

F R O S T & S U L L I V A N

**OFFICE OF THE GOVERNMENT CHIEF
INFORMATION OFFICER (OGCIO)**

Government of the Hong Kong Special Administrative Region (HKSAR)



EXECUTIVE SUMMARY

**ECONOMIC BENEFIT ANALYSIS OF
DEVELOPING HONG KONG INTO A REGIONAL
DATA CENTRE HUB**



Developed By:
Frost & Sullivan
Public Sector Practice
January 2011

Table of Contents

1.	INTRODUCTION.....	2
2.	TANGIBLE ECONOMIC IMPACT	4
3.	INTANGIBLE ECONOMIC IMPACT.....	6
4.	OVERSEAS POLICIES/MEASURES AND DEVELOPMENTS	10
5.	ADDRESSING THE NEED FOR FACILITATION.....	13
6.	CONCLUSION	16

1. Introduction

The Government of the Hong Kong Special Administrative Region (the “Government”) represented by the Office of the Government Chief Information Officer (“OGCIO”) appointed Frost & Sullivan to conduct a study on the economic benefits of developing data centres to entrench Hong Kong’s position as a trade and financial hub. The key objective of the study is to examine the economic benefits that are attributable to data centres in Hong Kong.

Hong Kong's position as the major financial and international trading and logistics hub in the region is undisputed. As a result, Hong Kong’s international data centre service market is one of the largest in Asia/Pacific. In terms of market revenues, it counts among the top 5 markets in Asia/Pacific, and in terms of Raised Floor Space (RFS) per USD billion GDP, it ranks second. Many multinational companies from a diverse range of industries have based their Asia/Pacific headquarters in Hong Kong. According to the annual survey released in 2010 by InvestHK and the Hong Kong Census and Statistics Department, 3,638 multinational companies have set up their Regional Headquarters and Regional Offices in Hong Kong. Together, these regional offices generate a large demand for data centre services linking all offices across the region to Hong Kong as a hub.

Locations such as Shanghai, Guangzhou, Singapore, and Taiwan have also been aggressively focusing on attracting corporate headquarters and investments in data intensive industries such as Financial Services, Trading and Logistics, IT/Telecommunications and Content/Media. As such, there is much emphasis on actively developing their data centre and telecommunications infrastructure to position themselves as the data centre hub and interconnection gateway to support the growth of these industries. As a result of these developments, it is imperative that Hong Kong sustains and enhances its competitive edge in facilitating and attracting investments for data centres, to retain its leadership position as a Global Financial Centre and Asia’s business capital..

To fulfil the objective of the study, more than 50 interviews were conducted with relevant businesses, including Data Centre Operators (DCOs) and businesses using End User data centres, as well as stakeholders from industry associations and relevant government bodies.

Data collated through the interviews were aggregated with secondary research and in-house analysis to develop the conclusions of the study, as summarised in this report.

2. Tangible Economic Impact¹

The Data Centre Sector provides benefits to Hong Kong's economy through its operating and spending activities. Economic benefits can be classified into two categories: (1) Direct Impact which measures economic benefits that is attributable to the Data Centre Sector in Hong Kong through the operating activities of Data Centres, and (2) Indirect Impact which measures economic benefits that is generated by other industries such as telecommunications, utilities and realty due to the spending of the Data Centre Sector on these industries in Hong Kong.

Direct Economic Impact

Taken together, DCOs and End Users directly contributed an economic value added of HKD 1.6 billion in 2009 (DCOs: HKD 1.0 billion; End Users: HKD 0.6 billion), which is about 0.1 percent of Hong Kong's 2009 GDP of HKD 1,622 billion. Total job opportunities directly attributed to the Data Centre Sector was estimated to be around 2,200 (approximate equal distribution between DCOs and End Users). Value Added per employment in 2009 was estimated to be HKD 727,300 per employee as compared to Hong Kong's economy overall value added of HKD 466,200 per employee, reflecting the higher value added nature of the Data Centre Sector.

Indirect Economic Impact

Indirect economic impact is due to the spending by data centres on other industries. Factoring information obtained through the interviews, these other industries² were identified as (1) Telecommunications, (2) Utilities, as well as (3) Realty. For each of these industries, industry-specific economic multipliers were estimated to determine how the spending of the

¹ Value Added, GDP and employment figures might be subject to further change upon clearance by EABFU.

² Spending by Data Centre Sector on other industries (e.g. security services) was judged to be relatively minor and hence, not included in the calculations.

Data Centre Sector in Hong Kong will affect the economic value added and employment generated.

For indirect impact, the spending by the Data Centre Sector resulted in these industries generating HKD 1.8 billion in terms of economic value added, and created around 2,600 job opportunities in 2009.

In 2009, direct and indirect economic impact for the Data Centre Sector generated around HKD 3.4 billion in terms of economic value added, representing 0.21 percent of Hong Kong's GDP at basic prices, and created around 4,800 job opportunities, representing 0.14 percent of the total employed persons.

The Data Centre Sector's economic value added and employment contribution to Hong Kong's economy may be relatively small as compared to other pillar industries such as Financial Services, as well as Trading and Logistics. However, the Data Centre Sector provides other economic benefits that are critical to the growth and development of the pillar industries.

3. Intangible Economic Impact

During the course of the study, the Data Centre Sector was identified by both industry players and stakeholders as a critical infrastructure for the rest of the economy. This was validated through both secondary research and through the use of pre-defined Hypotheses. The Hypotheses were generated through a series of internal discussions with industry research analysts, and cross-validated through discussions with stakeholders. These Hypotheses were then tested and validated during the interviews.

Summarised below are Hypotheses where the strength of linkage with the Hong Kong economy is deemed to be positive. Even though the impact cannot be quantified, the subsequent benefits attributable are viewed to be important, if not critical to the economy.

Data Centres are Critical Infrastructure Used across Key Industries

To compete as a global city and key financial centre, data centres are critical and can impact Hong Kong's status as a regional hub and financial centre in several ways.

Reliance on Data Centres by Businesses

Data centres are key infrastructure that supports the operations of industries such as Financial Services, Trading and Logistics, IT/Telecommunications and Content/Media. In total, these verticals contribute more than 45 percent of Hong Kong's GDP in 2009 and accounts for more than 84 percent of the total demand for data centre space in Hong Kong. This reflects the dependence of these industries on data centre services.

Regional Data Centres are Typically Sited in the Same Location as Regional Support Operations of Financial Services Players

An environment which encourages the development of data centres *potentially* reduces the risk of regional support operations (e.g. IT functions, Credit Card Operations & Processing) locating in other competing markets. Based on empirical evidence, most financial firms choose to locate their regional support operations in the same location as their regional data

centres. The primary reasons for such decisions include ease of management, availability of skilled manpower, and the overall attractiveness of the location for business.

As can be seen from the table below, most financial institutions have large manpower in the cities where their regional operations and data centres are located. This includes manpower associated with both financial and support operations (e.g. IT, credit card processing).

Table 1: Location of Regional HQs and Data Centres of Financial Institutions in APEJ

Financial Institution	Location of Regional HQ - Asia/Pacific excluding Japan (APEJ)	Location of Regional Data Centre	Total Number of people employed (2009)	
			Hong Kong	Singapore
Goldman Sachs	Hong Kong	Hong Kong	2,000	800
JPMorgan	Hong Kong	Hong Kong	4,000	2,500
HSBC	Hong Kong	Hong Kong	27,000	3,000
Standard Chartered	Hong Kong, Singapore	Hong Kong	12,200	7,800
Credit Suisse	Hong Kong, Singapore	Singapore	1,500	4,800
Citibank	Hong Kong, Singapore	Hong Kong, Singapore	4,000	8,500
Deutsche Bank	Hong Kong, Singapore	Singapore	1,000	1,900

Source: Frost & Sullivan Research and Estimates

As an example, Singapore is Citibank’s ASEAN Hub, Regional HQ for Asia Consumer Banking business and a regional Centre of Excellence. Singapore serves as a strategic hub for regional operations and technology expertise and hosts Citibank’s state of the art processing and data centres. The centre at Singapore processes 250,000 regional transactions amounting to HKD 935 billion per day for more than 50 countries.

Hence, benefits will accrue to Hong Kong’s economy if financial institutions choose to locate key regional support operations in Hong Kong. Providing an attractive data centre environment potentially influences decisions on where these support operations are located.

Data Centre is a Key Enabler for Critical Financial Transactions

Ability to locate the trading platforms of Financial Services players near the Stock Exchange could impact the trading operations of the Financial Services industry due to network latency issues. Algorithmic trading is most affected by network latency as it relies heavily on the ability to instantly recognise arbitrage opportunities and make trades to capture them.

Hence, if Financial Services players' trading platforms cannot be sited near to or co-located within the Stock Exchange data centre due to space constraints, there will be a negative perception on Hong Kong's ability to provide a world-class trading environment. Industry has highlighted that this may increase the risk of losing high value IPO deals in future as algorithmic trading becomes a key component of the global financial market.

Locating Data Centres in Hong Kong Reduces the Operational Risk for Businesses

By 2012, global spending on Cloud Computing is forecasted to grow to HKD 326 billion, making up 9 per cent of total IT spending, indicating an increasing reliance on technology services delivered over the network or 'Cloud'.

If businesses in Hong Kong are to rely on overseas data centres or on Cloud Service Providers who base their data centre operations in overseas locations, the operational risk of businesses increases due to increased exposure to service/network outages. For example, earthquakes or typhoons can cause damage to undersea cables, resulting in businesses losing connectivity to their overseas data centres or Cloud Service Providers, which will adversely impact the operations of businesses in Hong Kong.

Hence, the ability for businesses to locate their data centres in Hong Kong, as well as positioning Hong Kong as an attractive data centre environment for Cloud Computing Service Providers is important in mitigating this risk.

Locating Data Centres in Hong Kong Potentially Act as “Anchors” for Businesses

Independent research indicates that it is highly unlikely for businesses to shift their operations once they invest in capital intensive infrastructure (like data centres). Using data gathered through primary interviews and secondary research, it was estimated that data centres can

account for up to 30 percent of total capital outlay of a regional company (e.g. financial institution) during the initial investment/start-up. Hence, businesses will less likely move their operations to other locations in future due to the high capital investment.

Furthermore, there is potential where the same location will gain preference for future expansion of regional operations. For example, after investing in a data centre and sales/distribution office in Singapore, Bosch announced the setting up of its new regional HQ in Singapore to provide support for more than 200 of its offices based in Southeast Asia. In the pipeline are plans to establish an IT research and development centre.

Data Centres Provide Higher Value Added Job Opportunities

Data centre employees in Hong Kong typically have higher salaries as compared to the average of all industries and provide higher value added per employee. For example, data centre managers in Hong Kong earn approximately HKD 600,000 annually, and Mainframe analysts, system administrators and data centre support engineers – all three roles are critical to the operations of data centres – can earn around HKD 300,000 to HKD 500,000 per year. This also indicates the high skill requirements that these jobs entails.

Furthermore, value added per employee for the Data Centre Sector is also comparatively higher than many other industries as shown below.

Table 2: Employment and Value Added Per Employee across Industries (2009)

Industry	Employment	Value Added per Employee (HKD)
Data Centre Sector (Direct Impact)	2,200	\$727,300
Financial Services	202,809	\$1,111,100
Tourism	197,400	\$263,400
Trading and Logistics	832,800	\$473,900
Professional Services & Other Producer Services ³ Industries	424,800	\$442,900

Source: Frost & Sullivan's Estimates, Census and Statistics Department, Hong Kong

³ Producer services refer to services for use by other companies (i.e. intermediate consumption), as well as exports of services to companies and individuals such as freight transport, trade financing and insurance services.

4. Overseas Policies/Measures and Developments

A. Policies and Measures

Hong Kong remains a key data centre and telecommunications hub for the region. However, for Data Centre Operators and End Users, the option of expanding or setting up their data centre operations in other locations such as Singapore is becoming increasingly attractive. Competing locations such as Singapore has been actively facilitating the development of the data centre industry. For example, the Singapore government has set in place processes to expedite the application and licensing approval required to set up a data centre. Similar to State practices in USA, incentives are also granted in various forms to attract foreign investors. According to feedback provided by industry respondents, this has encouraged global DCOs such as Digital Realty Trust, Equinix and Global Switch to put in significant investments in Singapore. Furthermore, Cloud service providers such as Amazon, Google, VMware and Salesforce.com already have a much larger presence in Singapore as compared to Hong Kong.

Due to the large land plots required for data centre development, the Singapore government is also planning to set up a 12 hectares data centre park, making it the largest single data centre facility in the world. The facility aims to attract multinational banks, telecommunication players, and global Data Centre Operators to set up their mission-critical operations there.

Studies reveal that data centres in clusters are expected to save on infrastructure costs and benefit from the last mile utility advantage. Industry generally feels that clustering effects can only lead to lowered start-up and operations costs if there is geographical consolidation, *which focuses on shared resources*, and not simply from the existence of more data centres.

Currently, there is no clustering of data centres in Hong Kong as they are geographically dispersed in different districts except for a few players in the Industrial Estates managed by the Hong Kong Science and Technology Park Corporation (HKSTPC). Hence, benefits from clustering effects could accrue if a large piece of land (about 8 to 10 hectares) is set aside.

Furthermore, service providers such as electricity companies may be attracted to invest in capital intensive infrastructure as demand is potentially assured.

B. Data Centre Development in Overseas Financial Centres

A review to identify the presence of data centres in specific locations indicates that global financial centres and cities such as New York, London, Paris, Tokyo, Chicago and Singapore have a significant number of data centres located near to these cities/areas to meet demand.

Table 3: Presence of Global Data Centre Operators in Key Financial Centres and Cities

Selected Global Data Centre Operators	Presence in Key Financial Centres (> 100,000 square feet RFS)	Presence ⁴ in Other Selected Locations
Digital Realty Trust	London, New York, Paris, Chicago and Singapore ⁵	Boston, Houston, Silicon Valley, Dublin, Amsterdam, Los Angeles, San Francisco, Dallas and Charlotte
Equinix	London, New York, Paris, Chicago, Tokyo, Hong Kong and Singapore	Boston, Dallas, Silicon Valley, Shanghai, Sydney, Amsterdam, Los Angeles, Atlanta and Washington DC
Global Switch	London, Paris and Singapore	Amsterdam, Frankfurt and Sydney
Telehouse	London, New York, Paris, Tokyo and Hong Kong	Shanghai, Los Angeles, Seoul, Cape Town, Osaka and Nagoya
Savvis	London, New York, Chicago, Tokyo and Singapore	Boston, Silicon Valley, Dallas and Los Angeles

Source: Frost & Sullivan Research

In addition, a quote from the CEO of Equinix in North America states that the demand for data centre services in the New York metropolitan area, particularly for the financial sector, has increased significantly over the past year. A new data centre, offering 100,000 square feet of RFS, and located just 17 kilometers from downtown Manhattan, was constructed specifically to increase Equinix’s capacity and enhance its capabilities to meet demand from the financial

⁴ In terms of RFS size, Data Centre Operators with presence in other selected locations have facilities that typically range between 50,000 to 100,000 square feet, sometimes more.

⁵ In 2010, Digital Realty Trust made a significant investment to build a 370,000 square foot facility in Singapore.

sector, and is just one of Equinix's eight data centres in the area. These indications serve to substantiate the need for data centres to be located near to or within global financial centres.

While it may not be feasible for Hong Kong to directly adopt these measures and policies, we must acknowledge them, take note of the constraints facing Hong Kong, and consider appropriate measures that benefit Hong Kong.

5. Addressing the Need for Facilitation

The Data Centre Sector is constrained by specific ‘needs’ for data centre development, and if not addressed, it will potentially restrict the development of the sector in Hong Kong.

Availability and the Need for Suitable Space/Land

A. Availability of Suitable Space/Land

One of the key constraints faced by the Data Centre Sector is the availability of suitable land plots for constructing large high tier (Tier III+ and IV) data centres. Based on our projections of unconstrained⁶ RFS demand, an additional 500,000 square feet of RFS is required for Tier III+ and Tier IV data centres in Hong Kong by 2015 and it is reasonably expected that such demand will continue to grow beyond 2015. This translates into an estimated total land size of about 10 hectares⁷. Current supply and availability of suitable⁸ land plots is considered to be insufficient to support future demand requirements for high tier data centres in terms of (1) size of land plot required, (2) total land space available, (3) availability of adequate power supply, and (4) suitability of land plots – e.g. sited away from hazardous industries.

Potential land supply was analysed by examining the different sources of land that can be made available for data centre development. The following lists down the current supply:

- Industrial Estates (IE) managed by Hong Kong Science and Technology Parks Corporation (HKSTPC):

⁶ ‘Unconstrained demand’ refers to the situation where there are no external barriers (e.g. unfavorable regulations or unavailability of land) that may restrict the growth of RFS demand.

⁷ Data centre with 100,000 sq ft RFS requires approximately 2 hectares of land.

⁸ Numerous factors need to be considered in terms of assessing suitability of land for high tier data centres. Some factors include: Distance away from major roads, not next to high risk facilities such as refineries, not directly under flight paths, buffer distance away from neighbouring facilities that may cause vibration or interference with data centre (computer) operations, availability of adequate power supply, etc

As of December 2010, only three vacant sites of about 4.5 hectares in total are left at the Tsueng Kwan O IE. It is expected that two of the sites will be offered soon⁹. There are no vacant plots available in Tai Po IE. Yuen Long IE is deemed to be unsuitable for high tier data centre development due to constraints in network capacity.

- Open Market:

Between 2008 and 2010, only 11 land plots were made available for commercial application. Of which, the largest plots were only 1 and 1.4 hectare in size, as compared to a 3 hectares site at the Tsueng Kwan O Industrial Estate acquired by a Data Centre Operator in 2010 to build a Tier IV data centre.

- Existing Industrial Buildings/Sites for Data Centre Use:

Some 300 and 200 hectares of land are now zoned for industrial and business uses respectively, which allow data centre use. There are however challenges to redevelop this land for high tier data centres. To redevelop existing industrial buildings, they have to be acquired and demolished, which involve additional redevelopment costs and additional lead time to materialise (12-24 months). Besides, potential multiple ownership of adjacent buildings will pose further difficulty in acquiring sufficiently large plot of land for high tier data centre projects. Together with issues such as inadequate power infrastructure, they limit the availability of suitable old industrial buildings for high tier data centres.

B. The Need - Hong Kong Being a Preferred City for Data Centres

Data Centre Operators and End Users have indicated that even though they could reap cost savings in other locations, majority of industry players prefer to locate their primary data centre operations in Hong Kong due to its inherent institutional advantages, including:

- Firstly, Hong Kong is the regional financial hub and gateway to the Mainland of China. There is a general preference and in some cases, a specific need for data centres to be located near business operations

⁹ As of March 2011, two sites have been offered, leaving one site of 1.5 hectares by the seashore.

- Secondly, Hong Kong is perceived by Data Centre Operators and End Users to be a safe location within the greater China region for locating their primary and/or backup data centres due to regulatory concerns, weak data privacy controls, and the lack of established infrastructure in other locations such as the Mainland of China
- Lastly, Hong Kong is not exposed to natural disasters such as earthquakes, which provides a stable operating environment for data centres

Hence, if there is inadequate supply of suitable land for high tier data centre development in a timely manner, the general viewpoint is that this will restrict Hong Kong's capability to develop a core infrastructure needed to serve the needs of businesses and in the long term, this may impede its ability to compete effectively as a global city and key financial centre.

Availability and the Need for Adequate Power Supply

Interactions with majority of industry players pointed out that the availability of power is one of the top two challenges facing Hong Kong's Data Centre Sector. In particular, converted industrial buildings might not be able to support the high power requirements of the high tier data centre, and retro-fitting is a long process. Depending on the capacity of the power sub-stations and/or the space of the transformer rooms in the buildings, the time required to provide enough electricity to data centres in existing buildings or new buildings can take a few months or longer. The time taken for green sites can even be a few years if there is no nearby power sub-stations.

Availability and the Need for Skilled Manpower

Some industry players encountered difficulties in recruiting data centre manpower at the two ends of the skills spectrum – highly skilled and experienced data centre managers and architects, as well as data centre operators. This can be a potential barrier in future for Cloud Service Providers who are looking to set up operations in Hong Kong as they require highly skilled manpower for their operations.

6. Conclusion

In conclusion, there is potential for strong growth in the Data Centre Sector, primarily due to demand for data centre services arising from technology trends such as increasing digitization of information, growth of electronic commerce and increasing adoption of Cloud Computing. Taking into consideration Hong Kong's position as a key technology and telecommunications hub for the region, the territory is poised to benefit from this growth. Total RFS demand is expected to grow at a Compound Annual Growth Rate (CAGR) of 9.8 percent from 2.3 million square feet in 2009 to about 4.1 million square feet in 2015. It is reasonably expected that total RFS demand will continue to grow beyond 2015.

From an economic point of view, the Data Centre Sector's value added and employment contribution to Hong Kong's economy may be relatively small as compared to pillar industries such as Financial Services and Trading and Logistics. Nevertheless, industry players and relevant stakeholders agree that data centres are critical infrastructure that supports the rest of the economy. In addition, increasing adoption of Cloud Computing will have a significant bearing on the demand for, and provisioning of data centre services in the region.

Several issues exist which should be addressed to facilitate the growth of the Data Centre Sector and secure Hong Kong's position as a key hub for the region. These include issues related to the availability of suitable large land plots for development of high tier data centres. Potential measures could also be taken to address barriers related to the adequacy of power infrastructure/supply, as well as the demand for skilled manpower by the Data Centre Sector.

Given the criticality of the Data Centre Sector, **we recommend** that measures to facilitate further development of the sector be explored, by concluding that:

- High tier data centre demand for suitable space/land cannot be satisfied at current status quo; and
- Consequence of not being able to meet demand is putting the overall economic activities and competitiveness of Hong Kong at risk; and

Further deliberation is required to identify and assess potential facilitation measures, taking into consideration the practicality, benefits and implications of each measure.

Glossary

Data Centres - Is a facility used to house computer systems and associated components, such as data communications and storage systems. It generally includes redundant power supplies and environmental control systems (e.g., air conditioning, fire suppression).

For this study, data centres include End User data centres that are used by businesses to support internal operations, and data centres managed by Data Centre Operators (DCOs) that provide revenue generating data centre hosting services.

End User Data Centres – In-house data centres that are non-revenue generating entities.

Data Centre Operators (DCOs) – Typically System Integrators, Telecoms & Internet Service Providers, and pure-play data centre operators who own data centres that are revenue generating entities. These players provide data centre services to other businesses.

Raised Floor Space (RFS) – Built-up floor space available in data centres for provision of data centre services. Usually measured in square feet or square meters.

Data Centre Tiers – Uptime Institute has categorized data centres into 4 tiers depending on the availability of services. Tier I has lowest availability (99.671%), Tier II has 99.75% availability, Tier III has 99.98% availability and Tier IV has the highest availability (99.995%). Most of the data centres owned by DCOs are Tier III and above. Some data centres are classified as Tier III+ facilities as they are currently running at Tier III availability requirements but have the capability to upgrade to Tier IV requirements with nominal changes.

Value Added – Value Added is defined as sum of operating profits, remuneration to employees and interest payments. Operating Surplus is defined as receipts less operating expenditure plus depreciation. Thus, the overall value added for DCOs is calculated as:

$$\text{Value Added}_{\text{DCO}} = \text{Receipts} - \text{OPEX} + \text{Depreciation} + \text{Manpower Costs} + \text{Interest Payments}$$

For End User data centres, operating profits are assumed to be zero. Thus, the overall value added for End User data centres is calculated as:

$$\text{Value Added}_{\text{End User}} = \text{Depreciation} + \text{Manpower Costs} + \text{Interest Payments}$$

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best-practice models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverages 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from more than 40 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>

66th Floor Suite 01 The Centre
99 Queen's Road Central Hong Kong
Tel +852 3965 3315 Fax +852 3965 3222