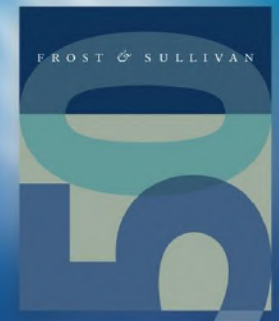


ASEAN Telecommunications Towers Market

Rise of the Towerco

January 2017



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Executive Summary

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Key Findings

ASEAN Telco Towers Market

1. **Towercos in ASEAN member states lack scale, which impacts tower build costs and capability to further reduce cost due to best practices and R&D.**
2. **The towerco business model is proving to be viable and more lucrative than conventional models. Towerco to benefit from growth in number of towers to 300,804 by 2021, mainly in Indonesia**
3. **Tower leasing rates vary considerably across ASEAN member states, but the basic pricing structure principles remain consistent.**
4. **Within ASEAN member states, the use of microcells and fibre is becoming increasingly common and an area of keen competition amongst towercos.**
5. **The market leader, i.e. edotco, has global aspirations beyond its #1 towerco ranking among ASEAN member states with 16,450 towers. It aims to be amongst the world's top 5 tower companies by 2020.**

Source: Frost & Sullivan

Growth Opportunities

No	Growth Opportunity	Brief Description
1	Cost effectiveness of tower build through scale and use of innovation and best practices	<ul style="list-style-type: none"> • Towercos in ASEAN member states are much smaller in size and more localized as compared to global towercos and towercos in populous countries such as China and India. • New towers in ASEAN member states cost more to build than in China and India due to lack of scale. • Towercos with scale (e.g. edotco) are able to offer more efficient solutions through research and development (R&D), and use of best practices
2	Towerco business model	<ul style="list-style-type: none"> • Growth is expected in the towerco business as an increasing number of MNOs are opting to sell and lease back towers from towercos. <ul style="list-style-type: none"> a. As the rollout of 4G LTE networks is levelling the playing field across ASEAN member states and allowing for adjustments in market share amongst MNOs, staying profitable is increasingly a challenge for MNOs. b. When network coverage becomes less of a competitive differentiator, MNOs consolidate networks (e.g. through network sharing with other MNOs or by working with towercos) to shift focus away from infrastructure investment and towards developing innovative services. In doing so, they also become asset light.
3	Microcells and fiber opportunities	<ul style="list-style-type: none"> • MNOs are increasingly infilling with microcells instead of building a new network from scratch each time there is a new spectrum allocated. <ul style="list-style-type: none"> a. This is particularly relevant to MNOs and their equipment vendors with the current 4G LTE network build out and the upcoming 5G spectrum allocation. • MNOs are increasingly turning to fibre to cope with increasing backhaul capacity as they move towards data centric networks.

Source: Frost & Sullivan

Background

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Top 10 Tower Companies in ASEAN Member States

ASEAN member state towercos are much smaller in size and more localized with few operating regionally as compared to global towerco benchmarks.

#1 – edotco – 16,450 towers in Malaysia, Cambodia, Myanmar, Sri Lanka, Bangladesh, Pakistan

#2 – Protelindo – 12,417 towers in Indonesia, Netherlands

#3 – DIF – 12,138 towers in Thailand

#4 – Tower Bersama – 11,154 towers in Indonesia

#5 – Solusi Tunas Pratama (STP) – 7,770 towers in Indonesia

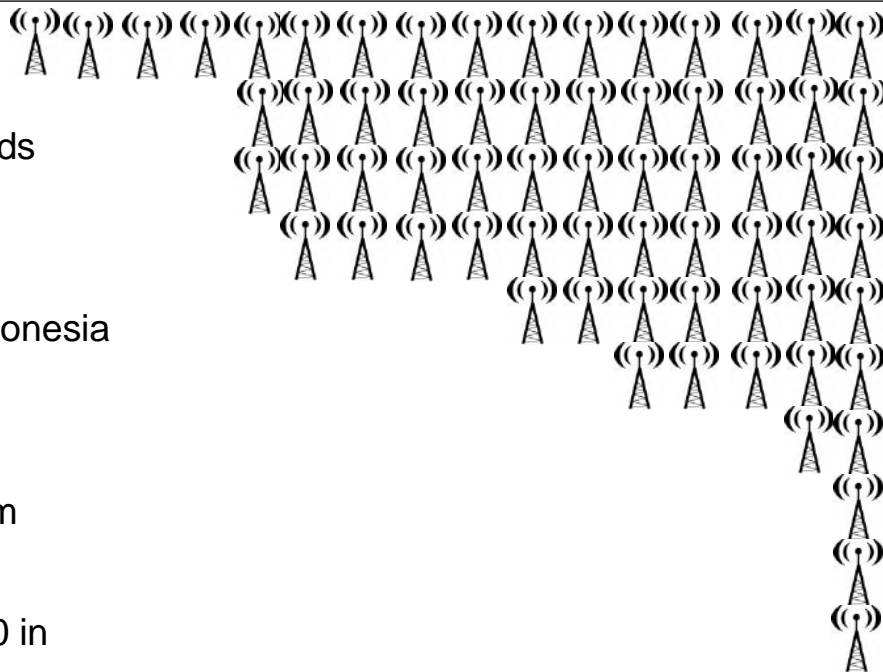
#6 – Mitratel – 5,500 towers in Indonesia

#7 – IBS Tower – 2,185 towers in Indonesia

#8 – ASEAN Tower – 1,972 towers in Myanmar, Vietnam

#9 – SEATH (Vina Capital / VNI) – 1,930 in Vietnam

#10 – Pan Asia Majestic Eagle Limited (PAMEL) – 1,250 in Myanmar



Global Benchmarks:

- China Tower Co – 1.16 million towers in China
- Indus Towers – 117,579 towers in India
- American Towers Corporation – 99,600 towers in USA, Brazil, Chile, Colombia, Peru, Mexico, Costa Rica, Germany, India, Ghana, South Africa, Uganda, Nigeria
- SBA Communications – 25,777 towers in USA, Canada, Brazil, Panama, Costa Rica, Nicaragua, Guatemala, El Salvador, Ecuador

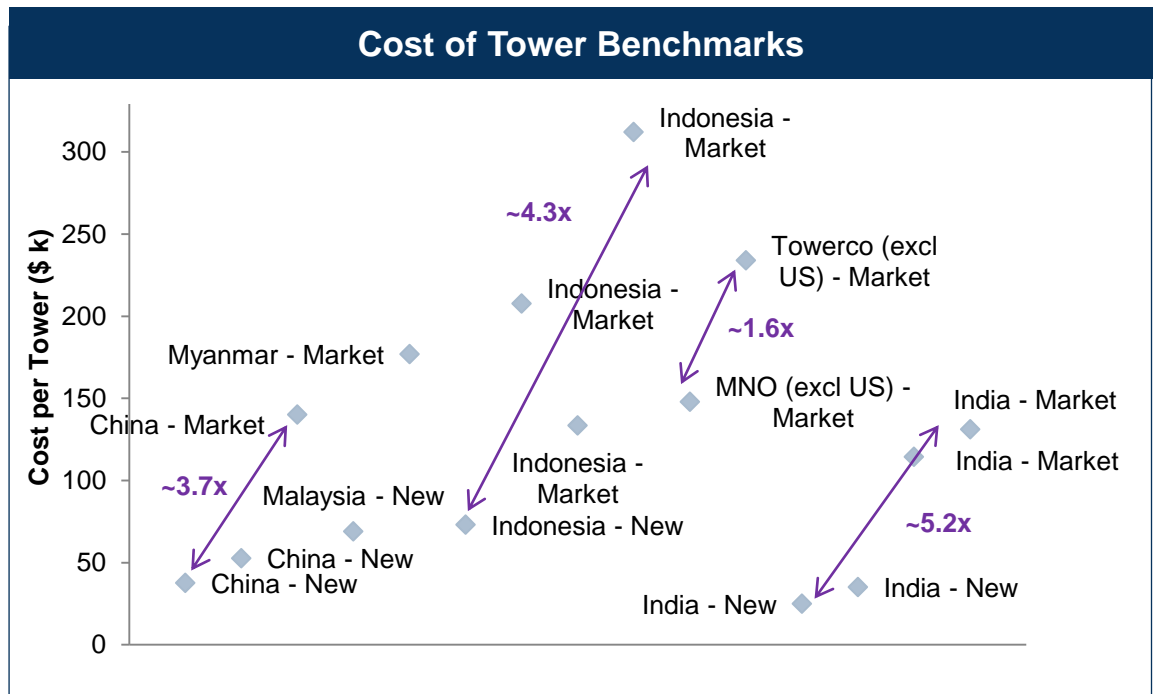
Note: Listing is as of January 2016

Source: TowerXchange, Frost & Sullivan

Valuations of Tower Companies

New towers in ASEAN member states cost more to build than in China and India due to lack of scale.

- **Tower build costs vary according to specifications and local construction and building materials costs.**
 - In India and China, new towers can be constructed for US\$ 25k-52k.
 - However, new towers within ASEAN member states are more costly to build. For instance, in Malaysia and Indonesia the average cost is US\$ 69k-72k.
- **The market value of Towerco towers is higher than that of MNO towers.**
 - For example, the global average for Towerco is 1.6x that of MNOs.
- **The cost to build a tower is lower than its market value.**
 - Market value in India and Indonesia is higher than it is in China.
 - The difference is due to higher growth rate of towers, tenancy, and FCF in India and Indonesia as compared to China.



Source: Frost & Sullivan

Tower Portfolio Valuation Measures

Current and future revenue potential, costs, and business sustainability are key measures.

1. Business Revenue Potential

- a. Lease rate and tenancy ratio
- b. Additional space leased by anchor tenant
- c. Desirability and uniqueness of locations

2. Business Costs

1. Operating efficiency
2. Age and performance of any energy equipment
3. Quality and capacity of structures and implications for improvement of Capital Expenditure (CapEx)

3. Business Sustainability

1. Credit worthiness of tenants
2. Cancellation clauses
3. Completeness of permits
4. Transferability of leases / remaining lease duration
5. Ownership or Right of First Refusal (ROFR) on land under tower
6. Integrity of the asset register

4. Future Revenue Potential

1. Potential future tenancy ratio
2. Potential for additional amendment revenue as 3G and 4G rollout



Source: TowerXchange, Frost & Sullivan

Ownership Models of Tower Companies

The towerco business model is proving to be viable and more lucrative than the conventional model.

- Towerco business models are increasingly becoming popular as 12-18x EBITDA multiples are being observed on publicly listed towercos as compared to 3-4x EBITDA multiples on MNOs.
- Towerco business model penetration is relatively low in ASEAN member states as compared to 100% and 68% in China and India respectively, but it is currently undergoing high growth.
- Below are typical tower ownership models:

MNO-owned – Conventional Model

- MNOs own their own towers
- Optional infrastructure sharing arrangements with local competitors
- For example, Maxis, Digi, and U Mobile in Malaysia

MNOs reducing focus on towers

MNO-owned Towercos

- MNOs set up towerco as wholly owned subsidiaries
- MNOs may then transfer or sell their towers to the towerco and then lease the same towers from the towerco
- Towers may be leased to other MNOs
- For example, Mitratel by Telkom in Indonesia and edotco by Celcom in Malaysia

Towerco Joint Ventures

- Towercos are set up and partly owned by one or more MNOs
- Towercos may then buy towers from MNOs and then lease the same towers back to the MNOs
- For example, Indosat and XLAxiata JV in Indonesia

Independent Towercos

- Towercos are set up as independent companies that are not affiliated with any MNO
- Towercos may lease towers to MNOs
- For example, Protelindo in Indonesia and state-backed towercos in Malaysia

Source: Frost & Sullivan

Key Success Factors for Towercos and Investors

Consider key principles and seek out key markets

To increase towerco valuation, towercos need:

1. To acknowledge local customs and business processes as well as tower regulations.
2. To design a network that is desirable to all MNOs in order to scale up tenancy.
3. To be independent from anchor MNO and remain in control in order to attract MNO competitors to co-locate.
4. To consider alternative business models to purely CAPEX-based models, for example:
 - a. Full OPEX, where all CAPEX investments and operational costs are borne by the towerco, or
 - b. Operational expenditure (OpEx)-led energy model.
5. To seek out key markets which include:
 - a. Markets that are exploring and / or starting to move towards the independent towerco model e.g. Philippines, Thailand, and Singapore.
 - b. Markets where telcos are strengthening 4G networks e.g. Thailand, Philippines, and India. Fitch estimates that telcos in these markets are likely to have capex / revenue ratios of 28–30%.

To invest in towers, investors can:

1. Invest in towercos with high valuations that are experiencing high growth rates and tenancy ratios.
 - a. Valuations can be conducted based on criteria as shared on page 8 of this study.
 - b. Growth rates are higher in India and Indonesia. The 3-year CAGR is estimated at 10-13% and 3% for Indonesia and India respectively.
 - c. High tenancy ratios mean recurring income. Tenancy ratios are higher in India and Indonesia. For example, the tenancy ratios are 2.1x and 1.7-1.8x in India and Indonesia respectively as compared to 1.47x in China.
 - d. Payback period is typically 6-7 years.
 - e. Investment opportunities in Indonesia, e.g. with Protelindo, are worthy of consideration since towercos in Indonesia buy land and own a higher proportion of ground based towers.
2. Invest in MNOs who might opt for sell and lease back or spin off of their tower portfolio.
3. Opt to buy towers directly.

Source: Frost & Sullivan

Key Success Factors for Towercos and Investors

Consider key principles and seek out key markets.

Key Markets in ASEAN Member States:



Indonesia

- High growth rates and tenancy ratios seen in towerco models. However, further consolidation is expected.
- Has scale within large local market.
- Towerco investment opportunities with market value at US\$133.4k – 312k/tower.

Thailand, Philippines

- Strengthening of 4G networks
- Exploring and / or starting to move towards towerco models
- Triggers are BOT resolution and site acquisition challenges in Thailand and the Philippines, respectively

Singapore

- Exploring and / or starting to move towards towerco models
- Trigger will be the entrance of 4th telco

Source: Frost & Sullivan

Leasing Rates across ASEAN Member States

Rates vary considerably, but basic pricing structure principles remain consistent.

Benchmarks:

China – average US \$900 / tower / month

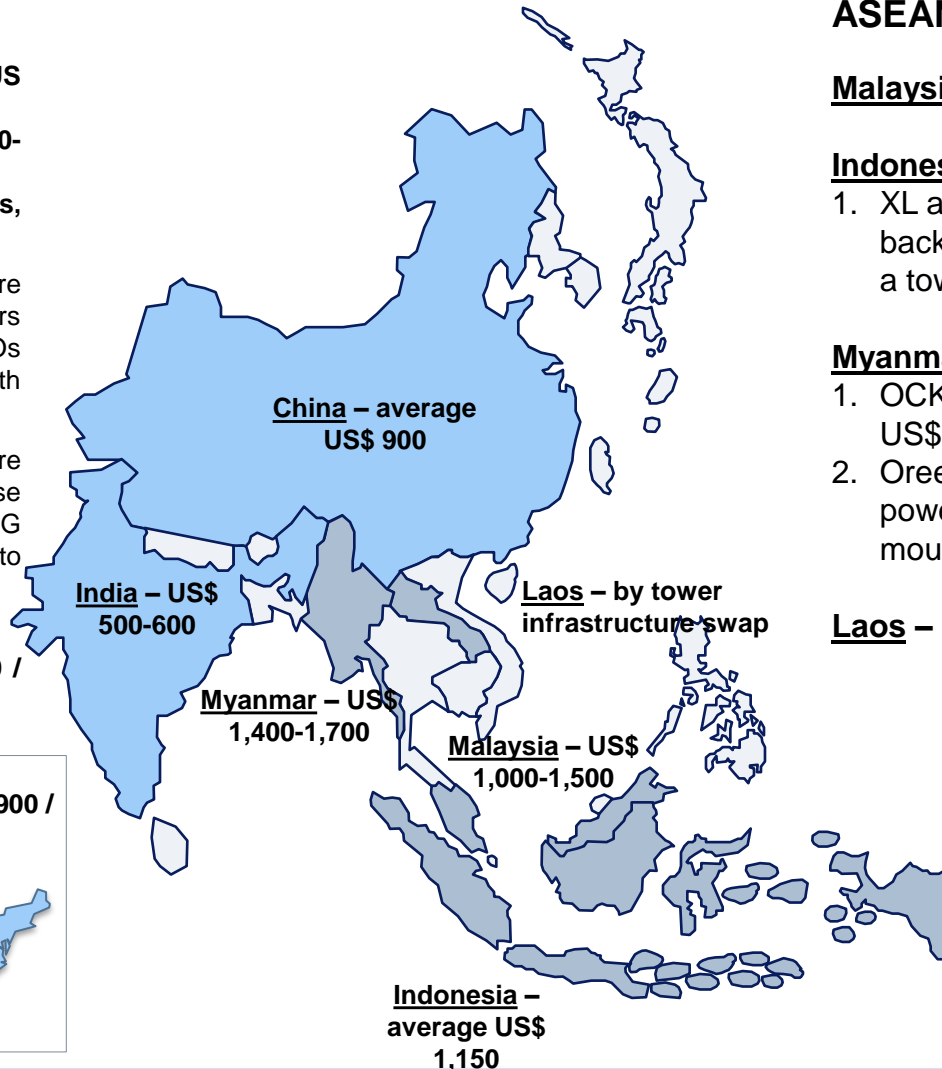
1. In cities, US\$ 800-1,500
2. In rural areas, US\$ 500-750

Note1: Lease terms are typically 10+10 years but the 3 main MNOs have 5 year leases with towercos.

Note 2: Lease rates are expected to decrease in 2017 as MNO 4G network rollout starts to ramp down.

India – US\$ 500-600 / tower / month

US – average US\$ 900 / tower / month



ASEAN Leasing Rates:

Malaysia – US\$ 1,000-1,500 / tower / month

Indonesia – average US\$ 1,150 / tower / month

1. XL agreed to 35% less as part of sell and lease back agreement for a period of 10 years under a tower master lease agreement.

Myanmar – US \$1,400-1,700 / tower / month

1. OCK is offering 35% less as new entrant or US\$ 900 / tower / month inclusive of power
2. Ooredoo charges more due to heavier, more power hungry, but ultimately efficient equipment mounted on Ooredoo's towers

Laos – by tower infrastructure swap

Lease rates are discounted for:

1. Rooftop sites
2. Multiple tenants
3. Cheaper electricity rates
4. Pass through electricity

Note 3: There is a preference amongst MNOs for fixed electricity rates instead of pass through rates to pre-empt pilferage and disputes.

Source: Frost & Sullivan

ASEAN Telecommunications Towers Market Outlook

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Market Outlook—Singapore

Market may open up to infrastructure sharing and towerco with the entrance of the fourth MNO.

7,140 Towers

- Existing MNOs have towers island wide that allow it to meet IMDA's QoS standard, with Singtel leading at 99.9% of outdoor coverage, followed by StarHub and M1 at 99.4%
- According to TowerXchange, there are approximately 1,000 greenfield and 5,750 rooftop sites.

Major Players

Towerco

- N/A

MNO

- Singtel
- StarHub
- M1

Regulatory Considerations

- No foreign equity limits imposed on FBO licensees
- IMDA's Spectrum Management Handbook specifies that spectrum sharing is not allowed
- MVNOs can obtain access to spectrum already allocated to MNOs through commercial wholesale arrangements

Market Outlook—Singapore

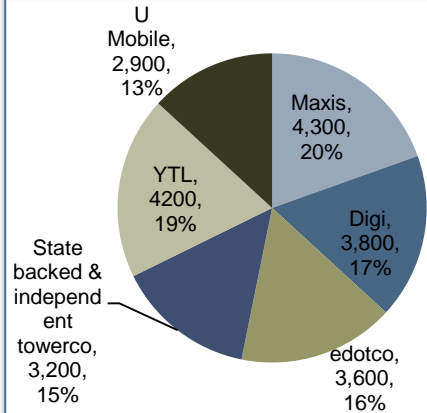
- There are no towercos and hardly any infrastructure sharing in this small, mature market.
- New sites will comprise mostly of in-building systems (IBS), distributed antenna system (DAS), and small cells for infill and indoor coverage.
- However, with the imminent fourth MNO (TPG) required to meet new quality of service standards, the market may open up to infrastructure sharing and towercos in order for the fourth MNO to provide coverage of more than 99% of outdoor areas and tunnels by October 2018.
- IMDA approved the shut down of 2G networks island wide by 1 April 2017, thereby freeing up spectrum for 3G / 4G services. It will commence the General Spectrum Auction (GSA) in Q1 2017 with the 700 MHz spectrum as part of the auction.

Source: Frost & Sullivan

Market Outlook—Malaysia

Increasing efforts amongst the industry to share spectrum and infrastructure

22,000 Towers



Source: Frost & Sullivan

Major Players

Towerco

- State-backed companies* (inclusive of KJS which is owned by YTL)
- edotco (owned by Celcom)

MNO

- Maxis
- Digi
- U Mobile
- YTL Communications

Regulatory Considerations

- 100% foreign equity is allowed in applications service providers
- Limit of 70% foreign equity on NFP and NSP licences.
- Restrictions on foreign ownership allowed in Telekom Malaysia (TM)
- Spectrum is not transferable. However, spectrum sharing is allowed with regulatory approval.

Spectrum Allocation in Malaysia, 2016

Bands	850 MHz	900 MHz	1800 MHz	2100 MHz	2.3 GHz	2.6 GHz	Total
Technology	4G	2G/3G	2G/4G	3G	WIMAX	4G	
Maxis	-	2x10	2x20	2x15 (FDD) + 5 (TDD)	-	2x10 (FDD)	115
Celcom	-	2x10	2x20	2x15 (FDD) + 5 (TDD)	-	2x10 (FDD)	115
Digi	-	2x5	2x20	2x15 (FDD) + 5 (TDD)	-	2x10 (FDD)	105
U Mobile	-	2x5	2x15	2x15 (FDD) + 5 (TDD)	-	2x10 (FDD)	95
TM	2x5	-	-	-	-	-	10
Webe	-	-	-	-	30	2x10 (TDD)	50
YTL	-	-	-	-	30	2x10 (TDD)	50
Asiaspace	-	-	-	-	30	-	30
Redtone	-	-	-	-	30	2x10 (FDD)	45
Altel	-	-	-	-	-	2x20 (FDD)	40
Total	<u>2x5</u>	<u>2x30</u>	<u>2x75</u>	<u>2x30 (FDD) + 20 (TDD)</u>	<u>115</u>	<u>2x70 (FDD) + 2x20 (TDD)</u>	<u>655</u>

Source: MCMC, Frost & Sullivan

Market Outlook—Malaysia

Increasing efforts amongst the industry to share spectrum and infrastructure

Market Outlook—Malaysia

- Towerco-owned penetration was approximately 33% as of Q1 2016.
- State-backed towercos maintain a dominant position amongst towercos due to their function to facilitate permits in some Malaysian states. Political relationships with these companies will be needed to gain access to those states. These state-backed towercos continue to expand with their coverage, including over 2,000 rural sites funded by the Universal Service Provision Fund held by the industry regulator i.e. MCMC.
- edotco is a towerco owned by Celcom that has a collaboration agreement with Digi. It has pioneered the lightweight, high tensile strength carbon fibre tower, which is 40-50% faster to install and offers a 20% reduction in TCO.
- More new sites will be required for 4G LTE since Maxis 4G LTE coverage is still only at 70%, Digi is at 57.6%, Celcom is at 52.9%, and U Mobile is at 42.2%. However, sites will mainly be infill sites using microcells, street level sites such as lamp poles, DAS, and IBS as that is where the demand lies.
- As intense competition continues to put pressure on the top line and cost savings become increasingly important, MNOs have entered into partnerships of mutual interest. For example, Maxis and REDtone as well as Celcom Axiata and Altel have partnered on infrastructure and spectrum sharing, YTL has partnered with Asiaspace on spectrum sharing and bought over KJS to invest in infrastructure and most recently in 2016, TM partnered with Celcom to enable Celcom access to TM's fibre infrastructure while TM's Webe service taps on Celcom's domestic roaming services.

Malaysia's recent budget for 2017 in Oct-16 has announced that fixed line broadband service providers will offer services at higher speeds for the same price from January 2017 and within the next 2 years, this doubling of internet speed will go hand in hand with a 50% reduction in prices. This has implications on the backhaul capacity of fixed line service providers such as TM, TTDC, and Maxis, and means increased use of fiber for backhaul.

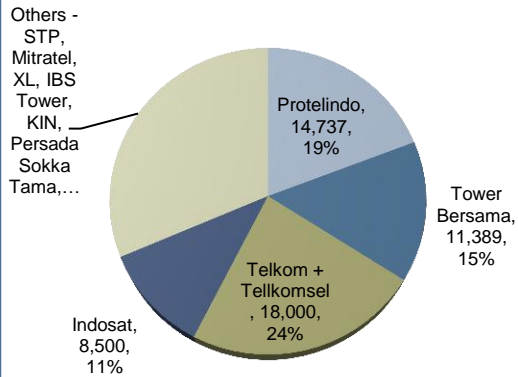
Note*: State-backed companies include Sacofa, Touch Matrix, D'harmoni, KJS, Common Tower, Infra Quest, Yikedbina, Perak Integrated Networks, Asiaspace, Desabina, Melaka ICT Holdings, Rangkaian Minang, PDC Telecommunications & Perlis Comm

Source: Frost & Sullivan

Market Outlook—Indonesia

Consolidation of towers under towercos is continuing; focus is shifting to microcell and fiber.

76,739 Towers



Source: TowerXchange

Major Players

Towerco

- Profesional Telekomunikasi (Protelindo)
- Tower Bersama Infrastructure (TBI)
- Solusi Tunas Pratama (STP)
- Mitratel

MNO

- Telkom + Telkomsel
- Indosat
- XL

Regulatory Considerations

- Foreigners can own up to 67% of a publicly listed towerco.
- Guidelines on tower construction standards and shared use. Monopolistic practices is prohibited
- Local authorities determine tower locations
- Spectrum is not transferable

Market Outlook—Indonesia

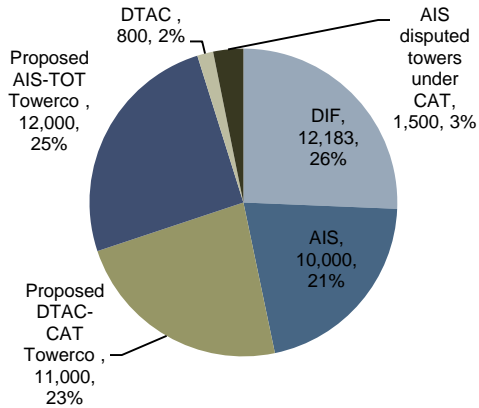
- Towerco-owned penetration was approximately 60% as of Q1 2016; consolidation of towers under towercos is continuing. Tower count to reach approximately 80+ k by the end of 2016.
- XL sold 2,500 towers to Protelindo and is leasing 2,433 back at 35% discount of lease rate as part of a sell and lease back arrangement concluded in June 2016. Similarly, XL has joined with Indosat in May 2016 to form a JV called One Indonesia Synergy. The JV has yet to start operations as it is still in the process of obtaining the necessary permits.
- Towercos such as Protelindo, STP, and Balitower are now focusing more on microcell and fiber. Protelindo acquired iForte that manages over 450 microcell sites, 7 BTS hotels, and over 700 km of fiber optic network with over 180 POP in Jakarta and Surabaya. Similarly, STP has acquired the fibre company, Bit Teknologi.

Source: Frost & Sullivan

Market Outlook—Thailand

A culture of infrastructure sharing is slowly emerging in Thailand.

47,483 Towers



Source: TowerXchange

Major Players

Towerco

- Digital Telecommunications Infrastructure Fund or DIF (owned by True)

MNO

- Advanced Info Service (AIS)
- Total Access Communication (DTAC)
- CAT Telecom (CAT)
- TOT

Regulatory Considerations

- Restrictions limit foreign ownership to the 49% FDI limit and specify guidelines on board control and management by non-Thai nationals.

Market Outlook —Thailand

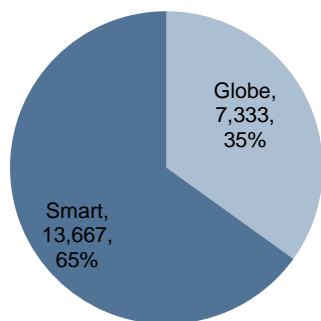
- In the midst of BOT disputes plaguing the industry, True managed to successfully form a towerco called TRUEGIF in late 2013, which was later renamed DIF. DIF now manages the 12,138 towers and over a million km of fiber transferred to it.
- Discussions to resolve BOT disputes by creating a JV towercos between DTAC and CAT as well as between AIS and TOT are still on-going. As there is some degree of overlapping in Thailand, some sites will be decommissioned once the JVs are formed. This means some decommissioning work for construction companies.
- With the recent 4G LTE spectrum allocation, the opportunity for new tower rollout ahead has resulted in a number of new fledgling tower companies emerging in Thailand.

Source: Frost & Sullivan

Market Outlook—Philippines

Market has no towercos yet but is open to exploring the towerco model due to new site acquisition challenges.

21,000 Towers



Major Players

Towerco

- N/A

MNO

- Globe
- Smart

Regulatory Considerations

- Only 20% foreign equity is allowed in the operation of private radio communications networks

Source: Frost & Sullivan

Market Outlook —Philippines

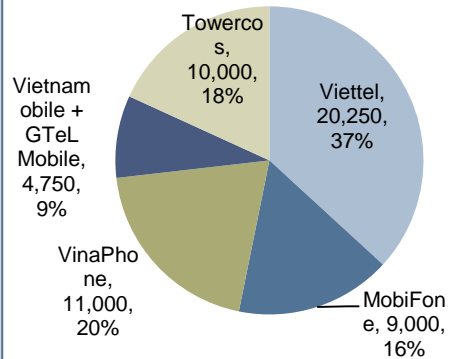
- There are currently no towercos in the Philippines market dominated by the Globe and Smart duopoly. However, MNOs are increasingly inclined to outsource their towers as a result of increasingly challenging market conditions, e.g. difficulty in securing new towers due to the local requirement to obtain the consent of potential tower neighbors prior to build out and high taxation, coupled with complex towers permitting requirements.
- Globe believes that with the government prioritizing telco infrastructure builds, the majority of consumers will benefit from better Internet speeds and service quality as well as connections to the Internet through public health centers and schools. Globe is also pushing for an Open Access Law in the Philippines.
- Fitch expects that 4G rollout will be accelerated in 2017.

Source: Frost & Sullivan

Market Outlook—Vietnam

Towerco consolidation is ongoing in Vietnam

55,000 Towers



Source: TowerXchange

Major Players

Towerco

- OCK Group (acquired SEATH in Aug-16)
- Golden Towers (subsidiary of ASEAN Tower)
- 30 other local towercos

MNO

- Viettel, MobiFone, VinaPhone, Vietnamobile, GTel Mobile

Regulatory Considerations

- Vietnam has made significant reform to investment policies by enacting new investment laws in 2015 that will facilitate foreign investment into telecom markets

Market Outlook – Vietnam

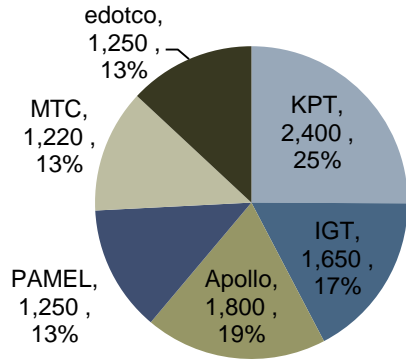
- Towerco consolidation is ongoing in Vietnam e.g. OCK recently acquired the largest of Vietnam's independent towercos, SEATH with their mostly guyed mast 1,938 towers. The deal excludes SEATH's small IBS business which will be retained by the existing owners, VNI. Also, Golden Towers is in the process of rolling up 5,800 towers by consolidating existing independently owned towers in Vietnam.
- The restructuring of MobiFone and VNPT could either unlock a sale and leaseback opportunity or an infrastructure sharing opportunity as VNPT had historically relied on MobiFone's network.
- 4G spectrum was allocated to the 3 major MNOs in Oct-16. Upcoming 4G LTE rollouts ensure new towers will be added but construction firms may get as much decommissioning as new build work as a result of some overlapping infrastructure.

Source: Frost & Sullivan

Market Outlook—Myanmar

Towerco market is consolidating, growth is expected with the imminent entry of the fourth MNO.

9,570 Towers



Source: Frost & Sullivan

Major Players

Towerco

- KPT / KDDI Summit
- Apollo
- Irrawaddy Green Towers (IGT), edotco, PAMEL

MNO

- Myanmar Posts and Telecommunications (MPT)
- Telenor, Ooredoo, MecTel, Viettel

Regulatory Considerations

- Myanmar is an underdeveloped country, eager to attract foreign investment.

Market Outlook – Myanmar

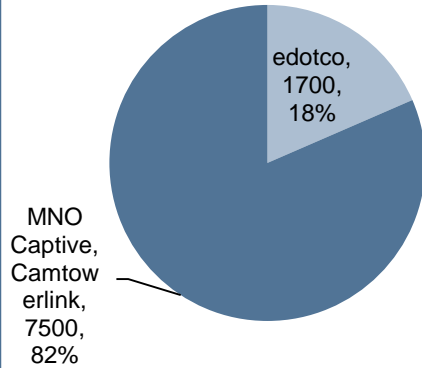
- Mobile penetration is still only 63%, but towerco-owned penetration was at 71% and forecasted at 89% in 2015 and 2017 respectively
- According to GSMA, 17,300 towers are required to provide coverage in Myanmar. This means another 7-8k towers are required and of these approximately 7k have already been planned for construction by towercos.
- The imminent entry of the fourth MNO will further accelerate growth rates and tenancy ratios of towercos. Tenancy ratio growth is expected to concentrate within urban sites rather than at rural sites, as this has been the trend thus far.
- While the market is growing, there is ongoing consolidation as some players plan to exit the market and some plan to grow. For instance, edotco plans to grow beyond its 1,250 towers to 5,000 in the next 3 years.

Source: Frost & Sullivan

Market Outlook—Cambodia

Cambodia needs new business models for infrastructure ownership and management.

9,200 Towers



Source: Frost & Sullivan

Major Players

Towerco

- edotco
- Camtowerlink

MNO

- Metfone
- Smart Axiata
- Mobitel
- qb, SEATEL, Cootel

Regulatory Considerations

- 100% foreign ownership is allowed.
- Infrastructure sharing is supported.

Market Outlook —Cambodia

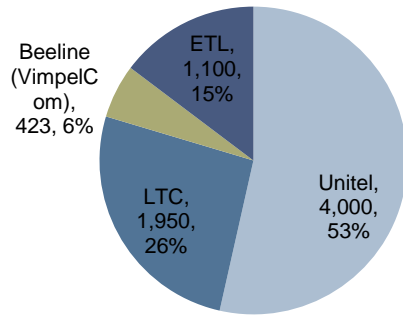
- edotco plans to invest in a remote tower operations centre in 2016 despite RMS not being widely deployed in Cambodia
- Camtowerlink is a new towerco in Cambodia where 20% of sites are off grid. It has full support of its parent company, Mutiara Teknologi Sdn Bhd from Malaysia
- With mobile penetration at approximately 130%, incumbent MNOs having outdoor coverage exceeding 90% are starting to focus on IBS rollout and new entrants co-locating, as opposed to building, demand for tower manufacturers and telecommunications infrastructure companies in Cambodia is expected to be limited
- The country faces challenging grid conditions with grid sites provided by SOE Electricité du Cambodge and by private microgrids and distributed generation projects.

Source: Frost & Sullivan

Market Outlook—Laos

Beeline could be a potential opportunity for investors looking to monetize its towers.

7,473 Towers



Major Players

Towerco

- N/A

MNO

- LTC
- Unitel
- ETL
- Beeline and Sky Telecom

Regulatory Considerations

- Laos has a very open foreign investment policy, and imposes few restrictions.

Source: TowerXchange

Market Outlook —Laos

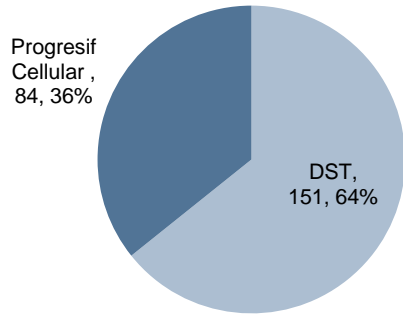
- There are no towerco in this small market where the top 3 MNOs, i.e. LTC, Unitel and ETL, are government owned
- Laos is an active market for bi-lateral infrastructure sharing, i.e. swaps where no money changes hands. LTC share infrastructure quite extensively while ETL and Unitel share some towers.
- Low ARPU at US \$ 5 and lack of foreign investment dollars mean that available capital goes into the 4G overlay rather than into new tower rollout.
- As the smallest network, 40% of Beeline's towers are co-located on third-party towers. VimpelCom's exit from Beeline could be a potential opportunity for investors looking to monetize its remaining towers.

Source: Frost & Sullivan

Market Outlook—Brunei

Small market and 4G LTE rollout to level playing field in Brunei amongst 2 key players.

235 Towers



Major Players

Towerco

- N/A

MNO

- DST Communications
- Progresif Cellular Sdn Bhd (PCSB), taking over from the defunct B-Mobile

Regulatory Considerations

- AITI, the industry regulator, is working towards a converged regulatory regime by combining the frameworks for broadcasting and telecommunications under a single umbrella to improve MNO services and speeds.

Source: <http://www.bt.com.bn>

Market Outlook – Brunei

- Brunei is a small market with a dominant market leader, DST and a new entrant, Progresif Cellular Sdn Bhd (PCSB). PCSB took over from the defunct B-Mobile in July 2014 and is targeting to increase its market share from 11% to 50% by 2017. As a step towards this, it aims to expand its mobile network coverage by adding 82 new base stations, which should increase their overall coverage by 25% by the end of 2016.
- Up until recently, DST was the only provider of 4G LTE services in Brunei. PCSB has recently obtained regulatory approval from the AITI, the industry regulator, to launch 4G LTE services in 2016. The rollout of 4G LTE is expected to level the playing field in Brunei by giving PCSB an opportunity to grow its market share.

Source: Frost & Sullivan

Tower Provider Outlook—edotco

Background:

- Has 16,450 sites; approximately 7,000 or 42.5% are ground based.
- It has pioneered the first carbon fibre tower in Asia, which is a lightweight, high tensile strength tower solution which not only is 40-50% faster to install but also results in a 20% TCO reduction. It has successfully capitalized on scale to recover R&D costs through regional TCO savings.
- Apart from the OCK group, edotco is the only other regional player in the fragmented ASEAN and APAC markets.

Plans and outlook for the next 5 years:

- edotco continues to evolve beyond a traditional tower company to remain competitive. It focuses on creating its own reliable supply of power and promotes cost efficiency through innovative telecom infrastructure solutions.
- The ASEAN member states are still the main growth areas for edotco as they offer a lot of opportunities. The company is already ranked #1 in ASEAN and aspires to be amongst the world's top 5 tower companies by 2020.
- With fresh funds from investors, edotco plans to acquire tower companies in Q1 2017, especially those operated by mobile operators. Small tower companies, for example, those in Vietnam, could be potential targets. It had relied on acquisitions to grow to its current size and will continue to do so in the coming years
- In Myanmar, edotco plans to grow beyond its 1,250 towers to 5,000 in the next 3 years.

Source: Frost & Sullivan

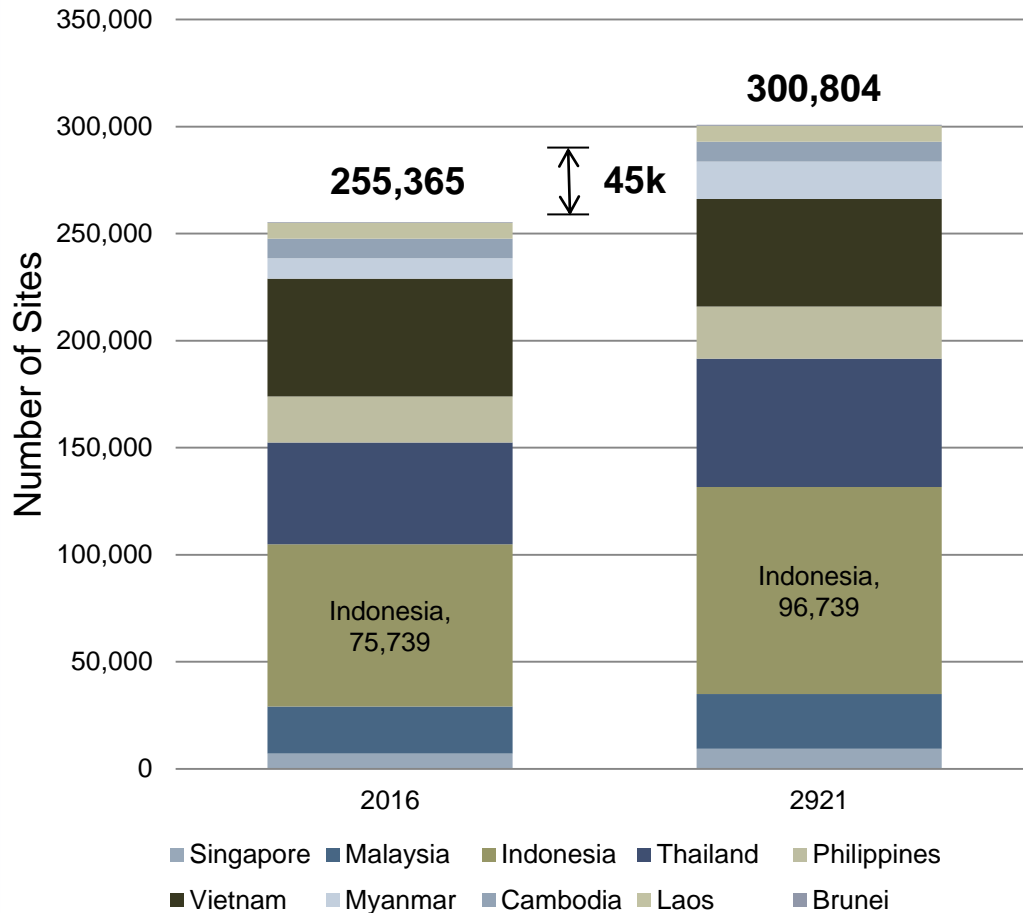
Forecasts and Trends—Total Market

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Number of towers in ASEAN will reach 301k by 2021

Growth will mainly come from Indonesia, Thailand, and Myanmar.

Split of Sites Across ASEAN



- In 2016, 51% of towers were in Indonesia and Vietnam.
- The number of towers in ASEAN member states will grow from 255k in 2016 to reach 301k by 2021.
- CAGR is estimated at 3.3% during 2016-2021.
- Growth in the number of towers will mainly come from 21,000 new towers in Indonesia, 12,500 in Thailand, and 7,903 in Myanmar
- Indonesia, Thailand, and Myanmar will account for 91% of new towers in ASEAN member states.
- The number of towers in Vietnam will decrease by 9% from 55k in 2016 due to industry consolidation.
- High growth in Indonesia helped to offset the effects of industry consolidation.

Source: Frost & Sullivan

Conclusion

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Key Takeaways

1

More and more MNOs are seeing the benefits of selling and leasing back towers from towercos. As downward pressure increases on the top line, the costs reductions required to stay profitable will mean that the industry will eventually move towards shared infrastructure, more likely than not through towercos. There is opportunity for towercos with scale to reduce costs for MNOs in the ASEAN member states through more efficient solutions, e.g. tower solutions, energy management, and network QoS management.

2

The rate at which new spectrum is being assigned implies shorter payback periods are required for new network build out. This means that MNOs with networks that requires minimal upgrades and enhancements will fare better. Also, data consumption has reached a point where fibre is now more cost effective for MNOs to use on its backhaul. Both of these factors are driving increasing use of microcells and fiber by MNOs and will benefit equipment vendors operating in ASEAN member states.

Source: Frost & Sullivan

Appendix

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Acronyms

4G	Fourth Generation Mobile Technology (Wireless Broadband)
AITI	Authority for Info-communications Technology Industry, Brunei
ARPU	Average Revenue Per User
BOT	Build Operate Transfer
BTS	Based Transmission Services
DAS	Distributed Antenna System
EBITDA	Earnings before interest, tax, depreciation, and amortization
FBO	Facilities Based Operator
FCF	Free Cash Flow
FDI	Foreign Direct Investment
IBS	In-building Solution
IMDA	Info-communications Media Development Authority of Singapore
JV	Joint Venture
LTE	Long Term Evolution
MCMC	Malaysian Communications And Multimedia Commission
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator

Source: Frost & Sullivan

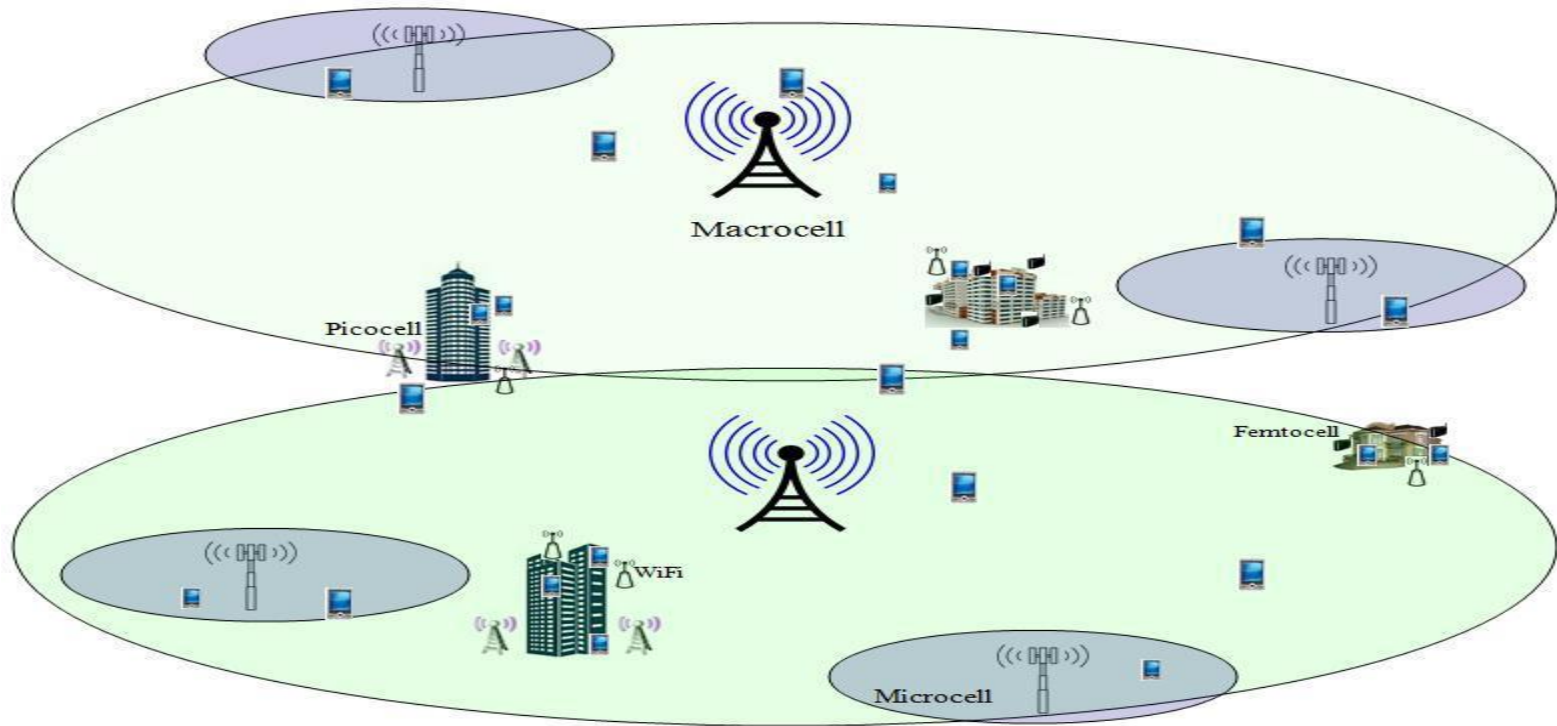
Acronyms (continued)

NFP	Network Facilities Providers
NSP	Network Service Provider
POP	Points of Presence
RMS	Remote Monitoring Service
QoS	Quality of Service
SOE	State Owned Enterprise
TCO	Total Cost of Ownership

Source: Frost & Sullivan

Heterogeneous Networks Offer Greater Coverage and Higher Capacity

Singapore is using a HetNet to strengthen its connectivity framework.



LTE Advanced Heterogeneous Network

- A heterogeneous network or HetNet comprises of wireless mobile networks with different cell sizes and varying output power, various radio access technologies and multiple architectures. Its primary objective is to achieve greater coverage and higher capacity while offering seamless handoff and connectivity.
- A HetNet rollout commenced in Singapore in August 2016 following successful trials by MNOs in 2015.

Source: <https://wirelesstelecom.wordpress.com/tag/macrocell/>, <https://www.techinasia.com/singapore-smart-nation-2015>

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The Journey to Visionary Innovation

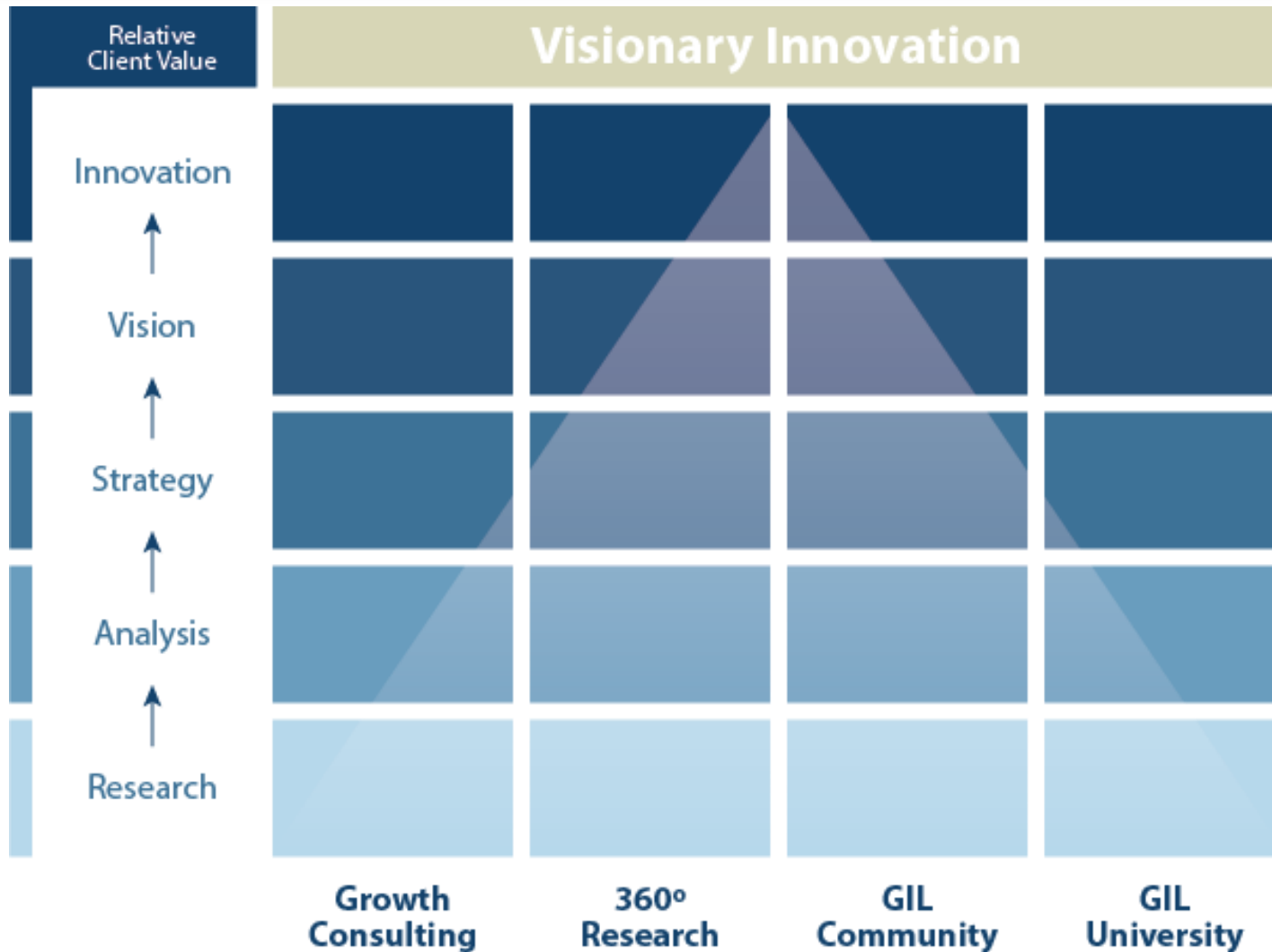
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Comprehensive Industry Coverage Sparks Innovation Opportunities



Aerospace & Defense



Measurement & Instrumentation



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Information & Communication Technologies



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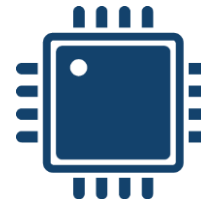
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Implementation Excellence

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