



Imperial College
London

Railway and Transport Strategy Centre

The Operator's Story

Case Study: **Hong Kong SAR, China's Story**

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Community of Metros
CoMET



The Operator's Story: Notes from Hong Kong SAR, China Case Study Interviews

February 2017

Purpose

The purpose of this document is to provide a permanent record for the researchers of what was said by people interviewed for 'The Operator's Story' in Hong Kong SAR, China. These notes are based upon 9 meetings between 7th and 10th March 2016. This document will ultimately form an appendix to the final report for 'The Operator's Story' piece. Although the findings have been arranged and structured by Imperial College London, they remain a collation of thoughts and statements from interviewees, and continue to be the opinions of those interviewed, rather than of Imperial College London. Prefacing the notes is a summary of Imperial College's key findings based on comments made, which will be drawn out further in the final report for 'The Operator's Story'.

Method

This content is a collation in note form of views expressed in the interviews that were conducted for this study. Comments are not attributed to specific individuals, as agreed with the interviewees and MTR. However, in some cases it is noted that a comment was made by an individual external not employed by MTR ('external commentator'), where it is appropriate to draw a distinction between views expressed by MTR themselves and those expressed about their organisation.

List of interviewees

Internal MTR views:

- Lincoln Leong, CEO
- Dr Jacob Kam, Operations Director
- David Tang, Property Director
- Morris Cheung, European Business Director
- Stephen Chik, Head of Projects Engineering
- Raymond Yuen, General Manager Marketing and Planning

External commentators:

- Andy Chan, Deputy Secretary for Transport and Housing (Transport), Transport and Housing Bureau
- Raymond Cheng, Principal Assistant Secretary for Transport and Housing (Transport)
- Dr Dorothy Chan, MTR Board Member
- Sunny Cheung, CEO, Octopus.

Key Messages: Relevance to International Learning about Metro Operators

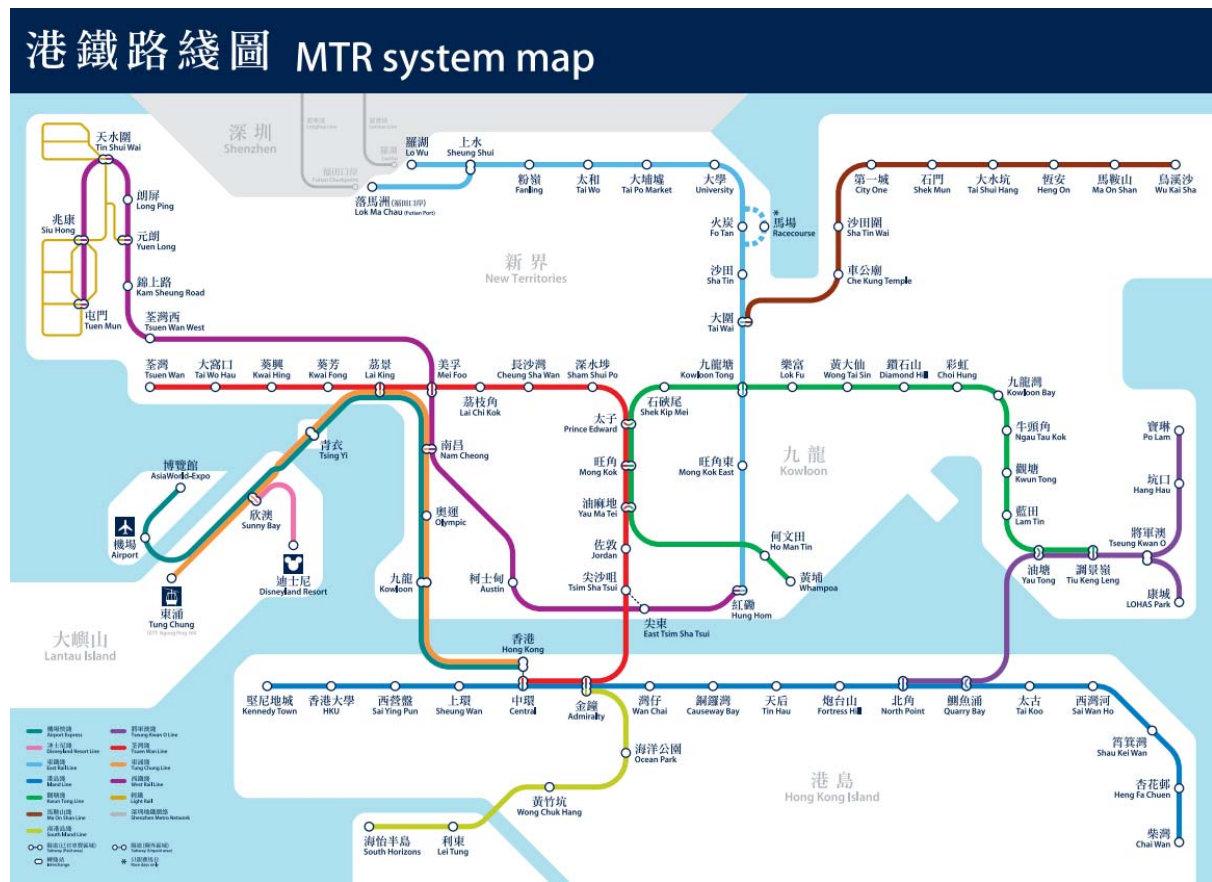
Hong Kong MTR provides insight into a world-class, proactive metro Operator with substantial influence, autonomy, business practices and operational outcomes. It has proved that the approach that delivers operational excellence is transferable and the case study key findings offer significant insight into how this could be achieved by other Operators. Key lessons for operators include:

- **Financial sustainability** affords the operator a level of autonomy and independence which aligns with trust provided by the authority. This provides MTR with the necessary independence to make decisions and reinvest in their network at the time and place of their choosing to align with service goals that are in the authority's interest.
- An authority providing a **predictable pipeline of projects** without a stop-start pattern of network development will retain talent and develop it in all areas of operation. The operator must be able to communicate to its authority what it reasonably can and cannot do and/or control. A good authority will help to bring external opportunities within the operator's control: "*Government should put in mechanisms to allow the railway company to help itself.*" A good starting point for metro success is to **reduce bureaucracy and conflicts between federal, state and local Governments**.
- MTR has not only proved itself capable of adapting to rapidly developing customer expectations, but has also **changed their expectations** itself. This has been achieved through the use of Octopus for example, where customers are now able to integrate their travel, retail and leisure experience. This has also resulted in the growth of **consultative processes** during planning, including transparency, public review, planning for implementation and mitigating impacts, and environmental impact assessments. Greater customer expectations from service as well as planning can increase cost and programme risk, and MTR advocate taking the time to **mitigate these at the outset of the project**, rather than trying to solve them during the project's implementation.
- The **rail and property** funding and delivery model for public transport projects is powerful – both for achieving financial sustainability and achieving development aims associated with transport. A key to making this work involves **siting stations in the right place**, not just where is easiest, providing foundations for future development and starting by developing above depots. Developments are also carefully managed to ensure the mix of services that customers want. The result are developments that feed the railway in exchange for a railway that maximizes the value of developments.
- **Over-station development** is achievable in a wide variety of environments. Because of the need to set out clearly the rights of owners at different levels, if there is a difficulty enforcing contracts then it is preferable for the operator to lead and own the project as a single planner, designer, developer and landlord. This may be easier on greenfield sites. There is also a need for extensive engineering to make developments work around the operating railway system, involving isolation of noise, vibrations, fire suppression, etc.
- However, there is no single correct business/operating model for metros and it is important to **consider the specific project and the specific location**. If a PPP operator is being procured to build capability, it is important that this is explicit: "*whoever comes in to help must have a remit to transfer know-how.*"
- When considering privatisation it is important to **differentiate between lowest cost and value for money** and to recognise that targeting lowest cost may not ultimately be the best way to serve passengers. In particular, Governments should beware bidding contracts where the operator's profits are based on ridership, as ridership is generally related more closely to GDP growth than metro service quality: "*do they want to give the*

contract to people who are ultra-aggressive in predicting GDP growth then hand back keys in a few years' time?"

- **Proven technology** is a given and MTR adopts technology only when it has been proved in similar environments. Standard industrial specifications provide a level of protection for operators providing sufficient plans are in place for procurement, risk, investment and obsolescence. Reinvestment in assets is not a like-for-like replacement because technology develops during its operational life.
- MTR advises that a metro system should be designed for at least **50 years after it is opened**, considering growth, change in customer expectation, travel patterns and labour markets. This should include a thorough set of **alternative analyses** that can serve as future business cases should circumstances change, and should highlight short-term costs against longer-term benefits to prioritise network sustainability.
- MTR spends substantial time and effort bringing people to a common vision, and **proactively managing stakeholders**. This may extend the early part of project development but is likely to result in long-term buy in and trust from the authority and stakeholders, reducing long-term project constraints, surprises and opposition.
- The **operator and authority need to collaboratively plan** a coherent metro system that fits into a wider public transport system. This allows for design features that maximise the passenger experience; in Hong Kong SAR, China's system this includes world-class paired cross-platform interchanges to be planned. These world-class design features are not possible with a line by line incremental approach.
- The **authority need to have the right competence** to undertake a major project and be able to provide enough resources to the operator. However, if dealing with a competent and experienced operator, MTR advises that the authority also need to be able to stand back from the project's development: *"If the rail company has enough expertise, I believe it's better for Government to stay off daily running"*.
- MTR believe their **full vertical integration** is key to their reliability success. They can operate a closed-loop management system which gives them operational control, building on full control of asset management.

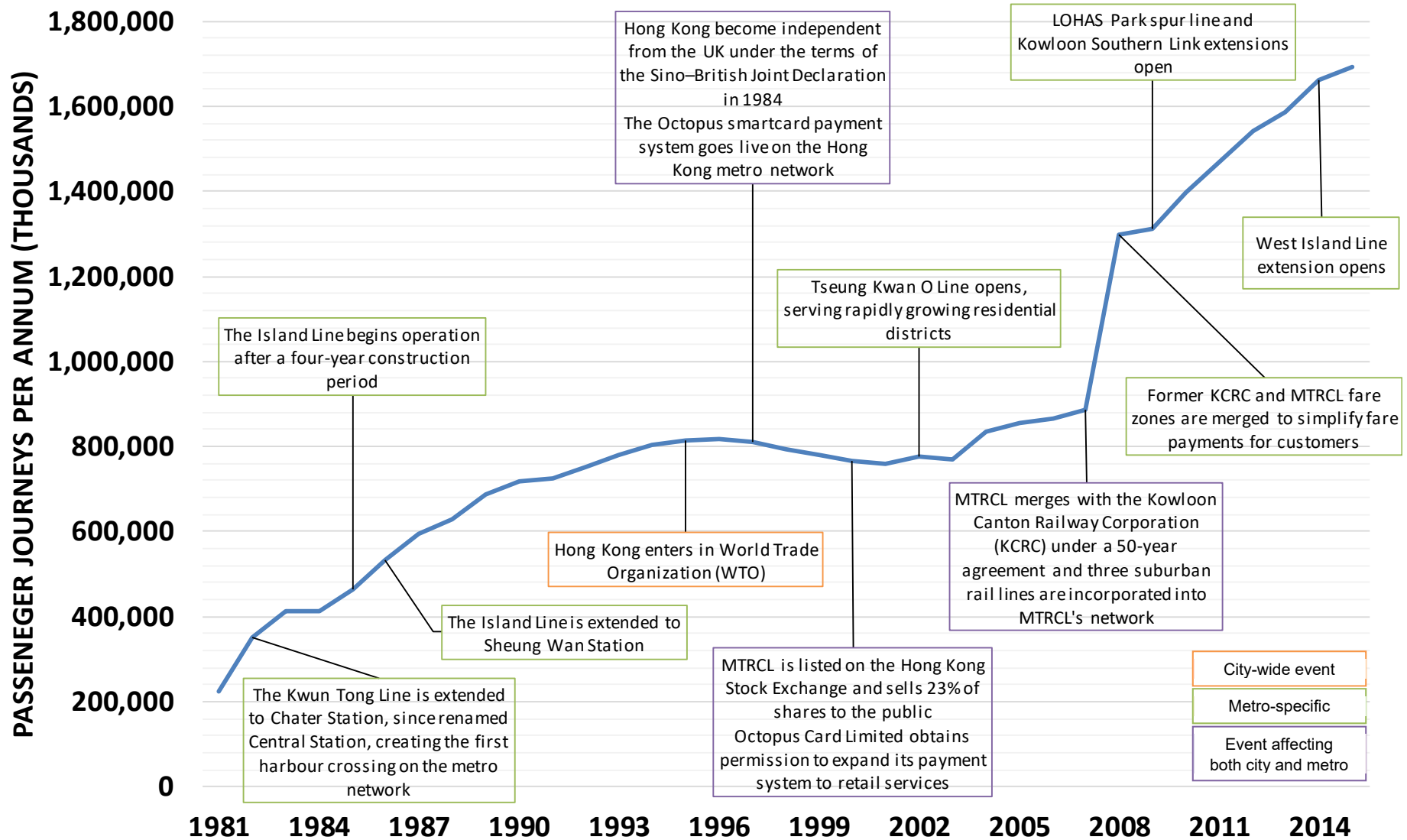
Transit Map



Growth in Passenger Journeys and Key Events in Hong Kong SAR, China

The following graph demonstrates MTR's growth in passenger journeys from 1981 – 2015 and includes selected key surrounding events that took place in Hong Kong SAR, China, and selected events in the history of MTR.

Hong Kong: Passenger Journey Profile and Key Events



General Summary of Hong Kong MTR

GENERAL SUMMARY		
Background and history		<ul style="list-style-type: none"> ▪ Rail transport is strongly considered by the Hong Kong SAR, China Government to be the backbone of sustainable public transport in Hong Kong SAR, China owing to its capacity and reliability in such a dense urban context. MTR is financially autonomous and does not receive any public financial subsidy but does receive subsidy in the form of land at the time of network development. ▪ The system consists of 9 metro lines and two rail links between the Airport and Hong Kong SAR, China Disneyland. The Kwun Tong Line opened in 1979, quickly followed by the opening of the Tsuen Wan Line in 1982 and the Island Line (1985). ▪ Several extensions and new lines have been constructed rapidly in Hong Kong SAR, China. These include the Airport Express opening to connect the city to a new international airport and the Tung Chung Line opening in 1998. The Tseung Kwan O Line was built as a consequence of new residential growth and opened in 2002. In 2005, the Disneyland Resort Line was opened in order to connect to the Hong Kong SAR, China Disneyland Resort. The LOHAS Park spur line, West Island Line, Kwun Tong Line Extension and the South Island Line opened in 2016. ▪ MTR took over the operation of the Kowloon-Canton Railway Corporation (KCRC), another railway operator in Hong Kong SAR, China, under a 50-year service concession agreement, which may be extended. This brought the East Rail Line, Ma On Shan Line and West Rail Line within MTR operations. ▪ Future expansion plans involve the Sha Tin to Central Link project, the North Island Line, the Northern Link and East Kowloon Line. The North Island Line in particular will relieve congestion in the northern part of Hong Kong Island, with construction expected to begin in 2021 until 2026. The Sha Tin to Central Link project is one of the most important projects of future expansion of MTR network and will create two new rail corridors upon completion. The Tai Wai to Hung Hom section, expected to be completed in 2019, will connect the Ma On Shan Line and West Rail Line to form the East West Corridor. The section from Hung Hom to Admiralty, across Victoria Harbour, extension of the East Rail Line to form the North South Corridor, is expected to be completed in 2021. ▪ Hong Kong SAR, China gained independence from the United Kingdom in 1997. The “one country, two systems” principle allowed (and still allows) Hong Kong SAR, China to maintain a market driven economy. ▪ MTR offers international consulting on railway-related projects and operates internationally. MTR operates Beijing Metro Line 4, Line 14 and Line 16, Shenzhen Metro Line 4, Hangzhou Metro Line 1, Melbourne’s Metropolitan Rail Service, Stockholm Metro, Stockholm commuter rail and Stockholm Gothenburg Intercity Express Service. MTR is the concessionaire for the operation of London’s Crossrail line (known as the Elizabeth Line when it begins operations).
Key dates and why they matter	1967	Construction of the Mass Transit Railway (MTR) system was prompted by a study, released in 1967, commissioned by the Hong Kong SAR, China Government to find solutions to the increasing road congestion problem caused by the fast-growing Hong Kong SAR, China economy. Construction started soon after the release of the study. Four rail lines were planned for development in six stages. These four lines were the Kwun Tong Line, Tsuen Wan Line, Island Line and Shatin Line.

1975	<p>Population growth, management and funding for the project cause modifications to the original plan. The construction of the “Modified Initial System” (now part of the Kwun Tong Line and Tsuen Wan Line) started in November 1975.</p> <p>In 1975, the government established the Mass Transit Provisional Authority (MTPA) as a government-owned statutory corporation to build and operate the Mass Transit Railway (MTR) system. This was then replaced by the Mass Transit Railway Corporation (MTR) in the same year with a mandate to oversee commercially viable operations.</p>
1977	<p>The construction of the Tsuen Wan Line, then known as the Tsuen Wan Extension, is approved by Government. This helps facilitate the development of Tsuen Wan New Town, an area of approximately 25km² in the New Territories of Hong Kong SAR, China. Tsuen Wan New Town is currently administratively considered as part of the Hong Kong SAR, China metropolitan area.</p>
1979	<p>The northern section, running from Shek Kip Mei Station to Kwun Tong Station opens in October. An additional route from Tsim Sha Tsui Station to Shek Kip Mei Station also opens in the same year.</p>
1980	<p>The Kwun Tong Line is extended to Chater Station, since renamed Central Station. Chater Station was planned to be an interchange hub as the metro developed, capable of accommodating 330,000 passengers per day.</p>
1981-1985	<p>The construction of the Island Line, started in 1981, was completed in four years and the line opens in May. The line connected Admiralty Station and Chai Wan Station, both interchange stations with the Tsuen Wan Line.</p>
1986	<p>The Island Line is extended to Sheung Wan Station. This extension included a stop at Central Station (formerly Chater Station) creating the planned interchange between the Island Line and Kwun Tong Line.</p>
1988	<p>The Light Rail Transit (LRT) system opens in Hong Kong SAR, China as part of the Kowloon-Canton Railway network after MTR had previously been unable to invest in the project. This required the withdrawal of bus services in the Tuen Mun city area despite being profitable services. The system opens with five loops serving housing estates in Tuen Mun.</p>
1989	<p>The Government approve the construction of a new international airport to replace the overcrowded Kai Tak International Airport, located at Chek Lap Kok on Lantau Island. The airport was not considered viable without direct public transport links. The construction of a new line, named Lantau Airport Railway, was included in the financing plans of the new international airport. Construction costs were also shared by the MTR. The Lantau Airport Railway turned into two MTR lines, the Tung Chung Line and the Airport Express.</p>
1997	<p>Sovereignty over Hong Kong SAR, China was transferred from the United Kingdom to the People's Republic of China. The “one country, two systems” principle allowed (and still allows) Hong Kong SAR, China to maintain a market driven economy.</p> <p>The Octopus smart card fare-payment technology goes live and is integrated into the metro system. It is a rechargeable contactless smart</p>

		card used in across the electronic payment system and allows passengers to travel on multiple modes.
	1998	The Airport Express and Tung Chung Line begins operations.
	2000	On 30 June 2000 the MTR was succeeded by the MTR Corporation Limited (MTR). MTR is listed on the Hong Kong SAR, China Stock Exchange three months after its formation. Octopus Card Limited, the company responsible for administering the Octopus payment system, obtains permission to expand the use of the card to different applications, particularly in the retail sector to provide passengers with seamless payment options in and around stations.
	2001	The Kwun Tong Line extension opens, connecting Quarry Bay to North Point.
	2002	The Tseung Kwan O Line begins operations. This line was built in response to rapid housing growth around the planned alignment.
	2005	The Disneyland Resort Line opens, running between Sunny Bay station and Disneyland Resort station. It connects to the Hong Kong SAR, China Disneyland Resort, which also opens in 2005. The line operates fully automated trains running every four to ten minutes without a driver. The AsiaWorld-Expo Station also opens in 2005 as an extension of the Airport Express line serving the AsiaWorld-Expo, a new international exhibition centre located at the international airport.
	2007	MTR takes over the operation of the Kowloon-Canton Railway Corporation (KCRC), another railway operator in Hong Kong SAR, China, under a 50-year service concession agreement, which may be extended. The primary driver was cost efficiency and effectiveness, given that both organisations had a similar role in delivering rail transport. MTR makes annual payments to KCRC for usage of assets. The network continues to expand after this merger.
	2008	Fare zones of all urban lines, East Rail Line, Ma On Shan Line and West Rail Line are merged. Student discounted fares are also introduced.
	2009	In 2009, LOHAS Park spur line opens. This is an extension of the Tseung Kwan O Line and opens alongside the Kowloon Southern Link.
	2014	In 2014, the West Island Line, extension of the Island Line, opened, serving the Western District of Hong Kong Island.
	2016	In 2016, the Kwun Tong Line Extension and the South Island Line opened. The South Island Line, between Admiralty and South Horizons, links the Southern District to the MTR for the first time. With the opening of the South Island Line, all of Hong Kong SAR, China's 18 districts are now served by the MTR.
Current ownership and oversight		<ul style="list-style-type: none"> ▪ The MTR system is owned and managed by the MTR Corporation Limited (MTR) railway operator. MTR is listed on the Hong Kong SAR, China Exchange, with the Government owning 75% of shares and other shareholders owning the remaining 25%. ▪ A chief executive officer and an executive committee are involved in the management of the corporation. They report to a Board headed by a non-executive chairman and formed by local business and community leaders and government representatives.

	<ul style="list-style-type: none"> ▪ MTR is involved in other business activities in addition to its railway operations, including residential and commercial projects, property leasing and management, telecommunication services, international consultancy services, etc.
<p>Complementary public transport and non-motorised transport services</p>	<ul style="list-style-type: none"> ▪ Buses: Franchised bus services are provided by five operators: KMB, CityBus, New World First Bus, Long Win Bus and New Lantao Bus. MTR operate non-franchised public buses to provide connectivity to railway stations on the West Rail Line and Light Rail services, and to residential areas. Other non-franchised buses include tourist, hotel, school, employee and residential services. Public light buses are minibuses providing feeder services to higher-capacity public transport and flexible services where necessary. ▪ Pedestrian infrastructure: Pedestrian schemes and road safety are managed by the Transport Department of the Hong Kong SAR, China Government with some input from the Planning department, as much of Hong Kong SAR, China's pedestrian infrastructure is related to development. ▪ Car sharing: CarShare operate in Hong Kong SAR, China, a car rental service renting cars owned by private systems. Car sharing is a relatively new service as yet with little regulation or policy. Reducing car congestion has been a long-term goal of the Hong Kong SAR, China Government. ▪ Cycling: The Transport Department of the Government of Hong Kong Special Administrative Region oversee cycling, focusing on providing cycle tracks and trails and leisure cycling in the north-west New Territories. Smartbike is a bike sharing service provided in West Kowloon Cultural District. ▪ Taxis and other ride sharing schemes: Taxis are assigned to specific areas and include urban taxis in Kowloon, Hong Kong Island, and the New Territories, New Territories taxis, which operate only in the New Territories, and Lantau taxis, which operate on Lantau Island and around Chep Lap Kok Airport. Taxi licenses are issued by the Hong Kong SAR, China Government. ▪ Trams: The tramways system is owned and operated by Veolia Transport RATP Asia. It only operates on Hong Kong Island, between Chau Kei Wan and Kennedy Town. Also, it is the only tram system in the world to be operated exclusively with double-decker trams. ▪ Surface trains: Cross-border trains are provided between Hong Kong SAR, China and China (Shenzhen, Beijing, Shanghai and Guangzhou East) between MTR and Chinese railway operators, sharing some track with the East Rail Line. Three former suburban rail was brought within MTR operations when the company merged with the former Kowloon-Canton Railway network (the East Rail Line, Ma On Shan Line and West Rail Line). Light Rail (LRT) also operates across six lines, previously managed by KCRC. ▪ Maritime Transport: Three types of ferry services coexist in Hong Kong SAR, China provided by 11 ferry operators. These services connect Hong Kong Island to outlying islands and across the Victoria Harbour. Two franchised ferry services are provide connectivity to outlying districts and small motorised ferries serving remote coastal settlements, known as "kaitos".

<p>Technical and operational summary as of 2015</p>	<ul style="list-style-type: none"> ▪ 218km under management - 37% underground, 0% elevated, 63% at grade ▪ 51km of new lines under development, 24km of which is the Hong Kong SAR, China section of the planned Express Rail Link between Hong Kong SAR, China, Shenzhen and Guangzhou in China ▪ 161 stations ▪ 1,868 train cars, 149 buses under management (MTR only) ▪ 19 bus routes managed directly, with approximately 20km of bus lane in the city ▪ 1,577 million passenger journeys per year (excluding cross-boundary services to China, Airport Express services and Light Rail services) ▪ 1,884 million passenger journeys per year across all MTR-managed rail modes ▪ HK\$16,916 million (USD 2719 million equ.) in annual farebox revenues (2015/16) ▪ HK\$41,701 million (USD 5370 million equ.) in total rev. / yr (2015/16) ▪ Approximately 28,284 employees ▪ 62km of network length opened between 2005-2015 (excluding the incorporation of 35km of rail lines previously operated by KCRC)
<p>Regulatory, oversight, and policy bodies:</p>	<p><u>Transport Department of the Government of Hong Kong Special Administrative Region:</u> This department is responsible for transport-related policy in Hong Kong and sits within the Transport and Housing Bureau. It was created in 1968 as a separate department within the Hong Kong SAR, China Government having previously sat within the Colonial Secretary's department. Senior staff rotate regularly and consultants assist in providing continuity.</p> <p><u>Railway Development Office:</u> Responsible for commissioning new rail projects.</p> <p><u>Legislative Council of the Hong Kong Special Administrative Region:</u> A semi-democratic body with the ability to manage laws, budgets, taxation and public expenditure. The Legislative Council also scrutinises Government activity from an accountability perspective. Motions are able to be passed directly affecting MTR, for example, promoting specific fare adjustments.</p> <p><u>Transport Advisory Committee:</u> Also within the Transport and Housing Bureau, this Committee advise the Chief Executive in Council on transport policy, financial issues and influencing other Committees. The Secretary for Transport and Housing provides a secretariat for the Committee. The Transport Advisory Committee is able to consult with and survey the public.</p> <p><u>Electrical and Mechanical Services Department:</u> in Hong Kong SAR, China, EMSD is the statutory regulatory authority on railway safety. It regulates and oversees the safe operation of the MTR system, in accordance with the Mass Transit Railway Ordinance and the Mass Transit Railway Regulations. Its main functions consist of ensuring the adoption of appropriate safety measures, assessing and verifying new railway projects and major modifications of existing railway facilities, evaluating improvement measures in respect of railway safety and investigating safety-related railway incidents. The previous regulator, the Hong Kong Railway Inspectorate, was merged into this department in 2008.</p> <p><u>Hong Kong SAR, China Police Force:</u> This Police Force has a Railways division, responsible for policing on MTR.</p>

<p>Summary of legal and policy framework:</p>	<p><u>1990 White Paper on Transport Policy</u>: Focused transport policy developments along three key lines: improving infrastructure, expanding and improving public transport and active road management.</p> <p><u>Hong Kong Moving Ahead (1999)</u>: This transport strategy explicitly states rail as the backbone of public transport and advocates for greater integration of transport and land-use planning, use of technology and improved public transport services. Key integration policies including siting dense development within walking distance of rail stations and creating new development areas along rail alignments.</p> <p><u>Railway Development Strategy 2014 (RDS-2014)</u>: This is an update of the previous 2000 strategy and aims to provide a framework for the future expansion of Hong Kong SAR, China's railway network up to 2031. It is mainly focused to providing an extended and accessible service, relieving bottlenecks on the network and improving resilience.</p> <p><u>Hong Kong 2030 – Planning, Vision and Strategy</u>: This study mainly provides the spatial planning framework to guide development and provision of major infrastructure until 2030. Initiatives of the study concern balancing conservation and city's development, creating new attractive places for residential and leisure activities, increasing quality of life, regenerating rural areas, and securing continued economic growth.</p>
<p>Key stakeholders:</p>	<ul style="list-style-type: none"> ▪ <u>Transport and Housing Bureau and Transport Department of the Government of Hong Kong Special Administrative Region</u>: This is MTR's key authority relationship with duties as described above. ▪ <u>Unions</u>: The Hong Kong Confederation of Trade Unions (HKCTU) and the Hong Kong Federation of Trade Unions (HKFTU) are the most influential labour and political groups present in Hong Kong SAR, China. ▪ <u>Bus operators</u>: Several feeder bus services to MTR stations are provided under franchise agreements. MTR must work with bus operators where increasing access to the metro is concerned.

Summary of Key Views from Interviews

Hong Kong SAR, China's growing and increasingly affluent population of 7.2 million people is located in one of the densest cities in the world. The population is concentrated on the island and small sections of mainland, with patches of development separated by steep hilly areas. Cross-harbour movements between island and China are a particular transport challenge. Today Hong Kong SAR, China's population growth is low but its rate of household formation is high. Since 1997, Hong Kong SAR, China has been a Special Administrative Region of the People's Republic of China (referred to within this report as Hong Kong SAR, China). During most of recent history Government has been technocratic, creating a low tax economy and enabling rapid economic growth. Central to this has been planning through 5-year Development and Comprehensive Transport Plans that have been successfully implemented. Periodic Rail Development strategies are used to identify and prioritise major rail projects, led by the Transport and Housing Bureau.

The Government's central objectives have been to create a successful sustainable society, and enhancing Hong Kong SAR, China's role as the southern gateway to China. Increasingly the Legislative Council and District Councils have facilitated community involvement and most land in Hong Kong SAR, China is owned or has been created by Government through reclamation.

The Mass Transit Railway Corporation (MTR) was incorporated in 1975. It arose from exhaustive planning, engineering and financial studies under strong Government control, which created a private sector, commercially-driven culture and ethos that has perpetuated to the present day. The initial metro system opened in 1979, following comprehensive studies, engineering and financial assessment. MTR was mandated from the outset to be self-sufficient and financially prudent. MTR has developed a metro system which is inextricably linked with the city's urban form and its residents' daily lives, through its involvement in commercial activities that build communities while increasing the metro's viability.

MRTC and its Authority Environment

This section presents MTR and its authority environment, as derived from interviews, factual sources and CoMET benchmarking experience. MTR Corporation Limited (referred to as MTR in this report) is a vertically integrated business that provides it with in-depth knowledge about the whole life of metro assets. It is unusual among metros in doing almost everything, ranging from involvement in planning, through financing, to implementation and operations. It develops and funds modernisation projects in their entirety, subject to obtaining the approval of their regulator (previously the Railway Inspectorate, now within the Electrical and Mechanical Services Department of the Hong Kong SAR, China Government). It develops extensions and new lines that are identified by Government, using business models agreed with Government, and with funding (including land provision) as agreed by Government.

MTR is accountable to its authority, the Government, and the public through its listed shares. 76% are owned by the Government and the remainder by private entities, providing a catalyst for ever-improving performance to drive the company's share price. Increasingly MTR is working overseas to support its strategic growth plans. The company's merger with the Kowloon-Canton Railway Corporation (KCRC) means that MTR became the sole rail developer and operator in Hong Kong SAR, China, at least for the life of KCRC's service concession. KCRC was established to cover its interest, but not make a profit.

MTRC has gained a reputation for being a world leader in metro development in delivery, operational and financial performance. It is a learning authority and in this pursuit has for over 20 years demonstrated leading performance in the CoMET metro benchmarking group. This reputation, widely acknowledged, together with its status as the sole rail developer and operator in Hong Kong, led to its massive programme of rail projects. MTR has a reputation for making people-centric decisions. This reflects both public pressure and an organizational ethos that is both commercially and customer focused.

MTR's Role in Building Communities: Sustainable City Development in Action

MTRC is a unique operator because of its role beyond Hong Kong's railway system and its ability to influence its authority environment. It does this through demonstrating its technical competence, but also in the whole-life approach it takes to metro planning and operations. The tagline "Building Communities" describes MTRC's approach.

Hong Kong's density and the primacy of MTRC's railway means that much of Hong Kong life takes place within the metro's physical reach, and the spatial layout of Hong Kong reflects this. For example, a mall is situated above the station, community facilities above this, apartments above them and all next door to a hospital, school, and recreation centre that MTRC helped develop. MTRC's development model is significantly more sophisticated than simply adding retail space or apartments to a given station location. At LOHAS Park for example, a community of 68,000 people is being developed above a railway depot and station on the Tseung Kwan O Line. This development is taking place across a 32 hectare site with 25,500 apartments, 5 schools, a 44,500m² shopping mall with ice-skating rink and cinema and over 10 hectares of open space. It has taken 10-15 years to create this development, and virtually every aspect of its future residents' life has been planned from the outset, when the Government announced the metro line.

The result is a city comprising high quality shopping malls, facilities (educational, social, and recreational) and housing above and adjacent to stations and depots with the metro providing seamless connectivity to the Hong Kong's other attractions. In other words, MTRC have advanced a compact sustainable city form that is attractive to many city residents. "*The railway plus property model is probably the best of them all because it incentivises the railway to do the best for society.*" Not only does the capital income support railway development and renewal, but the property developments provide a ready source of patronage (fare income). The system also increasingly achieves its original intention, to reduce traffic congestion, as access to the metro is so convenient.

As revealed through interviews, it is core to MTR's approach is to be 'people-centric'. MTR seeks to enhance the life experience of its customers by providing attractive facilities convenient to their work and homes. "*By good integration we derive financial benefit and it adds value to society.*"

How MTR Build Communities

1. Property experts are involved from the outset of new developments throughout the process of selecting an alignment and station location planning. This begins with a critical assessment of likely destinations and trip generators. The goal in this process is to provide clarity about the railways role in a development as well as the location factors that provide opportunity for building communities. MTR places stations and the individual entrances and exits to stations in the "right" locations - not just close to the "right" locations such that even relatively small distances are not compromised. With Hong Kong SAR, China's climate, there is a keen appreciation that outside vs. inside routes to destinations makes a difference as well. Similarly, across to road linkages and footpaths makes a difference to customer satisfaction. MTR strongly emphasises that stations should have as many

entrances as they need, and those entrances must be in the right place not the easiest place. In many instances this requires additional land acquisition, engineering, or other additional challenges that a more compromising approach could avoid.

2. In Hong Kong SAR, China most land is owned by the Government, but legal title and roles / responsibilities for different aspects of a development must be clarified. For example, who is responsible in a 5-storey development for a crack in the station box below? The Hong Kong SAR, China Government has created a legal provision for what is called 'strata title' whereby different horizontal levels of a development can be owned by different people with responsibilities for different aspects of the integrated structure set out from the beginning. This enables MTR to plan developments above the railway and to manage different categories of occupants who may have very different needs and resources. The strata title concept uses a similar theory as "leasehold" in a residential apartment block, but is more complex given greater diversity in occupants. MTR plans this meticulously, and ensures that the first priority always lies with the operating railway. "Railway paramount" principle is key to Rail + Property model – at all times when planning, constructing and operating developments around the railway, the needs of the railway takes priority.
3. MTR is given development rights by Government as a form of support for new developments. It pays a land premium for these rights at a price level corresponding to the pre-railway status of land. MTR therefore keeps the development gain resulting from the railway that it builds. For example, if farming land will be re-zoned to a 15 storey building after the railway is built, MTR buys it at the farmland price, and keeps the rise in value after it has a railway and 15-storey developments. This is in effect a one-off subsidy in kind that is used to offset the railway's capital cost.
4. MTR ensures the mall at each station provides the right mix of facilities for its customers such that the majority of needs can be met locally. As a result, tenancy is not random and MTR carefully plans a mixture between the shops, restaurants, residences, services, facilities, etc. that make developments complete for daily life. When planning developments that include malls MTR considers different mixes for 'destination', 'hub' and 'neighbourhood' facilities with a different development strategy for each.
5. MTR often works with developers in joint ventures (JVs). Developers compete for this opportunity – because the close linkage to MTR and the railway provides a major source of land that is attractive because of its connectivity.
6. MTR usually sells the apartments above and retains the ownership of retail space below which provides a mixture of upfront cash and cash flow from recurrent rental fees. This subsidises both upfront capital and operational expenditure respectively.
7. MTR allows other developers to link individual developments directly into stations, and evaluates and agrees on the commercial terms for this on a case-by-case basis. Planning large station boxes facilitates this and enable both connectivity and greater income generating opportunities. Larger station boxes also provide capacity and flexibility to handle a greater number of entrances and exits that benefit the dense catchment area. MTR advises: *"Don't be afraid of the initial investment, I would encourage you to enlarge the station box as much as you can – there is a business case for this"*.
8. The ideal location for MTR's rail plus property approach is green-field projects, but it can also be done by retrofitting existing sites (e.g. development above a live depot at Fo Tan).

9. MTR's model takes time to plan and execute but does not slow down the railway construction as dependant tasks are staged to minimise delay. Generally, this works by agreeing an initial design which identifies key parameters such as a basic structural configuration and number / type of different units in order to define the concrete deck above a station and the appropriate foundations. Once a basic design is achieved, the metro and the development can be planned in parallel but with coordination between different teams.

MTR are now managing the implementation of this model within the scope of its existing overseas work. It has won a tender for a development site around the Shenzhen Metro Line 4 depot (operated by MTR) to deliver 1700 homes and a 10,000m² shopping mall. Its overseas activities are as follows:

	Commencement of Operation	Route Length (km)	Number of Stations
London Overground, United Kingdom	Nov 2007	124	57 out of 83
Stockholm Metro, Sweden	Nov 2009	110	100
Melbourne Metro, Australia	Nov 2009	390	218
Beijing Metro Line 4, Mainland of China	Sep 2009	28	24
Daxing Line of BJT4, Mainland of China	Dec 2010	22	11
Shenzhen Metro Line 4 (Longhua Line), Mainland of China	Jul 2010	20.5	15
Hangzhou Metro Line 1, Mainland of China	Nov 2012	48	31
Beijing Metro Line 14 (Phase 1 & 2), Mainland of China	May 2013 (Phase 1)	12.4	7
	Dec 2014 (Phase 2)	14.8	12
MTR Express, Sweden	Mar 2015	455	5
Crossrail, United Kingdom	May 2015 (Phase 1)	32	12 out of 15
North West Rail Link, Australia (Sydney)	2019	36	13

List of MTR's overseas activities (MTR Consultancy Service brochure, 2013)

Government's Relationship with MTR

The Hong Kong SAR, China Government own 76% of MTR's equity, regulates MTR, and represents the community's interests to MTR (particularly interfacing with the District Councils). The Government of Hong Kong SAR, China has a reputation for technocratic decision making and general alignment between the Ministries of Finance (who own MTR shares) and Transport. MTR's Listing in 2000 summarised this, saying - "*The arrangement is like a marriage – a long-term contract*".

The decision to list shares in MTR on the Hong Kong SAR, China Stock Exchange was likely linked to fiscal considerations as it occurred around the time of the Asian Financial Crisis when Government's fiscal space was constrained. Since this time, public shareholding has raised several issues. While reporting and oversight associated with listing drives efficiency to reward shareholders it is important to note that Government and other shareholder interests are not identical, especially with respect to dividend payments.

The Government's view is: "*overall we are on the right track*". According to interviews, Government has over many years come to respect and trust MTR, and refers to them as a 'colleague' engaged in a joint endeavour to develop Hong Kong SAR, China. Government generally has a hands-off approach because MTR has proved its competence and seeks MTR's advice on strategic development and financing of the metro network. There are 4 lines to be developed by 2020, with another 7 lines identified for development to 2030.

Key views raised during interviews include: "*The community always wants things better. Congressmen are always critical of metro / MTR*", although: "*Overall the community is fair minded, know they have a fair deal and one of the best systems in the world*".

Merger with KCRC in 2007

MTR is the sole developer and operator in Hong Kong SAR, China following a merger with KCRC in 2007. There is a common view amongst MTR and the Government of Hong Kong SAR, China that the benefits of this merger outweigh the costs. In particular, the merger has increased the potential for achieving integration. Formerly, the stations of the two companies were deliberately physically separated, whereas now new connections can be integrated as closely as possible.

Regulation: Safety and Fares

The Transport and Housing Bureau assists with regulating competition between operators in Hong Kong SAR, China, because all public transport systems are managed commercially. The MTR Governance defines the main requirements for regulation:

- There is a separate Railway Safety Inspectorate;
- Services are regulated through KPIs agreed and published;
- CoMET benchmarking informs MTR's performance assessment;
- Legislative Council hearings mean lawmakers and the public can and do hold MTR officials to account regularly;
- There is control over investment through Government's role on the Board.

Following the merger with KCRC in 2007, the Government of Hong Kong SAR, China adopted a formula-based fare adjustment mechanism. This is commonly called a 'direct drive formula' as it incorporates key Government-published parameters such as inflation and wage index to determine an annual fare adjustment rate. MTR had previously held full autonomy over their fares, but the merger changed the new company's customer base, and the fare adjustment mechanism was partly brought in to avoid unfairly penalising medium and long-distance passengers. Since the merger, fares have been increased six times according to this fare adjustment mechanism.

While the mechanism was extensively discussed during the legislative process of the rail merger, the public has increasingly criticised the fare adjustment results and the system is now becoming more political. Some major changes to the mechanism implemented in response to public/political pressures¹ include the fare adjustment mechanism being reviewed earlier than specified (every 5 years) and MTR faces penalties for major service delays – although this has not yet posed a problem for MTR owing to its high reliability. There have also been a suite of measures implemented alongside revisions to the fare adjustment mechanism, such as an affordability cap to ensure that fare increases are not higher than the change in the Hong Kong Median Monthly Household Income figure, concessionary fares and ticket schemes introduced alongside mechanism-adjusted fare increases (e.g. the "MTR City Saver" where frequent medium and long-distance are able to travel 40 times within 30 days under this ticket).

The result of these compromises is that fares per passenger-km have declined by about 2.5% in real terms each year since 2008. According to interviews, there has also been some discussion of changing Government's shareholding, either selling down its existing stake or bringing MTR back into public ownership to alleviate the opposing pressures of lower fares and financial returns for shareholders.

¹ Further information on <http://www.info.gov.hk/gia/general/201406/18/P201406180408.htm> (accessed 23/8/16)

Operations

This section presents MTR's operational characteristics, practices and business strategies to secure its long-term operational success, as derived from interviews, factual sources and CoMET benchmarking experience. MTR is a highly-rated operator, on average receiving one award every seven days. MTR carries approximately 5.4 million passengers per day. Ridership grew at 1.5-2% per annum for 20 years, but at 4% per annum for the last 8 years.

One train reaches a station on the network every second, with lines operating up to 32 trains per hour in the peak and higher frequencies planned in future when signalling technology allows. Its trains operate with 99.9% on time performance and its services have one 8-minute delay due to internal causes for each 3 million km, approximately equivalent to going to the moon and back 4 times. It achieves this by:

- Doing “whatever is needed” to ensure resilience;
- Replacing all similar parts if an asset / part fails repeatedly to avoid the risk of recurring failures on equipment with the same part;
- Applying international best practice: “*We learned a lot from CoMET*”. Examples of initiatives following benchmarking and case study participation include:
 - Setting annual train service reliability targets using estimates of increased delay incidents associated with forecast demand growth following research into the determinants of metro reliability (2012);
 - Support for engagement with Government on the revision of the Fare Adjustment Mechanism in 2013, following a study into the fare mechanisms of worldwide metros (2013)
 - A forecast 6% improvement in driver productivity based on internal studies of line-by-line variation of performance, following a study into metro driver productivity (2013).

MTR believe their full vertical integration is key to their reliability success. They can operate a closed-loop management system which gives them operational control, building on full control of asset management. Since 2015 the railway has been operating at capacity during peak times. Relief will be provided when the Shatin to Central Link opens in phases in 2019 and 2021.

Metro Design

The Hong Kong SAR, China metro network was built to cater for future population growth. The developers of the initial system learned from older systems elsewhere in the world that regretted building a small metro with not enough space in the trains or stations. The high capacity design provides a sound financial basis, given the density of the city and size of its population. Trains for example are wide and long its ‘metro’ style lines operate 183m 8-car trains, while the former KCR suburban lines operate 4-car to 12-car trains. The high capacity trains support MTR's ability to achieve its objectives (mass transit) and also support financial efficiency: MTR's 8-car 183m trains carry approximately 1800 people, whereas the 6-car type B train commonly used in China carries 1100, and London Underground Northern Line ‘tube’ trains which are constrained by the tunnel width carries 700.

MTR's interchanges are world class. The first 3 lines were planned together, so space for optimal interchanges was reserved at the relevant stations. Most of the interchanges are cross-platform, and the system also includes the world's first paired cross-platform interchange. Regular cross platform interchange only allows a cross-platform transfer to the parallel line in either the same or the opposite direction. Paired cross platform interchanges at certain stations have opposite-direction transfers at adjacent stations. MTR add that paired

cross platform interchanges also enable more effective crowd control because interchange movements are spread between two stations.



Part of MTR network (As of Aug 2016) showing paired cross-platform interchanges

Cross-platform interchanges greatly increase the level of integration between lines in the system and are highly valued by customers. Research has shown that passengers are discouraged from travelling by time spent interchanging, and so increasing the convenience of interchanges is a key way to make public transport attractive. This type of provision is possible to create if planned from the beginning, but very difficult to add afterwards. MTR knew the first three lines would happen so reserved the necessary space for this feature: *“we’re not miracle workers, just diligent planners.”*

MTR emphasise the importance of developing space in stations for non-fare revenue streams at the time of building and a driving design ethos to offer everything that the customer needs: *“the bigger hole doesn’t add much more to the cost”*. This supports MTR’s long-term strategy to build communities that are inextricably linked to the metro.

MTR is now using its expertise as an operator to lead designs of metros overseas. In Sydney they are leading an ‘operator-led’ design process, whereby MTR having been appointed as the future operator is helping to let the contracts for the design and construction of the metro. The advantage of this is that *“operator input at an early stage of design will help to optimise lifecycle costs because the operator will put into its formula the future costs”*.

Modal Integration

MTR adopt a systematic detailed approach to service planning, to optimise the integration arrangements and secure potential revenues. This primarily features:

- Considering different catchment markets based on the distance from stations, such as those living/working close to stations prefer to walk and use MTR; while those living/working far away from stations will require feeder services to access the rail network. This will require extensive stakeholder engagement with bus operators to ensure that this is feasible, given the commercial nature of public transport operators in Hong Kong SAR, China;
- Bus-metro interchange fare discounts are determined to optimise metro and bus operator revenues, and discounts are negotiated with individual bus companies;
- Fare savers are installed at strategic locations on a commercial basis, with an aim at encouraging daily commuters not living/working close to stations to use MTR through a fare discount.

Fares and Finances

Income

For 2015, railway operations account for 38% of MTR's HK\$19 billion (USD 2.4 billion equ.) EBITDA, station commercial 26%, property rental management 19%, and property development 15%. The fare-profit return on railway assets is less than 2%, which is why MTR strongly believe that the property aspects of their model are needed to justify the railway business.

Fares are governed by a legally-binding fare adjustment mechanism, introduced at the time of rail merger in 2007. Previously, MTR had full autonomy over fares, and the new fare adjustment mechanism aimed to replace this with an objective and transparent approach.

Income from property enables the MTR to make their own financial and investment decisions, as this income is able to directly fund the significant levels of railway investment needed. This is crucial: MTR's transport operations HK\$7 billion (USD 900 million equ.) EBITDA translates to HK\$2.5 billion (USD 32 million equ.) EBIT due to the significant depreciation resulting from necessary reinvestment: *"this is what kills railway companies when they try to operate on a commercial basis. The capital costs just pull the whole business down."*

Octopus Stored Value Card

Hong Kong SAR, China has integrated ticketing without integrated fares, in the belief that integrated fares can be added when a common smartcard system is in place. In Hong Kong SAR, China, integrated fares are currently delivered on an ad-hoc basis through 'fare savers' where the bus operator concerned and MTR agree there is a mutually beneficial business case to offer an integration discount.

Octopus, however, demonstrates the metro's symbiotic relationship with public life in Hong Kong SAR, China. Octopus is an independent company delivering a stored value smartcard that can be used on public transport, and it is owned entirely by the participating public transport operators. Hong Kong SAR, China's population is approximately 7.2 million people and there are no less than 30 million Octopus cards in circulation. Approximately 99% of Hong Kong SAR, China residents have them. The Octopus payment system is useable for public transport, retail and many other functions. Hong Kong SAR, China residents can even use Octopus to pay a hospital bill after having a baby.

MTR is the major shareholder of Octopus (57%) and pioneered the system that has been incrementally developed over 20 years. It was initially started by MTR and 2 bus companies; as its success grew more operators joined. The separate company creates independence and enables competing operators to work together for a common ticketing platform. Fares are handed over daily directly to each operator, minus a transaction fee which is paid to Octopus. Of the 14 million transactions per day (total value HK\$173 million, USD 22 million equ.), approximately 50% are for transport and 50% for retail. There is automatic top-up via a credit card link and a loyalty points system. There are separate cards for children, students, adults and seniors. The card's multiple uses mean it stands out from competitors (e.g. contactless, open payments) who struggle to compete with Octopus' near-universal adoption.

There are several success factors at play for Octopus:

- Its price is affordable for both the user and its merchants;
- Octopus has a high degree of control over its business, and there are no multiple partners sharing revenue;
- The participating public transport operators in the system are on Octopus's Board, giving a unique insight into the needs of these companies;

- Incremental growth has been sustainable and in line with changing customer behaviour and expectations. Creative Star Ltd (the precursor company to what is now Octopus Cards Limited) was created in 1994 by five major transport operators in Hong Kong SAR, China, to deliver a smartcard ticketing system. Between 1994-1997, the system was developed and tested before its launch. Octopus estimate that 3 million cards were sold in the first three months of its operation across six public transport systems in 1997, and since then its development has included:
 - 1999 – allowing payments at retail outlets and including an automatic Add Value Service through financial institutions;
 - 2000-2002 – widespread acceptance of Octopus at non-transport related businesses (food outlets, schools, car parks, cinemas, sporting venues, public facilities etc) as well as cross-border buses,
 - 2006 – Octopus acceptance in Shenzhen;
 - 2008 – Octopus Citibank Credit Card launched, integrating credit card payments and Octopus payment functions;
 - 2012 – Launch of a range of options for cross-border payments, increasing the interoperability between Shenzhen and Guangdong province in China and Hong Kong SAR, China;
 - 2014 - Octopus Rehabilitation Transportation Subsidy Scheme launched, subsidising low-income wheelchair users for Accessible Hire Car services.

Octopus is now providing products and consultancy overseas in Netherlands (since 2003), Dubai (since 2007), Auckland (since 2009), Budapest etc. The overseas markets are chosen strategically according to the potential for two-way learning to improve the Octopus product.

An example of how seriously public transport issues are taken is from 2013. It was brought to the attention of the Legislative Council of Hong Kong SAR, China that Octopus customers were routinely being charged more than MTR's own single journey fares. This was because Octopus had been set up to change fares by 10 cents, whereas single journey tickets were only allowed to change in units of 50 cents. This issue was only deemed to have taken place 204 times, in a system that handles approximately 5 million passengers per day.

Business Strategies

This section will discuss MTR's business strategies, as derived from interviews, factual sources and CoMET benchmarking experience. These strategies are employed to retain its financial sustainability, mode share and role at the forefront of shaping and facilitating life in Hong Kong SAR, China, and critically includes asset and major project management.

MTR's success is fundamentally underpinned by the Rail + Property model. This model uses property development rights granted to the operator to subsidise railway building, operations and reinvestment as discussed in Section 1 (How MTR Build Communities). The model creates a symbiotic system whereby the building of the railway generates land value, which is captured by the railway operator who intensively develops the land above the railway. This intensive development generates not only one-off capital income but also two long-term recurring income streams: rental from commercial facilities, and fare revenue from the passengers travelling to the commercial and residential developments above and around the station.

Business Decision-making

MTR is an exemplar of agile business decision making. The 'value assessment mechanism' is used to assess all investments against 4 factors: safety, reliability, customer service and costs. The results are then used to rank, prioritise, package and bundle various potential projects.

MTR assess whole life costs, then can and do change their strategy when the facts change. For example, 10 years ago MTR studied changing to LED lights for energy efficiency but the business case was marginal. Now the cost of LEDs has reduced, the business case is positive and the company are going ahead. Similarly, although a 15 year refurbishment of urban line trains had been planned to delay replacement, when the international supply market reached a low point, there was a lower lifecycle cost to replace straight away, so they changed strategy. A key enabler of this agility is that because they self-fund, they do not have to go to a public hearing and have capex spends approved for specific projects. Secondly MTR's thorough approach to planning projects means that there are several alternative options to refer to should circumstances change, avoiding the need to start new projects from scratch.

Asset Management: Maintenance

MTR emphasises the crucial importance of preventive maintenance for safety: *"the only reason [derailments and collisions] don't happen more often is because of the maintenance procedures and safety processes we put in."*

TRC operates a 19-hour day, leaving 4 hours for maintenance (with an hour for first and last services to clear the tracks). They describe the importance of the night-time maintenance window to keep the metro running reliably at full capacity with a medical metaphor: *"every night for 4 hours the patient has to go through brain surgery, heart surgery, then get up in the morning, run a marathon and win."* The need for night-time maintenance on a 2-track standard metro is sacrosanct: *"if you really want 24 hours you need to design like a mainline railway" with 3 or 4 tracks, as in New York.*

MTR is a world leader in their advanced approach to maintenance. Their asset management strategy outlines a move towards predictive maintenance based on risk assessments. This assessment assigns highest priority to risks to operational reliability and aims to address them through a maintenance programme; *"we believe it's more optimised to target resources where and when it's needed"*. MTR are also planning on developing a predictive maintenance programme based on technology that collects operational data in real-time and compares this to pre-set thresholds for the asset condition. MTR acknowledge that this approach can be more difficult for regulators and politicians to understand than a regular cycle-based approach, which can be politically difficult if a fault happens and they are asked how the part was maintained.

A 'whole company' approach has also improved maintenance practices and reliability: *"create a culture that we're in it together, no matter how the organisation is laid out...that has taken us at least 15 years to develop. We started with the barons each with their own kingdom"*.

Reinvestment

MTR invests significantly in asset management: approximately HK\$6 billion (USD 772 million equ.) per year. This amount will grow over the coming years as the system is now ageing and requires renewal, a very significant challenge. A key success driver is that MTR is financially sustainable, and as a result have the independence to keep reinvesting in their own network

in a commercially prudent way, and apply business planning techniques to optimise spending over the long-term.

MTR takes a 50-year view of their assets, focusing on lifecycle cost. Their thinking is encapsulated in its Long-term Asset Replacement Plan (LARP), which takes into account all future projected renewals and plans in the long term to maximise value, so that the rate of reinvestment can be smoothed over time. For example, some trains were refurbished to prevent the need to replace an entire fleet all at once. The LARP considers whole life cost, balancing maintenance, refurbishment, and replacement. The plan is for 50 years, including a 10 year vision for assets and customer service, and MTR is currently implementing a plan to 2020 and planning up to 2030.

Reinvestment in assets is not a like-for-like replacement because technology evolves: *“we try to enhance, but we’re not enhancing beyond being reasonable. We get what’s the best at the time when we procure it”*. However, MTR is very committed to buying off-the-shelf industrial standard products rather than demanding customisation: *“whatever else you demand, they raise the price and give you the same”*. For example, they asked for a signalling system specified to last 25 years instead of 15 years. The supplier raised the price by 50% but they found that the system itself was the same in practical terms. According to interviews, procuring the industry standard and spending the savings on doing in-house improvement or life extension work is a better approach for MTR.

MTR have been world-leading in terms of advance planning for renewals. Reinvestment needs equal 10% of operating cost for new metros, and 40% of operating cost for old metros. In the first 10-15 years, the additional capital costs of metros are usually affordable, but MTR have noticed that for many new metros *“they did not realise that after 10-15 years the capital costs jump.”* This has even resulted in them being out-bid on franchises by inexperienced competitors who calculate 30-year costs assuming that the costs after 30 years will be the same as the first 10-15. In these cases they tried to convince the Government of the problem but were not always believed, so the lesson will be learned the hard way.

Obsolescence is an increasingly important and costly issue to manage. For example, MTR bought a signalling system nominally designed to last 15 years, but after 5 years were served an obsolescence notice for a component. MTR stress the importance of setting a strategy for this from the beginning: *“What’s really important is what capability you have to manage obsolescence”*. This requires contractual provisions for adequate technical information, testing facilities, menus, drawings, etc, from the original equipment manufacturer (OEM).

Major Project Development

The metro was designed as a coherent system to begin with. An initial multi-line system was planned together (rather than line-by-line), which allowed world-class paired cross-platform interchanges to be planned. This would not have been possible with a line by line incremental approach. The existing system is now at capacity, and the current rail development strategy aims to duplicate the key corridors (e.g. cross-harbour) to build in more capacity and more resilience.

Line routings and station locations are planned in great detail, because *“metro is a very expensive infrastructure, you’re there for the long haul – not like a road”*. It is much easier and cheaper to move the alignment of a road than the alignment of a metro line or the location of a station. According to interviews, taking the time to optimise the alignment is paramount. Stations should be located in the midst of key trip generators such as housing, commercial, or public facilities such as hospitals and schools: *“when they come out [of the metro], they are invariably already in their destination.”* Hong Kong SAR, China’s good planning contrasts with

some places in the world: *“I have been in cities where I just cannot understand why they put the station there”*.

Planning practices in Hong Kong SAR, China have been shown to be effective. Rail projects are subject to exhaustive alternatives analyses establishing the potential scope of projects according to various financial scenarios, separately by Government and MTR. Their results are used to determine what should be implemented and on what delivery model.

Project Development Process

Alongside Government, MTR leads on design for major projects and the project team includes experienced operators and maintainers. The Operator’s input ensures that any value engineering process does not remove operationally useful features from the project.

Society has become increasingly demanding, requiring to be informed and consulted. Interviewees suggested that this growth and intensification of customer expectations has been partly caused by MTR’s repeated achievements and operational competence: *“MTR is a victim of its own success”*. This causes prolonged consultation processes for project development that need to be managed. *“The scene has changed completely since the 1990s”*. Government has had to be much more transparent and statutory processes are longer to meet higher expectations, with gazetting, time for resolution of objections and compensation to those affected. All megaprojects require an Environmental Impact Assessment (EIA) and much greater emphasis is given to impacts on the environment and ecology than in the past. There is also an increasing focus on how the project will be implemented and how these impacts can be mitigated. Overall these uncertainties can increase cost and programme risk, and MTR advocate taking the time to mitigate these at the outset of the project, rather than trying to solve them during the project’s implementation.

Pauses between major projects, or overload of projects reduces MTR's efficiency and increases costs, as project management expertise is lost or diluted. Government should seek to plan a smooth pipeline of projects to support growing major project capability within MTR.

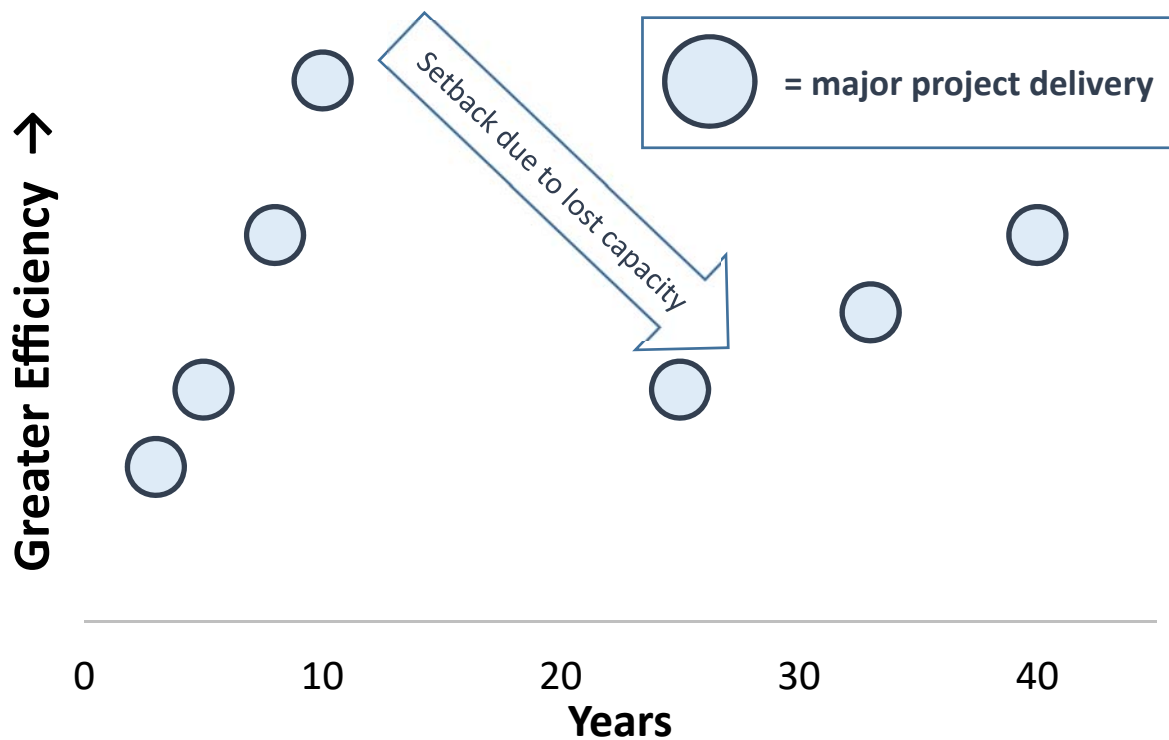


Figure 1: Impact of a project development pipeline on Operator efficiency

Cross-Boundary Express Rail Link (XRL – Hong Kong SAR, China to Guangzhou High Speed Rail)

The Cross-Boundary Express Rail Link is a high-speed rail connection between Guangzhou and Shenzhen, connecting to the National High-speed Railway Network in China. 26km of this rail link runs in Hong Kong SAR, China. The project was conceived partly to strengthen Hong Kong SAR, China's position as the southern gateway to China.

The project was the first to be approved under a concession model in Hong Kong SAR, China, with MTR appointed to design and manage construction while Government, based on MTR's reputation in project management, while Government retain ownership and construction risk. MTR were also expected to eventually operate the link. The Government adopted a monitoring and verification role overseeing MTR's emerging design under a formal Entrustment Agreement.

Construction started in 2010 with a two-phase programme: the first phase to be delivered in 2015, and the second in 2021. Delays were experienced early into the project, as a result of cross-boundary tunnelling, interface with an underground terminus station in Kowloon, late arrival of tunnel boring machines from China inclement weather causing flooding and interfering with the tunnel boring machine. The Government of Hong Kong SAR, China have also highlighted wider causes of delay, including labour shortages (a widespread construction sector issue).

A "Partial Opening" scenario was proposed by MTR to retain the original opening date of Phase 1 in 2015: consisting of opening six platforms instead of the originally planned ten, which was assessed to still deliver the same amount of capacity upon opening. This scenario

was presented to Government, although in the time it took to propose this plan, further project delays had been incurred and MTR's project team requested a further six months to establish the likelihood of a Partial Opening scenario being achieved, following completion of tunnel boring. It was not until April 2014 that the Government and the project's Board were formally notified that the original 2015 opening date would not be met, despite the project team being aware of this risk since November 2013. A new date for opening Phase 1 was set for 2017.

The project is unique in Hong Kong SAR, China and uniquely complex. The implications of this may not have been fully recognised by MTR or Government. Unique and complex challenges include:

- Interfaces with public institutions from the Government of the People's Republic of China, and its railways;
- The first instance that MTR had worked on a project in Hong Kong SAR, China where they were not accountable for everything to do with the project;
- Contemporaneous execution of 5 projects simultaneously under MTR's leadership, straining staff and financial resources.

Ultimately, an investigation into the project issues undertaken in 2014 highlight that MTR followed its obligations and processes as set out in the Entrustment Agreement, and managed the emerging risks as professionally as possible. For example, reporting of ongoing project delays were transparent and accessible; the issue with Government and the Board not being aware of the issue arose from assurances that the 2015 deadline would be met. The experience has been a shock to MTR and Government. Until this project, MTR had earned a reputation for project delivery success, time and time again, partly due to MTR's excellence in risk management. It remains to be seen whether the concession model will deliver advantages, or whether the usual model of MTR taking all risk and managing the project more independently is a preferable model.

A [report by the Independent Board Committee on the Express Rail Link Project](#) carried out an objective investigation into the project, reporting to both MTR and Government in 2014. Lessons learned span areas of reporting, culture and relations between project actors, including:

- The establishment of a Capital Works Committee, reporting to the Board, to oversee major projects (over an undetermined budget). This Capital Works Committee should be formed of members with appropriate knowledge to critically assess the project's state (and appointed by the Board);
- Improved judgement on when operational matters should be escalated to the project's Chairman, Audit Committee and Board, which is entrusted to manage strategic matters of public importance. The issues encountered during this project's development highlight how operational issues can quickly become strategic issues of public importance at such a scale;
- Improved openness on project progress between senior management of the project team and the Board, and where assurances are given that they must be substantiated;
- Improved communication management and the consideration of communications as a strategic matter, to avoid the issue becoming viewed as a "crisis" in the eyes of the public.
- The convening of an emergency Board meeting should have been called to review the communication strategy for informing the public of delays.

Conclusions: MTR's Strategy for Success and Future Strategy

Hong Kong SAR, China provides insight into a reliable, efficient and proactive metro operator with substantial influence, autonomy, business practices and operational outcomes. Its success can be attributed to three key elements that can be applied to new metros.

Three Reasons for Success, as set out by MTR's CEO

1. The MTR business model establishes independence and substantial autonomy for MTR. MTR practice commercial prudence from its outset, creating a sustainable business model and financing. Its investments provide a return on capital, satisfy shareholders and keep fares reasonable for passengers (on average, HK\$7.5 (USD 1 equ.) The two core components of their business model are:
 - The Rail + Property model that supports sustainable growth and secures demand;
 - The fare adjustment mechanism that considers factors affecting Operator's financial position as well as balancing fairness to the customer.
2. MTR's people: A culture has been established of continuous improvement (for example exhaustively establishing the causes of problems) and a 'can do' spirit that overcomes challenges. MTR staff noticeably made constant mention of continuous improvement. This mentality is clearly embedded in the company.
3. Stakeholder management is open, outward looking and proactive. The main stakeholders are Government (as shareholder and regulator), passengers, shareholders and the Hong Kong SAR, China community (including District Councils). MTR continually seeks to establish and enhance relationships.

MTR's Success: The Authority's View

The Government has also offered the reasons it believes that MTR is so successful:

1. MTR started as a corporation, not a Government department, but a 100% Government-owned company. This has equipped the organisation with a private sector ethos that serves the public;
2. It was given a 50-year franchise, providing a long-term decision-making perspective;
3. New projects are approved once the project is shown to be financially viable. Government helps create viability by one of two methods. This approach underpins MTR's financial viability – and its financial stability.
 - The rail + property model – land development rights are given. The result – nearly all stations and depots have property above.
 - Cash where land is not available e.g. West Island Line. This is a 1-off grant approved by Congress.

Challenges Facing MTR: The Authority's View

"MTR is a victim of its own success", and is overcrowded in part because of the high level of service provided. Satisfying increasingly aspirational and critical customers, assisted by social media is a real problem: "a 2 minute wait is far too long". Customers have become ever more demanding. Despite very high reliability (the average commuter will experience a 5-minute delay only once every 3 years), complaints happen, and MTR must be able to respond.

Future Strategy

Enhance MTR's Reputation in Hong Kong SAR, China and Worldwide

This is a 2-way process, success in each market reinforcing success in the other. It places great value on the MTR brand to set it apart from potential competitors outside Hong Kong SAR, China. MTR perceive their strength as taking total responsibility for operations and maintenance, whether this is carried out in-house or not.

MTR looks for a 'good' authority to work with, meaning one that is reasonable, technically competent if the asset owner and know what they want. New-build 'green-field' projects offer the prospect to establish a new MTR culture, while existing concessions have their own established cultures and attitudes that need to be influenced.

Facilitate Growth in Hong Kong SAR, China

The Second Rail Development Strategy incorporates 4 new projects (52kms) that will be implemented by 2021, by MTR. This ensures MTR has its hands full to 2021. Thereafter 7 projects have been identified for implementation by 2030 (+35kms), and Government is to decide priorities. Rail Gen 2.0 has also been launched – delivering to customers a new generation railway by 2020. There is also growth planned in:

- Property: In the next 5 years MTR's investment property portfolio will increase significantly – by approximately 40%
- Asset replacement: All trains are to be replaced + signalling systems on the whole existing network – while keeping 99.9% reliability.

Business Growth Overseas

MTR has 15 years overseas experience, starting with consultancy. It now knows what its role should be and where its target markets are. There are two business models: operating concessions in developed cities that are awarded on a quality (not lowest cost) basis, and a project + concession model in China. In all cases it will pursue some property add-ons opportunistically, as in Shenzhen. MTR is willing to take on franchises that include revenue risk, but only within their risk profile and only in circumstances where there is a contractual boundary to contain the level of risk (sometimes known as cap and collar).

MTR has proven its operational effectiveness, for example in London, Stockholm (where in 7 yrs. it increased punctuality from 93% to 98%, and where its perception as a good employer increased from 34% to 93%) and in Melbourne (where on-time performance has increased 86>92%). It has proved that the approach that delivers operational excellence in Hong Kong SAR, China is transferable.

When concessions are taken over, the employer changes but the workforce stays the same. MTR has a strong focus on communications and is proud that "*We have a good dialogue with the Unions*" and its approach is "*we want them to feel empowered to continually improve*" – creating opportunities for staff to suggest and implement improvement projects. They also provide training, especially on MTR values, and motivate staff by improving the working environment where possible (e.g. common rooms, cleaners' offices) to show MTR care.

Customer Centricity

Central to the strategy is a 'people-centric' approach to everything. For example in 2015 it established a detailed customer experience framework analysing every part of customers' overall trip, and seeking to make customers feel valued throughout their MTR experience.

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Quotations

Governance, Regulation and Leadership

Quote	About
“If rail company has enough expertise, I believe it’s better for government to stay off daily running.”	On the need to minimise intervention unless there is a shortfall of either expertise or money.
“Make sure [the metro operator] is competent to do the job, give them enough resources, and leave them alone.”	On the need to put a performance and safety regulation in place and then leave the operator to do the job
“The good thing about Hong Kong SAR, China is the policies are quite steady.”	
“If [government] don’t understand rail operations, they don’t get good results.”	On the need for decision makers to understand the complexities of rail
“Either you don’t have fare increases, or the fare increase is subject to political pressure.”	On the inevitability of politicization of fares
“[HK passengers] know they have one of the best metro services in the world...I believe they know they get a fair deal.”	On fares vs. service quality
“The yearly operation of that formula is not subject to a legislative process.”	On having an agreed formula for fare increases
“There’s a formula outcome and we implement the outcome. That’s it.”	On implementing the annual fare increase formula
“It’s part of the deal: you have the monopoly so you’d better do your job really well.”	On having a single operator
“[MTR] have a culture of continuous improvement. They don’t stop at a predetermined level.”	External view of MTR culture
“The arrangement is like a marriage – a long-term contract”	Relationship between MTR and Government
“Overall the community is fair minded, know they have a fair deal and one of the best systems in the world.”	Attitudes towards MTR
“Government wears many hats: owner, regulator, public representative.”	Government’s need to support the metro by managing competing objectives

Integration and Connectivity

Quote	About
“Railway is 5-10 times more efficient than other modes of transport in terms of land use.”	The original reason for building HK’s metro was to solve the city’s congestion problem with efficient land use
“The interesting thing about our business model is we go beyond rail integration into the local community...that is what makes us different.”	
“We have to think about what is at A and what is at B.”	Metro is for getting people from A to B – and A and B have to be located as specifically as possible
“When people come out [of the MTR], they are invariably already in their destination.”	Stations exit directly into offices, malls, residential towers.
“To achieve a good people-centric rail line, you need to think about seamless integration.”	
“I have been in cities where I just cannot understand why they put the station there and why they put the entry and exit where they are”	

“You need to be people centric, then you have patronage.”	Passengers will only use metro if it is convenient
“People say, ‘I’m not doing that 7 minute walk to the railway station.’”	Passengers won’t change their habits if competing modes are more convenient.
“When we build a depot we are at the same time doing foundations for building on top.”	
“Of course we’re building communities”	Literally
“You are within <u>crawling</u> distance from a shopping centre”	In a mixed-use transit oriented development (TOD)
“You have to think about where your exits are”	MTR charge developers to put a pedestrian tunnel into their station, because it’s so valuable
“In Hong Kong SAR, China, properties above the MTR stations are very popular, because of the convenience.”	On the public desire for transit-oriented development
“After you deliver your child in hospital, you can pay with your Octopus.”	On widespread adoption of the Octopus smartcard for payment
“We have a separate company to create independence”	On ensuring that the smartcard did not favour one or other public transport operator
“It’s totally a commercial decision between two companies”	On offering specific, targeted integration discounts
“Octopus is now integrated into HK’s society”	Octopus card

Major Project Development and Planning

Quote	About
“Operator input at an early stage of design will help to optimise lifecycle cost because the operator will put into their formula the future cost”	
“If you really want 24 hour operation you need to design like a mainline railway”	On the need for more than 2 tracks to enable 24/7 operations
“The other extensions aren’t going to relieve crowding, they’re going to feed more people into the network.”	
“We’re not miracle workers, just diligent planners.”	On planning convenient paired cross-platform interchanges
“Use industrial standard specifications. Whatever else you demand, they raise the price and give you the same product.”	On the lack of value in bespoke products or specifications
“How can I best use this piece of land?”	The key question to ask
“We start right at the beginning in feasibility study to advise government on alignment”	Influencing project development right from the start
“To be effective, we do it from railway planning phase”	TOD planning starts not even from the design phase but from the planning phase.
“The bigger hole doesn’t add much to the cost”	On increasing the station box size to allow for retail space
“Once it’s there, it belongs to you”	The recurring non-fare revenue in the future from retail within the station
“If you cannot capture that business you have done very badly”	On the clear opportunity of siting convenience stores just outside the fare gates
“Don’t be afraid of the initial investment. I would encourage you to enlarge the station box as much as you can – there is a business case.”	On designing the station box size to allow for retail space
“If MTR could do it from day 1, the Island Line would have a HUGE station box.”	On designing the station box size to allow for retail space

“Economies of expertise”	...these arise when projects are well phased and staff are retained
“Value engineering’ usually removes that which is useful” (value!)	Project development process

Operating and Managing an Metro

Quote	About
“Every night for 4 hours the patient has to go through brain surgery, heart surgery, then get up in the morning, run a marathon, and win.”	A metaphor for the pressures on maintenance and performance for a metro
“We believe [reliability centred maintenance] is more optimised, to target resources where and when it’s needed.”	On how reliability centred maintenance is more optimal, but more difficult for regulators and non-experts to understand.
“We’re able to understand whole of life”	On being vertically integrated and having a 50-year franchise
“The average commuter will experience a 5-minute delay once every 3 years [99.9% reliability]...but for many even a 2 minute wait is far too long”	Customer expectations
“Social media pose a real challenge – customers sit quietly with their smartphones <i>raging</i> against MTR shortcomings when faced with minor inconvenience”	Customer expectations
“HK people do not allow shutting down of railway for improvement”.	Customer expectations
“MTR is a victim of its own success”	Operations - MTR is overcrowded in part because of the high level of service provided.
“We are a 50-year-forward business.”	A long-term business
“Everything starts from the common belief in continuous improvement”	MTR strategy
“The MTR brand we want to build globally. We want authorities to think: “MTR is the operator we want to engage with” – always on the basis of providing safety and customer service/ satisfaction”	MTR strategy
“Decisions change if the facts change”	Opportunistic strategy. Example - metro cars have reduced in cost from \$1.3 million to 1 million. So MTR has decided to replace its whole original fleet, rather than refurbish/ enhance for a longer life,
“We learned a lot from CoMET”	Operational high reliability and the importance of benchmarking to business improvement
“We have a good dialogue with the Unions” and “We want them to feel empowered to continually improve”	Taking over staff on winning concessions

Paying for the Metro and Private Sector Participation

Quote	About
“Railway has a lot of external benefit to society but little internal economics to make it work.”	On the need for there to be subsidy of some form for all railways at some point
“This is what kills railway companies when they try to operate on a commercial basis: the capital costs just pull the whole business down.”	On the need for there to be subsidy of some form for all railways at some point

Quote	About
“People think ‘you’re making a lot of money’ but no, we’re ploughing it back into the railway.”	On the need to save profits to fund future reinvestment
“The railway + property model is probably the best of them all, because it incentivises the railway to do the best for society.”	
“Enough resources is the key to success.”	Money to build, run, and reinvest properly.
“We have the resources to do what we think is the right thing to do.”	
“Financial sustainability gives us the independence to keep reinvesting in our own network.”	
“Because we’re financially sustainable we’re able to make investments in the existing network without third party approval.”	
“You have to decide what type of efficiency you’re going for: capital efficient, operational efficient, or overall financial case efficiency”	On the need to think long-term when designing stations to allow non-fare revenue.
“Farebox income is a sustainable source of income and that’s needed alongside property”	On the need for a mix of funding sources
“There is no point asking a railway operator to continue to suffer.”	On the need to mitigate revenue risk if forecasts are not as expected
“Either in kind or in cash”	On the need for financial support to all railway projects
“It’s not that we are cleverer than others, but we have the resources to do something. Having enough resources is the key to success”	Having enough resources is critical
“NPV or gap? ...cash injection or land?”	Funding new projects – in cash or in kind
“I don’t think there’s one right or correct model for a city.”	On the variety of capital funding models available – Rail + Property, government grants, or PPP
“If the aim is to get lowest cost, financially [privatisation] may achieve that objective but does it serve your passengers?”	A question for governments considering privatisation
“How good are rail operators at predicting GDP growth?...Do you [government] want to give contracts to people who are ultra-aggressive in predicting GDP growth then hand back the keys in a few years’ time?”	On the risk (to governments) in contracting-out revenue risk, given ridership is more closely related to GDP than railway performance
“There is no one size fits all”	On 5 year vs 50 year franchises
“Unless you have parallel lines operated by different railways you can hardly have competition in urban railways.”	
“We only bid if there is a high quality component”	MTR strategy – a quality operator, not a low cost operator
“Very difficult to find investors with 30/50 year perspective based on 1-off payment”	Procurement process for new projects