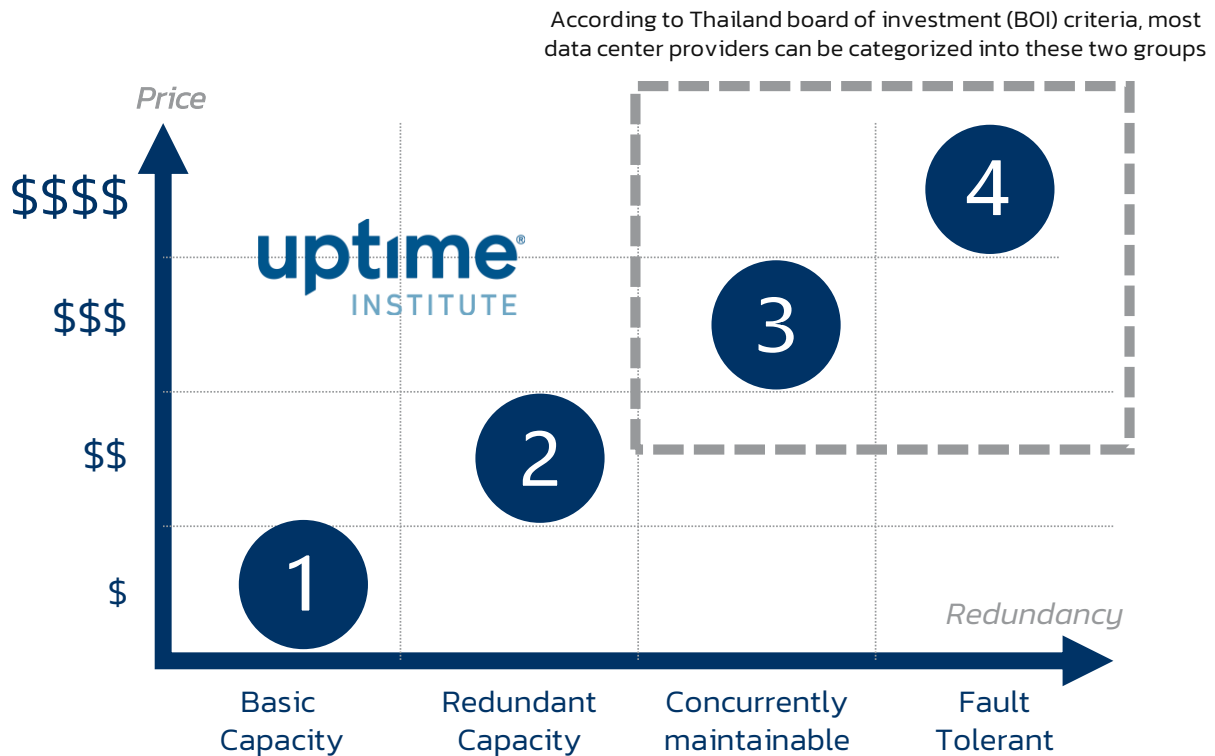


**Figure 1** Key components of a data center

The four key components of data center are shown in [Figure 1](#). Data centers, with their power supply, storage, cooling, and network systems, act as the digital infrastructure for three key functions: storing information, processing information with powerful servers, and allowing access through secure networking. Analogously, this is like working in a spreadsheet with multiple access. While data is being stored in the spreadsheet (storage of information), calculation can be done in real time using a formula (feature of processing), while several persons can edit the sheet simultaneously (access through secure networking). In short, data centers are the powerhouses that store, process, and connect us to the digital world.

There are two aspects which affects the functionality of a data center: **level of technology and types of business**. For the technological aspect, [figure 2](#) shows data centers ranked by their reliability, typically classified by the Uptime Institute's Tier system. Higher tiers offer more reliable backup systems with less downtime. Firstly, Tier I is the most basic, with no redundancy, making it suitable for businesses that can tolerate interruptions. Due to its simplicity compared to other tiers, its cost is lower, and it is easier to maintain and construct. Tier II adds redundant components, offering more protection against disruptions. Tier III allows for any single component to be maintained without impacting operations, ideal for organizations

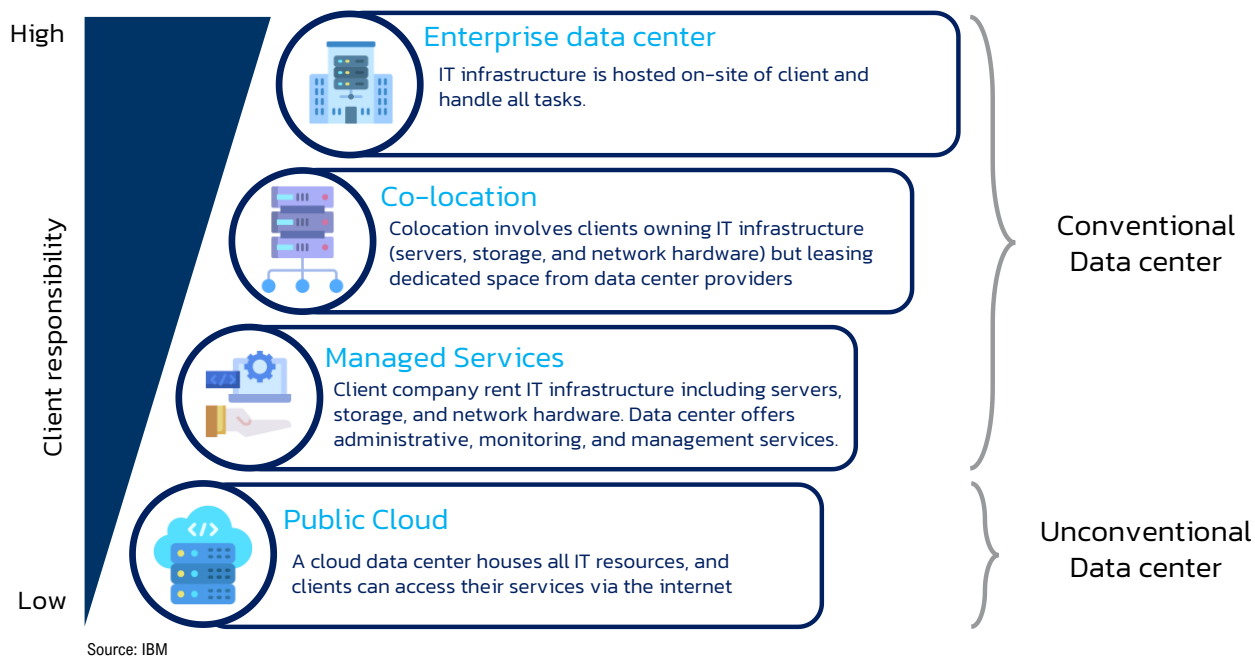
requiring consistent uptime. Lastly, Tier IV provides the highest reliability, with full fault tolerance, ensuring continuous operation even during complete system failures, essential for backbone or critical applications. (IBM, 2024; Uptime Institute, n.d.)



Source(s): Uptime institute, IBM

Figure 2 Tiers by Uptime Institute

Data centers for businesses can be split into two main types: conventional and unconventional. Conventional data centers include **1) Enterprise (On-Premises) Data Centers**, where firms host their IT infrastructure directly within their own facilities, providing full control over security and customization. However, upfront costs are significant. **2) Colocation**, where clients own IT infrastructure (servers, storage, networking) but lease dedicated space from data center providers. This is ideal for clients who lack the expertise, physical spaces, or resources to manage an on-premises data center. **3) Managed Services** are similar to colocation but go a step further. Clients not only lease space but also infrastructure (servers, storage, networking). Data center providers handle administrative tasks, monitoring, and overall management. This model is ideal for those who want a hands-off approach. On the other hand, **4) Unconventional Data Centers (Public Cloud)**, exemplified by tech-giant-firms like Google or Amazon, host all IT infrastructure and deliver services via the internet. Clients benefit from scalability and flexibility but trade some control for convenience, with usage fees applying.



**Figure 3** Types of data centers based on business

## 2. The Thai data center industry

### Thailand: Opportunity for Data Center Investment

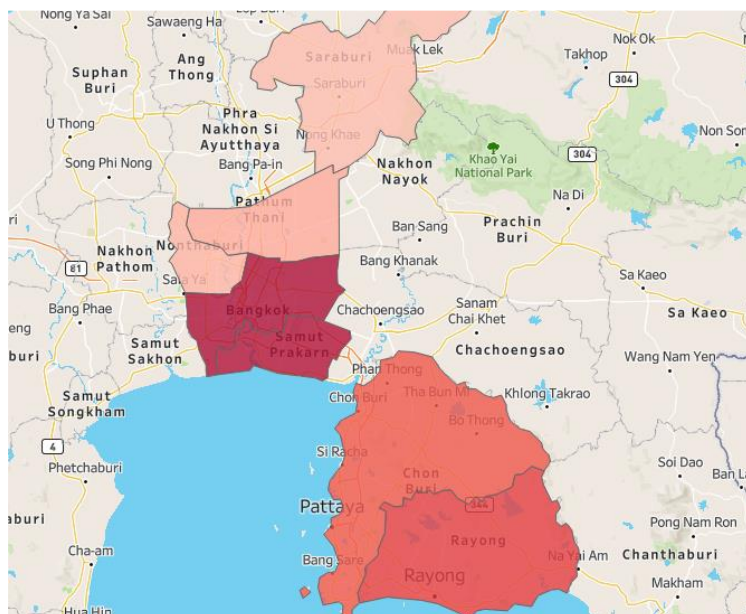
In Southeast Asia, **Singapore has long been the center for ICT services and data centers.** However, limitations in space and energy resources have led them to impose stricter requirements<sup>1</sup> for new data center projects, making it more costly for data center companies to expand in Singapore. This has created an opportunity for neighboring countries to attract new investment in terms of digital infrastructure. Thailand is one of them.

As of now, approximately 21 investors have pledged to invest in data centers in Thailand with an aggregate budget of more than 90,000 million baht. Between 2018 and 2022, most data center investments that applied through BOI<sup>2</sup> were conventional types. However, starting from 2023, data center investment became a large-scale investment towards unconventional types, focusing on providing infrastructure for cloud services. For example, CtrlS decided to build hyperscale data center in Chonburi, Thailand, with a capacity of up to 150 Mw.<sup>3</sup>

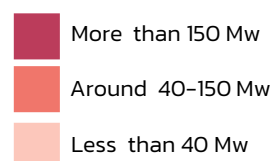
<sup>1</sup> According to Singapore's DC-CFA scheme, new data centers must be best-in-class in terms of IT and energy efficiency. (Infocomm media development authority, Government of Singapore)

<sup>2</sup> Board of Investment (BOI) does not use uptime as a criterion, but they have their own criteria and follow standards like ISO, which is roughly comparable to Tier 3 in the Uptime Institute's Tier system.

<sup>3</sup> [Bangkok Post – CtrlS and NT enter into strategic collaboration for Thailand hyperscale data center](#)







The red-shaded areas correspond to data center locations, with darker shading indicating higher megawatt (MW) capacity




Estimated by authors. Note: The Megawatt values are approximate number only. They reflect the intensity of megawatts in each area based on the size and information released by data centers

**Figure 4** Data centers located in Thailand that have recieved promotion from the Board of Investment (BOI)

There are several reasons why Thailand is an attractive destination for data center investment. [Table 1](#) compares different factors, which could affect investment decision and grouped them into cost, location and demand factors. While other countries may currently hold better rankings in specific data center metrics and offer comparable investment incentive, Thailand presents a compelling alternative. It has a combination of factors that are essential for successful data center operations. We believe that there are four primary reasons for data center investment in Thailand.

	Cost factor		Location			Demand factor			
	Electricity Cost (THB/kwh)	Land price (\$/sq. m.)	Subsea Cable	Natural Disaster Risk	Government Subsidy	Digital Adoption Index (2016)	E-commerce (2016)	Internet Speed (mbps)	Internet penetration
	3.84	3,980	13	21.09*	BOI	0.62	3 <sup>rd</sup>	201.81	85.27%
	6.98	18,632	39	0.63	-	0.87	1 <sup>st</sup>	234.55	96.92%
	2.49	2,938	25	14.04	DESAC scheme	0.69	2 <sup>nd</sup>	92.69	96.75%
	2.89	1,853	3	24.39	Decision 29	0.52	4 <sup>th</sup>	84.19	74.21%

 The shaded area represents the top rank

**Table 1** Countries comparison

1. **Location:** Compared to neighboring countries such as Vietnam, Laos, Myanmar, and Cambodia, Thailand, apart from Malaysia, stands out by its extensive sub-sea cable<sup>4</sup> network that surpasses most others. This infrastructure, coupled with Thailand's central location within the region, enables it to serve a wide range of neighboring nations.
2. **Market Demand:** as with other goods and services, data center operators are driven by market demand. When local demand is high, investment becomes more profitable. For Thailand, many businesses are in transition towards digital economy and upwards trend in demand has become more apparent especially in the manufacturing sector. This trend is reflected in locations of data centers being built in the vicinity of industrial estate areas such as Rayong province, other than central business area in Bangkok (Figure 4). Additionally, Thailand stands out in terms of internet speed compared to neighboring countries (excluding Singapore).
3. **Electricity:** as mentioned in the previous section, electricity is a critical component of a data center. Singapore's growing data center industry accounts for 7%<sup>5</sup> of the country's total electricity consumption. Additionally, Singapore's electricity costs are nearly double those of neighboring countries. In contrast, Thailand offers lower electricity costs and ample production capacity, making it an attractive and reliable location for data centers. As global data center operators commit to using eco-friendly power sources, over one hundred industry players and several associations in Europe pledged in 2022 to the EU that their data

<sup>4</sup> A sub-sea cable, or submarine cable, is a long, thick wire laid on the ocean bed to carry internet and telephone data across continents. It's essential for global communications, connecting countries with high-speed data transfer.

<sup>5</sup> See <https://www.straitstimes.com/tech/tech-news/new-standard-to-help-data-centres-in-s-pore-save-on-energy-costs-increase-efficiency>

centers would achieve climate neutrality by 2030, known as the Climate Neutral Data Center Pledge ([Climate Neutral Data Centre, 2022](#)). This commitment poses a challenge for all nations, including Thailand, to ensure a sufficient supply of green energy for data centers. In response, the Thai government is actively preparing for a green transition. The criteria for the Utility Green Tariff (UGT)<sup>6</sup> and the associated rates were officially published in the Royal Gazette<sup>7</sup> on January 8, 2024, with plans to initiate subscriptions before the end of 2024.

### 3. Impact to the Thai Economy

Benefits of having a data center in a country can be examined via direct benefits, which discussed gains from construction and employment on an economy, while indirect benefits focus more on its positive externalities as a crucial digital infrastructure.

#### 3.1 Direct economic impact

There are three main direct benefits of having a data center in a country; construction investment, high-skill job creation and improvement in current account balance.

**First, initial investments of the data centers would help increase GDP mainly through construction investment.** Building construction of a typical data center constitutes 40% of the capital structure, while machinery investment makes up the remaining 60%. However, given the level of devices' complexity and the standard requirement, most of these machines would have to be imported from abroad. Thus, building construction, which used local content, would account for most of the initial increase in GDP.

**Second, according to interviews with the industry firms, data centers create high-income employment opportunities, albeit in limited numbers.** Data centers generally employ a significant proportion of local labor (approximately 90%) with an average salary of 80,000 baht per month. In contrast, foreign employees can expect to earn up to around 150,000 baht per month. However, given their nature, data centers typically function with a lean team of 30 to 40 employees, primarily for operations and maintenance. Even though data centers may not create many direct jobs and typically require highly skilled workers, they indirectly contribute to job growth in the digital sector.

**Lastly, data center would help reduce Thailand digital deficit.** Previously, the reliance on foreign hyperscale data centers<sup>8</sup> resulted in Thai consumers and businesses to pay for these

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<sup>6</sup> The Utility Green Tariff (UGT) is a pricing structure that enables users to directly purchase electricity produced from clean or renewable energy sources.

<sup>7</sup> For additional detail, please refer to the Royal Gazette document on <https://ratchakitcha.soc.go.th/documents/16414.pdf>

<sup>8</sup> Hyperscale data centers are large facilities tailored for vast data management and cloud-based services, designed for efficiency and rapid scalability.

digital services overseas. This impacted Thailand's current account. The establishment of domestic data centers would keep these expenditures within the country, which potentially stimulate the local economy.

### 3.2 Indirect economic impact

In the following section, the focus will be on positive externalities or the indirect economic benefits from having data centers in Thailand. One can refer these indirect benefits as **Government digitization, Domestic productivity and Preparedness for high-tech industry** or “**G-D-P**”, for brevity.

#### Government Digitization (G)

The first potential benefits involve upgrading the public sector through digitization. Given that The Thai government is a major data holder, they can benefit significantly from having domestic data centers as these centers offer both immediate and long-term advantages, which can ultimately contribute to a more efficient and data-driven approach to public policy.

**In an immediate term, domestic data centers provide secure storage for government data within the country, adhering to world-class standards.** This aligns with the growing global trend of data privacy, similar to the European Union's GDPR<sup>9</sup> regulations that mandate data storage within the region of collection.

**Looking ahead, efficient data storage and distribution systems facilitated by domestic data centers can enable the government to function more effectively.** This paves the way for utilizing a centralized “data lake”<sup>10</sup> to design targeted public policies, tailored for specific needs of the Thai businesses and households.

Many governments in developed countries are already moving towards digitalization, for example, The Inland Revenue Authority of Singapore (IRAS) has transformed tax filing with its No-Filing Service (NFS) for eligible taxpayers. By integrating data across platforms, the NFS replaces an eight-page form with a pre-filled electronic one. This efficiency mirrors modern data centers, where consolidation and automation enhance performances. (Corydon, Ganesan, & Lundqvist, 2016; Smart Nation, Government of Singapore, n.d.)

#### Domestic Productivity (D)

**Prior to the widespread availability of data centers, embarking on a journey of digital transformation meant a significant investment for businesses.** This includes purchasing and

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<sup>9</sup> The General Data Protection Regulation or GDPR is a global rule requiring companies to protect EU citizens' personal data, with strict penalties for violations. For more information see [What is GDPR, the EU's new data protection law? - GDPR.eu](https://gdpr.eu/what-is-gdpr-the-eus-new-data-protection-law/)

<sup>10</sup> A data lake is a centralized repository that stores vast amounts of raw, unstructured, and structured data at any scale. This allows for diverse analytics, including real-time processing and machine learning, to support better decision-making.

maintaining all the necessary IT infrastructure, from servers to complex cooling systems and security protocols. Managing such infrastructure often requires specialized knowledge that fell outside the core competencies of most business owners.

The advent of data centers has revolutionized this landscape. **Businesses have been leveraging the expertise and resources of data center operators**, essentially outsourcing their IT infrastructure needs. This allows them to choose a service level that aligns with their risk tolerance and data privacy requirements. Instead of becoming IT experts, business owners can now focus their energy and resources on what they do best: running and growing their core business. Thus, data center would provide a critical infrastructure for businesses to improve their productivity through usages of these digital services.

**In terms of usage, having a local nearby data center can greatly benefit manufacturing factories.** In the digital era, manufacturing operations can utilize advanced technologies like robotics to enhance production speed and manage inventory accurately through intelligent supply chain management. These processes demand extensive data storage, processing, and networking, which is where the role of data centers becomes indispensable. Another reason is the ease of maintenance since some manufacturing plants use their own programs and software, or they may have concerns about their internal systems and proprietary information, especially in emergency events, therefore having a local data center would be beneficial. (Fang & Greenstein, 2022)

**For the service sector, although currently the proximity of data center is beneficial but not essential, the future trend of real time activities may make proximity an essential benefit.** Currently, many digital services do not require a real-time response between users and servers. For example, when using a streaming movie service like Netflix, a user in Thailand does not need to interact with the server (located elsewhere) in real-time. Users also do not need to be in proximity<sup>11</sup> or know the origin of the data. However, in the coming years, certain services, such as live music, online gaming, or real-time activities, may require faster data transfer. This is due to the continuous increase in the quality of content and the volume of data transferred per minute. Applications are becoming more data-intensive such that even minor delays in data transmission can disrupt the flow of communication, gameplay, or streaming. As a result, latency<sup>12</sup> and proximity could become increasingly important in the future and having a local data center may prove to be beneficial for the service industry.

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<sup>11</sup> "Proximity" in data centers means placing data centers close to users for faster service and cost savings, unlike "nearness" or "closeness," which just mean physical distance. Proximity enhances user experience by strategic location.

<sup>12</sup> "Latency" is the time delay in a network, affecting how quickly data is transferred. Lower latency speeds up services, while higher latency can slow them down and worsen user experience.

## Preparedness for High-tech Industry (P)

This brings us to the next benefit. **Data centers play a critical role in supporting Thailand's infrastructure for the future**, particularly as the economy becomes increasingly reliant on advanced technologies. A key advantage of domestic data centers is their proximity to Thai users. As technology advances, particularly in areas like cloud computing and real-time applications, low latency becomes crucial for optimal performance.

For example, sending a data packet to a server in Indonesia would be significantly faster compared to a server located in the United States, simply due to the reduced physical distance. This translates to a smoother user experience and enhanced efficiency for businesses and individuals alike.

Take medical industry for an example, **these centers could offer benefits such as reduced latency for real-time communication during procedures like remote surgery**. Additionally, domestic data storage might enhance data security and compliance with regulations of Thai data privacy regarding patient information. Furthermore, data centers could facilitate collaboration between medical institutions, potentially leading to advancements in research and development within the Thai healthcare system. For instance, one human genome sequence occupies approximately 200 gigabytes<sup>13</sup> of storage. If one aims for genomics and precision medicine, which needs to store the DNA of the entire population – in this case, the Thai population – one would need approximately<sup>14</sup> 14,400,000 hard drives, either HDDs or SSDs<sup>15</sup>, each with a capacity of 1 terabyte (TB).

Another application of data centers is the Usage Based Insurance (UBI) pioneered by Ford. UBI allows drivers to pay for car insurance based on actual mileage, not a flat rate. **Data centers make this possible by connecting cars and securely transmitting usage data**, which allow insurance companies to accurately assess risk and offer personalized premiums. This translates to potential cost savings for customers who drive less. ([Ford Motor Company, n.d.](#))

In the future, there will be more advanced technology in various sectors that require low latency and rapid connectivity. Having data center in Thailand will enable Thai consumers to benefit from all prospects of advanced technology.

## 4. Conclusion and Recommendations

To summarize, data centers are essential to the digital economy, providing crucial storage, computing, and networking infrastructure. Although they may not directly generate

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<sup>13</sup> Approximated by (National Human Genome Research Institute, 2022)

<sup>14</sup> We start with the Thai population, which is around 72,000,000. Next, we multiply this by 200 gigabytes to get a total of 14,400,000,000 gigabytes. To convert gigabytes to terabytes, we divide by 1,000 (since 1 terabyte = 1,000 gigabytes), resulting in approximately 14,400,000 terabytes (rounded for simplicity)

<sup>15</sup> Memory storage. An HDD (hard-disk drive) has spinning platters and uses a read/write head to access data. On the other hand, an SSD (solid-state drive) stores data on flash-memory chips, offering speed and reliability.

significant economic gains, their true value lies in the indirect benefits they offer, such as enabling government digitization, increasing domestic business productivity, and preparing the nation for a high-tech future. To advance Thailand's digital transformation, it is vital to promote the continued use of data centers and fully leverage new infrastructure to maximize these benefits and drive progress.

Driving Thailand's digital transformation and attracting new investments requires a strong focus on businesses that need data center capabilities. By offering incentives, building robust infrastructure, and developing a skilled workforce, Thailand can become an attractive location for data-intensive companies. This investment would not only boost the data center industry but also draw in other businesses looking for advanced computing resources. Although data centers might not be major economic contributors on their own, they play a key role in supporting the digital economy. Their presence would help Thai businesses compete globally and allow consumers to access a wider range of online goods and services.

To make this happen, a collaborative approach is needed. The government should improve regulations to make it easier to do business and offer incentives like tax breaks and subsidies. Investing in modern infrastructure, a reliable power supply, and high-speed internet is also essential. The private sector can support innovation by partnering with technology firms and educational institutions to create a skilled workforce for the digital economy. Promoting digital literacy and entrepreneurship will help build a culture of innovation. Additionally, marketing Thailand as a hub for digital businesses through targeted campaigns and participation in international trade fairs can attract global companies looking for a strategic location in Southeast Asia.

Moreover, the next generation of data centers will focus on Artificial Intelligence (AI) and Machine Learning (ML), requiring immense processing power and specialized hardware. A thriving digital economy is crucial to attracting these next-generation data centers. By fostering innovation and entrepreneurship, a robust digital landscape encourages businesses to leverage AI and ML, creating demand for the specialized hardware and processing power that these advanced facilities offer. Therefore, Thailand's path forward lies in nurturing a strong digital economy that uses traditional data centers as the foundation, which in turn will attract investment in next-generation data centers.

**On the other hand, if Thailand fails to attract firms that need data centers, it risks becoming merely a storage hub, rather than a center for digital activities.** To unlock its full potential, Thailand needs to become a magnet for businesses that leverage data for innovation and growth.

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