Performance Measurement and Outcomes

DETAILS

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International Transit Studies Program
Report on the Spring 2009 Mission

PERFORMANCE MEASUREMENT AND OUTCOMES

This TCRP digest summarizes the mission performed March 20 to April 3, 2009, under TCRP Project J-03, "International Transit Studies Program." This digest includes transportation information on the organizations and facilities visited. It was prepared by Harrington-Hughes & Associates, Inc., and is based on reports filed by the mission participants.

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INTERNATIONAL TRANSIT STUDIES PROGRAM

The International Transit Studies Program (ITSP) is a part of the Transit Cooperative Research Program (TCRP), authorized by the Intermodal Surface Transportation Efficiency Act of 1991 and reauthorized, in 2005, by the Safe, Accountable, Flexible, Efficient Transportation Equity Act. TCRP is managed by the Transportation Research Board (TRB) of the National Academies, and is funded annually by a grant from the Federal Transit Administration (FTA). ITSP is managed by Harrington-Hughes & Associates, Inc., under a contract to the National Academies.

ITSP assists in the professional development of transit managers, planners, and others charged with public transportation responsibilities. ITSP carries out its mandate by offering transportation professionals practical insight into global public transportation operations. The program affords the opportunity for them to visit and study exemplary transit operations outside the United States.

Two ITSP study missions are conducted each year, usually in the spring and fall, and are composed of up to 14 participants, including a senior official designated as the group spokesperson. Transit organizations across the nation are contacted directly and asked to nominate candidates for participation in the program. Nominees are screened by committee, and the TCRP Project J-03 Oversight Panel endorses all selections. Members are appointed to the study team based on their depth of knowledge and experience in transit operations, as well as for their demonstrated advancement potential to executive levels of the public transportation industry. Travel expenses for ITSP participants are underwritten by TCRP Project J-03 funding.

Each mission abroad focuses on a theme that encompasses a topic of concern in public transportation. Cities are selected according to their ability to demonstrate leading-edge strategies and approaches to public transportation issues and challenges, as reflected in the study mission's overarching theme.

The members of each study team are fully briefed prior to departure. The intensive, professionally challenging, two-week mission has three objectives: to afford team members the opportunity to expand their network of domestic and international public transportation peers, to provide a forum

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

for discussion of global initiatives and lessons learned in public transportation, and to facilitate idea-sharing and the possible import of strategies for application to transportation communities in the United States.

For additional information about the International Transit Studies Program, please contact Gwen Chisholm-Smith at TCRP (202-334-3246; gsmith@nas.edu) or Kathryn Harrington-Hughes at Harrington-Hughes & Associates (410-770-9192; khh@tcrpstudymissions.com).

ABOUT THIS DIGEST

The following digest is an overview of a mission that explored how performance measurements are used to achieve organizational goals and enhance quality of service at public transport planning, funding, and operating agencies in Hong Kong, Special Administrative Region of the People's Republic of China; in the city-state of Singapore; in Kuala Lumpur, Malaysia; and in Taipei, Taiwan. It is based on individual reports provided by the mission team members, and it reflects the observations of the team members, who are responsible for the facts and accuracy of the data presented. The digest does not necessarily reflect the view of TCRP, TRB, the National Academies, American Public Transportation Association (APTA), FTA, or Harrington-Hughes & Associates.

A list of the study team members is included in Appendix A. A list of the public transport agencies and organizations with whom the team met is included in Appendix B.

INTRODUCTION

All organizations need to develop a strategy for how they want to grow and where they want to be in the future. Although many definitions exist for organizational strategy development, one way to explain it is as strategic and thoughtful planning with stakeholders to improve an agency and guide its development into the future. Because transportation agencies affect the public in such direct ways, organizational strategy development is a vital component of providing efficient and effective services that meet the needs of the public. Measuring performance is one important way to ensure that an organization is moving in the right direction.

Performance measures are used by U.S. public transportation agencies to direct resources, improve operations, determine the efficiency and effectiveness of service, and ensure strategic goals are met. Increasingly, funding agencies are also evaluating public transport agencies' performance when determining where to allocate public funds for system expansion and improvement.

This study mission brought a team of transit professionals from large and small systems in communities throughout the United States to Southeast Asia (Appendix A). There, they met with transit operators and regulators in four cities in four countries to learn how performance measurement systems are used to improve public transport services (Figure 1).

The host agencies in the four cities (Hong Kong, Singapore, Kuala Lumpur, and Taipei) were each sent a list of questions as a starting point for discussion and to help them tailor their presentations to the study mission theme. The questions included the following:

- How are performance indicators determined?
- What data are collected? How do you know you are measuring the right things? How does the data relate to agency goals and objectives?
- What benchmarks are used?
- What means are used to collect the data? How do you optimize the use of automated data collection?
- How do you summarize, store, and report the data?
- How is the data evaluated and analyzed? By whom?
- How do you use technology or outside vendors to ensure the quality of the data?
- What outputs are used to indicate outcome?
- How are data integrated to enable better decision making?
- How are the outcomes linked to customer and community issues?
- How do you translate the information into action?
- How does transit management make use of the data?
- How are performance measures used to improve customer service? To evaluate cost effectiveness?
- How do you make measurement everybody's job?
- Do you use performance measures for rewards?

Taipei
Taipei Rapid Transit Corp. (Taipei Metro)
National Chiao Tung University
Taipei City Government

Hong Kong
Kowloon Motor Bus Co. (KMB)
MTR Corp.
Transport Department

Kuala Lumpur
RapidKL

Singapore
Land Transport Authority (LTA)
Public Transport Council (PTC)
Singapore Corp. (SMRT)
National University of Singapore

Figure 1 The study team met with transit operators and regulators in Hong Kong, Singapore, Kuala Lumpur, and Taipei.

- Do you use pay for performance in service contracts?
- How are performance measures implemented? How do you get employees to support the performance measurement system? How do you educate them about performance measurement?
- How do you tie measurements to strategy? Do you measure results that focus management attention on key strategic objectives?
- How are performance measures used in planning and delivering service, ensuring passenger safety and security, maintaining vehicles, contracting for services and vehicles, and evaluating the effectiveness of service?

The meetings, presentations, tours, and experiences in conjunction with the study mission gave the team members a broad understanding of the history, political structure, operation, management framework, and performance measurement systems in place at each agency. The systems have much in common with each other and with U.S. transit agencies. Quality of service, safety, and cost control, for example, present the same challenges worldwide. On the other hand, many of the conditions underlying the success of transit systems in Asia do not exist in U.S. cities. The political systems, approaches to planning, population densities, and levels of investment in transit in those systems are dramatically different from what one often sees in the United States.

To structure the study mission and ensure a comprehensive review of the agencies visited, the team members decided to organize their review around a

model of performance measurement that includes the following:

- Strategy development—the agency's articulation of a clear strategic vision and direction and the connection of performance measures to that strategy;
- Measures—the specific items the agency has chosen to observe, quantify, and document;
- Reporting—the mechanisms and media the agency uses to inform appropriate parties within and outside the agency about what they have measured, and why;
- Quality control—a process the agency has put in place to verify and ensure the accuracy of performance measurement data;
- Course correction—how the agency uses the knowledge gained from the performance measures to improve its operations; and
- Strategy refinement—how the agency uses performance information to make adjustments in the strategic direction of the agency.

The following common themes were noted in conversations with the host agencies:

- It is important to provide a choice for the traveling public.
- Providing public transportation is a social responsibility.
- Global warming/climate change is real, and the government wants to do something about it.
- Roadways can no longer continue to be expanded for additional capacity. Cities cannot build themselves out of their capacity and congestion problems.

These themes provide a context for the various strategies and approaches taken by each of the host agencies.

STRATEGY DEVELOPMENT

The public transit systems in the four cities visited are seemingly motivated by fundamentally different factors than the public transit providers in the United States, primarily because they are largely privatized and focus on business strategies that improve profitability. This focus on profitability is, together with the requirements set by the government regulator, the foundation for the business strategies developed by each of the transit operators. Strategies are generally articulated in relatively broad terms, and most systems focus on customer satisfaction, safety, and organizational learning. From the broader strategies, the organizations identified individual goals and objectives by department or disciplines. Specific, more refined targets and the performance measures used to gauge progress were then identified and monitored.

Base-level performance targets in all cases were established by governmental oversight agencies or regulators, and additional targets and performance measures were developed internally, as well as through industry standards, such as those of the International Organization for Standardization (ISO), and international benchmarking groups. Similarly, internal systems for gathering, storing, and reviewing data are used. In most cases, system concepts were borrowed from other organizations or toolkits adapted for use in a particular system, such as the balanced scorecard, which is a tool to help organizations align strategies with positive outcomes.[1]

Figure 2 illustrates the basic model for performance improvement processes used by the transit systems visited during the study mission.

The transit operators in the four cities receive some capital subsidies, such as land grants to build facilities, initial capitalization for system infrastructure, and fuel and/or tax relief subsidies to promote profitability. But each system's ability to expand and to sustain profitability relies heavily on internal strategies.

Hong Kong

Hong Kong has a population of 7 million in an area of 1,108 sq km. The transit system is privatized, but is overseen by the Hong Kong Transport Department, a governmental regulatory agency. There are no direct government subsidies in the way of cash outlays, but initial system capitalization is funded by the government. In addition, licensing fees are waived, rent on government-owned facilities is below market value, and licensed transit operators are exempt from gasoline taxes.

[1] The balanced scorecard is a performance measurement system, developed by Robert Kaplan and David Norton, that provides managers with several key measures of agency performance (customer satisfaction, internal processes, and ability to learn and improve) that augment the traditional financial performance measures; the balanced scorecard gives a more complete picture of where a business is, as well as where it is heading.

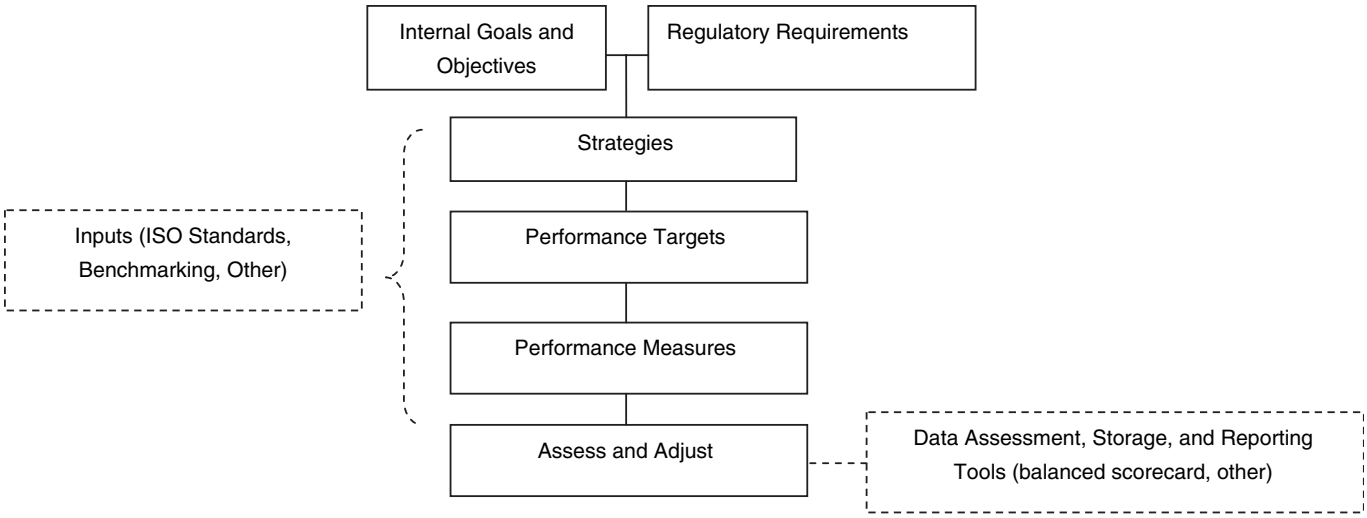

Figure 2 Basic model of performance improvement processes used by the transit systems visited during the study mission.

Hong Kong's public transportation system includes heavy rail, light rail, trams, buses, ferries, minibus systems, and taxis, as well as nonfranchised bus operators that supplement the franchised bus services during periods of peak or high demand.

Recently, Hong Kong has experienced a modal demand shift from bus to rail. The Transport Department encourages this trend as it will optimize road capacity by reducing the number of vehicles traveling on its highly congested road system (Figure 3). Even the use of bicycles is discouraged in Hong Kong, as they consume a significantly larger per capita use of the road. Pedestrian walkways are typically located above or below street level to minimize interruptions to traffic. The number of vehicles in the city, including commercial vehicles, totals 565,000, of which only 372,000 are privately owned automobiles, resulting in a phenomenally low rate of car ownership (53 cars per 1,000 population).

The study team met with the Hong Kong Transport Department, the Kowloon Motor Bus Company (KMB), and the MTR Corporation (MTR).

Figure 3 Hong Kong's roadway system is extremely congested, and there is no land for expansion; the Hong Kong government encourages travelers to shift from bus to rail as a means of reducing the number of buses on the roads.

Transport Department

Transportation infrastructure is a challenge in Hong Kong due to the mountainous terrain that covers approximately two-thirds of the land. The 2009-km roadway system has limited capacity, and there is just not enough land to expand the roadways. The Hong Kong Transport Department recognizes the importance of increasing the freight capacity of its roadways and thus encourages residents to shift to mass transit, and in particular to rail transit. The Transport Department estimates that its public transportation system, including taxis and nonfranchised transit operators, accommodates 12 million passenger trips per day.

Approximately 90% of trips are taken on public transport, with about 35% on rail transit. The Transport Department has defined the modes by capacity, with heavy and light rail at the top of the list. Trams are also considered part of the high-capacity rail

network. Franchised buses fall into the medium capacity category; they serve as feeder service to the rail lines and provide service in areas not accessible by rail.

The Transport Department grants licenses, or franchises, to private companies, allowing them to operate a variety of public transportation services, including rail and bus service. Although the franchisee's performance is not necessarily related to the renewal of the license, a license can be revoked for "bad behavior." As part of the license agreement, franchisees are required to provide an annual progress report to the Transport Department, as well as maintain a "forward planning program" to address future needs and operations.

Part of the Transport Department's vision is providing a transportation system that is "satisfying to both users and operators." While there is no guarantee of profit for the franchisees, the government encourages the use of prudent business practices in delivering service to the customers in order to expand ridership and turn a profit. The government does not typically directly subsidize the operations of transit service providers, but does provide indirect financial support through waivers of license fees and depot rental fees. Operators are also eligible to apply for fare increases if they are operating at a loss. In some cases, the government may contribute up to 80% of costs as a subsidy. The government always encourages the franchisees to continually improve productivity so that they can eventually lower fares.

The franchisees are allowed to keep 100% of their profit, up to a 9.7% return. If profits exceed 9.7%, the franchisees are required to share 50% of the excessive profit with their customers, through a rider fund that must be used for the benefit of passengers.

The Transport Department recently commemorated its 40th anniversary. Comprehensive transport studies (CTS) are completed about every 10 years. The third CTS (CTS-3) was completed in 1999 for the horizon year 2016. It established the long-term strategy for Hong Kong's transport system.

Critical pieces of CTS-3 included integrating land use and transport planning, optimizing rail usage, improving public transport services and facilities, improving the use of new technologies, and increasing environmental responsibility. The government's policy is to establish rail trunk lines and to use buses to feed the trunk lines and serve sections of the city that cannot or will not be served by rail. It is also the government's policy to provide sufficient service at reasonable fares. The Transport Department wants to promote healthy competition among the various transport modes in order to elevate service, reduce waste, and enhance sustainability.

The Transport Department plans to expand its rail transit system with an investment of approximately HK$90 billion on five additional lines. As the rail service is expanded, bus routes will be reconfigured to ensure integration and avoid competition between the two modes.

The Transport Department gives priority to development of rail transit, but it considers the franchised bus operations to be an essential component of the overall system.

The Transport Department has granted six licenses to five competing franchises to operate the 600 bus routes in the city. Routes are negotiated by the Transport Department. Bus companies must provide the Transport Department with data to justify any requests to modify, change, or eliminate routes. In addition to the rail and bus franchises, the Transport Department grants 18,000 taxi licenses to 15,000 owners/operators within the city.

As part of the license agreement with the Transport Department, transit operators must meet government-specified performance measures. Using surveys and site visits, the Transport Department audits the data that has been submitted. To evaluate actual performance, the Transport Department compares the data to the targets that had been established and works with the operators to identify problems that are keeping the operators from meeting their targets. They also work together to identify any necessary course correction.

Kowloon Motor Bus Company

In Hong Kong, where 90% of trips take place on public transit, the Kowloon Motor Bus Company carries 2.7 million passengers daily on roughly 400 routes. KMB is the largest private bus company in Hong Kong, and it is a wholly owned subsidiary of Transport International Holdings Limited, a publicly traded corporation. KMB began operations in 1933, and it has expanded significantly since then. Today it operates and maintains a fleet of 4,300 buses in eight depots, and it employs 13,000 persons.

There are two primary motivations for KMB's performance measurement strategies—to achieve the regulatory requirements set by Hong Kong Transport

Department, which allow KMB to maintain its public transport franchise, and to improve its public image and hence improve profitability. The objectives and strategies for meeting these goals are set by the regulatory agency and by KMB's board of directors and are articulated in its Corporate Social Responsibility Charter, which focuses on employee engagement, caring for customers, effective communication, and environmental performance.[2]

Bus operators in Hong Kong must compile and submit performance data to the Transport Department at least annually. The Transport Department establishes performance targets based on the prior 3 years of data. Performance is indexed to targets, and the regulatory agency can recommend improvement measures if an operator does not meet its targets. The Transport Department establishes performance measures and targets that are not dissimilar from the business objectives expressed in KMB's internal strategies. The targets include the following:

- Reliability,
- Bus availability—the ratio of actual bus allocation to scheduled allocation,
- Lost trips—a maximum allowable percentage of total trips scheduled,
- Efficiency,
- Bus utilization—the percentage of the licensed fleet that is actually on the road,
- Safety,
- Training program for new bus captains (drivers)—percentage of newly recruited bus captains who receive training before providing service to passengers,
- Training for in-service bus captains—percentage of bus captains who participate in at least one training session every 3 years,
- Cleanliness of system,
- Bus body—washed once daily,
- Bus floors—swept at least twice per day,
- Environmental friendliness—percentage of fleet meeting Euro 2 (or higher) emission standards,
- User friendliness,
- Complaints—each person filing a complaint should receive a full response within 10 days (for more complicated cases, the reply period can be extended to 1 month, provided an interim reply is sent within 10 days),
- Passenger liaison meeting—held six times each year,
- Passenger information at bus terminals—current route and fare information should be readily available, and
- Passenger information at stops—current route information should be readily available.

To identify and measure its performance in various areas, KMB uses frameworks provided by organizational standards, ISO standards, and regulatory measures.

The publicly listed company is governed by a board of directors, and two of the board members are appointed by the Hong Kong Transport Department.

KMB considered participating in an international benchmarking group, but elected not to, in the belief that the group's measurements were not relevant to the company.

MTR Corporation

MTR operates nine rail lines serving Hong Kong Island, Kowloon, and the New Territories, as well as a light-rail network, a bus fleet, and the Airport Express high-speed rail line. The Hong Kong government, once the sole shareholder, now owns 75% of MTR. In 2007, the operations of the other government-owned rail operator, Kowloon-Canton Railway Corporation, were merged into MTR's operations, making MTR the only rail operator in Hong Kong today.

MTR's business interests are quite diverse and include private consultancy services in planning, engineering, and design, as well as business development. The company also has a flourishing real estate management division. Five new lines, including one to mainland China, are currently in the planning phase and are expected to be in operation within the next 6 or 7 years. MTR carries 4.2 million passengers daily in its 1,200 vehicles; 3.8 million of these passengers are on heavy rail.

There are two discrete streams for establishing performance: regulatory requirements and business strategies. MTR uses strategy planning as a basis for its budget development, and it requires that system performance standards correspond to its customer service pledge. Service standards that do not drive performance outcomes are identified and used

[2]The Corporate Social Responsibility Charter is available at www.kmb.hk/eng/pdf/csr.pdf.

occasionally. MTR tries to optimize performance improvements by evaluating demand for the improvements with the associated costs.

The company wishes to create a "lifestyle of health and sustainability," and the company motto is "the ride to great living."

MTR's business strategies are the key drivers for improving financial performance, and they are aimed at two broad objectives—growth and productivity. MTR concentrates on the following four interrelated areas:

- Financial performance, which focuses on increasing MTR's market share, revenue diversity, optimization of assets, and cost efficiencies;
- Customer satisfaction, which focuses on customer service, fostering/improving community relations, and improving safety;
- Process and efficiency, which involves system reliability, ensuring service and service expansion are meeting market demand, and good safety practices; and
- Organizational learning.

MTR's operating agreement also requires that it meet certain performance criteria in various areas.

MTR's commitment to customers is embodied in its customer service pledge. The pledge, combined with customer satisfaction survey data, informs the company's customer service target. The target is then used, in conjunction with other performance requirements, to develop the system performance standards. MTR also provides historical data and performance trends as input to the system performance standards.

MTR considers multiple factors when establishing performance measures, including the following:

- The requirements set by the regulator (Transport Department);
- Local regulations or standards (e.g., noise levels);
- Customer needs;
- Market competition;
- Benchmarking with agencies in other cities;
- Cost efficiencies; and
- Targets established by best practices and achievable and acceptable by equipment suppliers.

MTR has a highly structured approach for establishing targets, developing performance measures, and evaluating outcomes. There are four primary areas that are key in developing performance strategies and objectives; safety, financial performance, regulatory requirements, and customer satisfaction.

MTR has developed a set of indices for each operational area, including environmental control systems, fixed plant fare systems, communications, and lifts and escalators. Data collection and monitoring is conducted through MTR's station management system and incident reporting. MTR also monitors customer satisfaction areas, such as train cleanliness and temperature, which are verified through scheduling reviews and customer surveys.

MTR publishes its data quarterly. The data are reviewed and validated by a public auditor. Directors and managers partake in monthly meetings to respond to specific performance indicators. MTR's commitment to constant improvement through performance targets is evident by its employment priorities, which include a full-time staff member who focuses on performance measures. Other members of MTR commit 10% of their time to performance measure assessment, and managers spend 20% of their time reviewing data and reporting performance measures. The resulting performance measurement data is a product of these efforts.

MTR uses the balanced scorecard system to align its strategies with performance; the scorecard is integrated into its business plan, where it is used to understand the data that is being collected and to measure progress. The balanced scorecard allows MTR to review a specific performance area and its relationship to the factors that influence performance, which helps management understand and determine how to allocate resources to specific areas. The three key indicators factored into the balanced scorecard are operational statistics, budget variance, and safety and security (accident and injury rates). The data are reviewed to gain an understanding of how system outcomes measure up to system targets.

Singapore

Land Transport Authority and Public Transport Council

The city-state of Singapore covers an area of 710 sq km, and it has a population of 4.8 million. There are 3,300 km of roads on this small island. Singapore has an extensive rail rapid transit system of 167 km with 143 stations, combining both heavy rail

and light rail technologies. Along with the rail system, 3,700 buses serve 4,600 bus stops on 260 routes to provide 4.5 million transit trips per day. The public transportation mode share is currently 63%.

Singapore's Land Transport Authority (LTA) and Public Transport Council (PTC) operate within the auspices of the Ministry of Transport. The government provides the transit infrastructure and operating assets. The operators are beholden to LTA as the regulator of public transport service and safety standards, and their operating licenses are dependent on compliance.

The Rapid Transit Systems Act gives LTA the authority to grant operating licenses, regulate terms and conditions of concessionaire contracts, and issue standards for practice, as well as directives, as needed, to individual operators. LTA can impose penalties, including loss of license, on operators for noncompliance. Rail transit operating licenses are granted for 30-year terms and require the operator to follow the operating performance standards and document and implement a safety management system and describe its plans for managing operations.

LTA integrates its planning efforts with Singapore's Urban Redevelopment Authority. The government owns 80% of the land in Singapore, and all new development must seek approval from the Urban Redevelopment Authority.

LTA is poised to take over central bus network planning. In the future, the department will license bus routes in packages in order to encourage better connectivity throughout the system.

Historically, Singapore's urban transport policy considered the regulation of transport providers as public utilities. The operators were not meant to compete with each other. LTA currently is taking steps to encourage more competition between transit providers. LTA believes that the system should be profitable and that individual lines should be regarded as contributing to the entire system. However, unprofitable routes or lines are not necessarily less important or less useful.

PTC is a 16-member organization made up of union representatives, academics, and community leaders. Members are nominated or recommended to the Minister of Transport for appointment.

PTC regulates bus service standards and fares. Its responsibility is to balance service standards with the need for financial sustainability of the operating companies. This is accomplished through government oversight of service quality and by maintaining a fare structure that is affordable while still allowing the operators to turn a profit. Operation and maintenance costs are expected to be covered by fare and nonfare revenues, including advertisement placements and leases of station space.

There is no cap placed on operators' revenues, but PTC can cut fares to limit revenues. Although fares are capped each year, they can change based on a number of factors, including inflation and unemployment. Opportunities to earn greater revenues are encouraged in order to maximize profits. Every 5 years, however, PTC asks the operators to extract some of their profits to give back to the communities.

Adherence to the bus quality of service standards is a requirement in each operator's license agreement. Public transport operators submit monthly compliance reports that explain any noncompliant performance and include requests for waivers from the performance standards. LTA evaluates the requests by considering the data and justification. Results are presented to PTC two times per year, including recommendations for penalties. The transit operators have an opportunity to appeal to PTC, and if the transit operator does not agree with the PTC's ruling, it may appeal to the Minister of Transport to overturn the ruling.

Public transport operators submit annual reports and financial statements to LTA and PTC for review. LTA has authority to conduct audits to ensure that operators are in compliance. Random audits are conducted on a monthly basis. Process audits of the operators are performed annually, and a system audit takes place every 3 years.

For the rapid transit system, the operating performance standards require compliance with comprehensive key performance indicators in service quality, safety, and equipment performance and reliability. To LTA, the customer's entire journey experience is important enough to require performance standards in these areas.

The *Land Transport Masterplan* for Singapore was finalized in March 2008.[3] In preparing to rework its transportation master plan, the Singapore government looked at the trends of increasing travel demand and of increasing use of private automobiles on the island. The government's study of the demographics of the changing population highlighted the fact that these trends were not in alignment with the

[3]The *Land Transport Masterplan* is available at http://app.lta.gov.sg/ltmp/index.asp.

expectations of the traveling public. LTA seriously considered the impact of increasing private automobile use on overall system capacity and environmental sustainability and concluded that drastic measures were needed to change travel behavior. It decided to focus the *Land Transport Masterplan* on the needs of the community. The plan's basic premise is to work toward "a people-centered land transport system."

The master plan contains three main strategies, or thrusts, as follows:

- Making public transport a choice mode,
- Managing road usage, and
- Meeting the diverse needs of the people.

Within these three strategies are several objectives. The first thrust, "Making public transport a choice mode," contains objectives for improving overall performance of the public transportation system, including making improvements to the system by expanding the rail network through new lines and extensions, improving travel times, creating more competition, providing bus priority, and changing the fare structure to a distance-based system. More specifically, the transport plan has set targets that would enable 85% of commuters to complete their door-to-door journeys within 60 minutes during the morning peak through improved transfers, accessibility, and frequency. The plan also seeks to double the rail transit network to 278 km by 2020 and increase bus speeds to 20–25 km/h, up from 16–19 km/h. LTA has set a goal of increasing the public transport mode share to 70% in 2020, from today's share of 63%. The operational key performance indicators that are required in the operator licenses address safety, reliability, accessibility, and customer service—all key factors in encouraging or deterring ridership.

The second thrust, "managing road usage," is designed to limit the number of cars that use the roadway system by engaging in electronic road pricing, allowing market forces to set parking policies, and strictly limiting the number of vehicle registrations issued.

The third thrust, "meeting the diverse needs of the people," will be accomplished through engaging the community, enhancing accessibility by providing barrier-free facilities and keeping fares as low as possible, making transfer stations into "lifestyle hubs," and promoting the use of bicycles and other clean vehicles.

These initiatives set the standards for quality of service by Singapore's public transport operators.

SMRT Corporation

In 1987, the Singapore Mass Transit Rail Corporation (SMRT) became Singapore's first transit operator. A publicly traded company, today's SMRT Corporation provides engineering, project management, and property management services, in addition to managing a suite of transportation alternatives, including heavy and light rail, bus, and taxi. A division sells and produces advertising media.

The corporation operates two driverless light rail transit (LRT) lines: the Circle Line, or CCL, with 33 km of track and 23 stations, and the Bukit Panjang Line, with 8 km of track and 14 stations. The LRT system, which is completely elevated, carries 14.3 million passengers annually. SMRT also operates the Mass Rapid Transit system, or MRT, a 93-km electrified heavy rail line with 53 stations serving 1.5 million passenger trips per day. Its bus system includes 860 vehicles, which carry more than 270 million passengers each year. SMRT is also the second largest taxi operator in the region.

The company's goals are adopted by its board of directors and made public. SMRT's overall goal is to become the transit customer's choice provider through its outstanding performance. SMRT's license and operating agreement commits SMRT to meeting performance standards in areas such as operations, maintenance, and safety, as set forth by LTA and PTC.

SMRT's performance strategies fall into two broad areas: those that are set internally to improve profitability, and those set by the regulatory agency (LTA). The internal strategies focus on customer satisfaction, profitability of existing services, and business diversity (nonfare areas) and growth (operating transit systems in other markets). Specific objectives articulated in SMRT's 2007 annual report[4] include the following:

- Maximize long-term shareholder value by
  - Improving group profitability,
  - Providing good dividend payouts to shareholders, and
  - Managing risks to mitigate impact on earning and prospects;
- Provide safe, reliable, and friendly travel experience at affordable prices;

[4]*With SMRT, I Can: 2007 Annual Report.* Available at http://www.smrt.com.sg/investors/documents/annual_reports/2007/external_pdfs/SMRT_AR_2007.pdf.

- Leverage core expertise in operations and maintenance for trains and related infrastructure;
- Maximize nonfare revenue through rental, advertising, and engineering businesses; and
- Enhance and sustain high standards in corporate governance, corporate transparency, and corporate social responsibility.

SMRT also relies on customer feedback to help determine its priorities for improvement. As part of this effort, customer feedback is logged and submitted to each relevant department head for a response. The customer service center is committed to a maximum 14-day turnaround period to respond to customer comments.

SMRT produces monthly performance reports to the regulators. Incident reports are also provided to the regulators on an ad hoc basis. Shareholder reports are submitted quarterly. As with many other corporations, SMRT also produces an annual report to document its performance and progress in the past year.

An example of SMRT's use of performance measures to change course occurred when ridership grew by 9% in 2008, requiring the company to expand capacity. SMRT's trainload estimation system helped the company determine when additional vehicles were required. For example, crush capacity per six-car train is about 1,600 riders. For comfort, however, SMRT uses 1,200 riders per train as the trigger for additional capacity. The daily load was averaged over a period of one month to determine if the loads had reached the tipping point. Service was then adjusted as needed by putting additional trains in operation. The company has established a number of systems for managing and reporting data, including the trainload estimation program, a train deviation system, and a safety information system.

In addition, SMRT's participation in the Nova international benchmarking group means its key performance indicators can be compared with those at other transit properties.[5] Nova's member forums allow SMRT to follow best practices within the industry to realize continued improvement.

Kuala Lumpur

Kuala Lumpur, with a population of 1.7 million, is the largest and fastest growing region in Malaysia. The surrounding Klang Valley, which includes Kuala Lumpur and its suburbs, is home to 7.2 million people. Compared with the other three cities visited, Kuala Lumpur's public transportation usage is relatively low, with a mode share of 14%. Car usage in the city is thus disproportionately higher than in other Asian cities.

The Malaysian government privatized public transportation in the 1990s and issues concessions and licenses that allow private-sector companies to run the mass transit systems.

The Malaysian government invests in the initial infrastructure for public transport, but the operator of the system is responsible for maintaining the system. The operator has little input on the equipment purchased, which can confound profitability and other operational objectives when system equipment fails.

RapidKL

RapidKL (Rangkaian Pengangkutan Integrasi Deras Sdn Bhd) is the only multimodal public transport company in Malaysia. Incorporated in 2004, RapidKL is a subsidiary of Syarikat Prasarana Negara Berhad (Prasarana), a government-owned company. Prasarana owns the assets of the two LRT lines (Ampang Line, formerly known as Star, and Kelana Jaya Line, formerly known as Putra). The city's monorail system is managed by KL StarRail, which is another subsidiary of Prasarana.

RapidKL operates both the LRT system and the bus system. Its bus service includes 165 routes in six areas of the Klang Valley, serving approximately 400,000 passengers/day. RapidKL has a fleet of 978 buses maintained at 11 depots, and it employs 1,300 drivers.

RapidKL's two LRT lines have a total of 56 km of track, with 49 stations. Ridership on the LRT system is approximately 350,000 passengers per day. The Kelana Jaya line is a driverless system that runs on 3-min headways during the peak periods. The Ampang line uses drivers and operates on frequencies similar to that of the Kelana Jaya line. The LRT fleet consists of 35 sets of two-car trains with a capacity of 400 passengers per train. RapidKL has recently purchased its first fleet of four-car trains.

The government grants a license to RapidKL to operate transit services. Expansion of the system is undertaken by Prasarana, with input from RapidKL.

In 2008, in response to media coverage and customer comments on its website, RapidKL's chief

[5]Nova is a consortium of 15 medium sized metro systems throughout the world that are engaged in benchmarking. Information is available at www.nova-metros.org.

operating officer undertook an effort to redefine the organization's business strategies with the intent of changing the image of the organization and achieving RapidKL's mission of being financially sustainable.

The vision of the organization is reflected in four business strategies or "pillars," which are based on the balanced scorecard approach to quality management:

- Internal processes,
- Financial performance,
- Customer satisfaction, and
- Learning and growth.

Within the four pillars, there are nine objectives and 21 key performance indicators.

RapidKL uses the Vancouver (British Columbia) SkyTrain as its model for operations. RapidKL's management team traveled to Vancouver for 3 months of training, during which time they also discussed the performance indicators that are used to evaluate and improve service in Vancouver. RapidKL then hired a consultant to assist in the development of its own performance measures. Over a period of 6 months, RapidKL's consultant developed and assigned weights to each of the key performance indicators. Some performance indicators are based on customer needs, shareholder expectations, and government requirements.

The pillars and their respective performance indicators are integrated into RapidKL's operating agreement. The operating license requires the company's performance to meet certain targets. Data on the performance of the company is collected through event logs, schedules, and automated data collection systems. On a monthly basis, RapidKL reviews the results of its performance as reported in the balanced scorecard. Rapid KL reports to the regulators on a quarterly basis.

RapidKL relies heavily on peer group input to validate its definition of performance indicators. As a reality check, RapidKL benchmarks its performance against similar systems, including those serving Vancouver (SkyTrain) and the John F. Kennedy International Airport in New York (AirTrain JFK).

RapidKL uses performance data to indicate where course correction might be warranted. For example, within the learning and growth pillar, the company has an objective to develop skilled employees. The performance indicator for this objective is the definition of staff training requirements. The target was to complete training-needs analysis within 2 months. Using this target, RapidKL would be able to define staff training needs within a given timeframe so that additional steps could be taken to realize the actual training.

In the long term, as part of their effort to enhance quality management, RapidKL is building a centralized bus control center to ensure the accurate collection of data. The company has also hired more staff and allocated more funds to support this effort.

RapidKL's performance measurement systems are less mature than those of the other agencies visited. The company has, however, taken lessons learned from other systems in order to establish its own processes, and it is realizing some significant successes with each step forward.

Taipei

The Taipei Rapid Transit Corporation (TRTC) operates 75 km of rubber-tired, fixed guideway, and electrified heavy rail (electric multiple unit, or EMU, technology) on eight lines with a total of 70 stations. Daily ridership is in excess of 1.2 million. The Taipei government owns the guideway infrastructure and grants TRTC a license to operate the system. The services provided by TRTC are known by the brand name of Taipei Metro.

Taipei Metro's mission is "Providing a Safe, Reliable, Cordial, and High-Quality Transportation Service" to travelers, and its management philosophy is "Customers Come First and Quality Above All."

Eighty-five percent of the company's revenues come from fares. The company provides a 20% discount to passengers who use the IC Easy Card, a smartcard system implemented in June 2002. Passengers are charged for transfers at a discounted rate. These discounts are absorbed in the operating budget for the organization. Currently, about 90% of the passengers use the smartcard.

In addition to operating rail passenger service for the city of Taipei, Taipei Metro collects revenues from leasing space at shops, underground shopping malls, and parking lots. The company also sells advertising space in trains and at stations. These revenues account for approximately 11% of the corporation's total revenues, about US$36 million. The company has also assumed management of the Taipei Arena, a 15,000-seat multipurpose facility for sports events, exhibitions, and performances, and operates a mountain gondola. In total, TRTC earns approximately US$20 million in profit each year.

Taipei Metro pays rental fees of approximately US$80 million per year to the government to fund the replacement of rolling stock, communications and signalization infrastructure, and mechanical equipment. Approximately US$18 million (before profit) is paid to the government and held in escrow to fund future capital maintenance.

In cooperation with the Taipei city government, Taipei Metro plans to expand its network to 132 km on five lines by 2013, at which time it expects to be serving about 2.7 million passengers per day. The Taipei government contributes about 50% of the capital cost of new construction, with the Taiwan government paying the remaining 50%.

Taipei Metro staff spent 2 full days with the study team to share its extensive experience using performance measures at all levels to improve quality and delivery of service to its transit customers. Led by Dr. Huai Sheng Tsay, president of Taipei Metro, the discussions focused on several systems and processes the organization has in place to continually improve operations companywide.

Taipei Metro representatives stated that the successful implementation and use of performance measures to improve operations was due to a combination of commitment and conviction of the organization's leaders, setting achievable goals, and recognizing employees when goals are met.

Taipei Metro historically looked at financial indicators to advise its business strategies. But in 1999 the company began refining its organizational management processes using four areas of quality management based on the balanced scorecard approach: finance, customer satisfaction, internal processes, and organizational learning and development.

Performance Evaluation of Private Bus Companies in Taipei

In contrast to Taipei Metro's well-developed use of key performance indicators, the city of Taipei is only in the early stages of establishing performance measures for its bus franchises. The City of Taipei understands the importance of the city bus network as a critical component of the overall public transportation system, providing both feeder service to trunk lines and transportation in areas not served by rail.

More than 300 bus lines serve 1.7 million passengers/day in Taipei. There are 14 bus companies that have licenses to operate in the region. To encourage higher bus ridership during peak hours, city officials recognized the direct link between service quality and ridership. In the context of this initiative, the Taipei City Public Transportation Office (TCPTO), the city department that regulates the quality of service for buses, asked Professor William Jen of National Chiao Tung University to conduct a study to evaluate the performance of bus companies. The research undertaken represents a very early stage in the use of performance measures to enhance quality of service. It is reasonable to assume that this is the first cut at developing performance measures that may eventually become an enforceable standard when the city grants licenses to operate bus service in the region.

Dr. Jen worked with the director of public transport and the bus operators to define the performance indicators and create a weighting system to score the quality of service of the bus companies. The 21 measures were divided into the following four categories:

- Terminal,
- Vehicle,
- Interaction quality (between passengers and drivers), and
- Management.

Within each category, four to six specific items were identified for assessment. Quantitative data for some performance indicators could be collected from the operators. Qualitative data, such as passenger perception, was collected through rider surveys. Data indicating compliance with government policy was subject to assessments and reviews performed by TCPTO.

The study outlines several steps to fully evaluate the bus companies. The process begins with the academic exercise of establishing the performance indicators and is followed by input from the TCPTO and a workshop with the bus companies. From that workshop, an action plan will be created to begin data collection and analysis. The results are intended to be reviewed twice per year.

By using performance measures to evaluate the bus companies, the City of Taipei hopes to encourage bus companies to improve quality of service and thus increase ridership. This may become a way for the city to enforce high standards of service. The potential loss of an operating license is an incentive for a bus company to comply. In addition, bus companies may be eligible for subsidies from the government, depending on their ability to meet the performance standards.

MEASUREMENT ITEMS

Hong Kong

Transport Department

The Hong Kong Transport Department uses several types of performance measures to evaluate public transport in the region. Specific performance measures and obligations are written into franchise agreements for each transport provider.

For monitoring and regulatory purposes, the department has defined the following six objective standards:

- Reliability,
- Efficiency,
- Safety,
- Cleanliness,
- User friendliness, and
- Environmental friendliness.

These objectives form the basis for its multimodal performance measures. For reliability, the agency targets bus availability and lost trips as the primary measures. For efficiency and quality of service, the agency measures the number of buses on the road versus its total licensed fleet. The agency also determines and evaluates time-of-day frequencies for each of its operators.

Safety is highlighted as an important goal and is measured by implementation of operator training programs. New hire and ongoing driver training programs are required for each transport provider. The transit providers must submit reports on how many operators are being trained annually.

For the cleanliness objective, the Transport Department requires vehicles to be cleaned on a daily basis, including daily bus washing and floor sweeping twice per day.

The Hong Kong Transport Department has also developed environmental standards for its transit providers, which includes defining the minimum percentage of existing vehicles that meet Euro 2 emission standards. There is also a requirement that all new buses comply with latest Euro emission standards.

The Transport Department requires that operators respond to complaints and inquiries in a minimum timeframe. Transit providers must also conduct bimonthly passenger liaison meetings and provide passenger information at stops and terminus locations. The Transport Department uses extensive surveying to measure customer satisfaction, user friendliness, and compliance with the above measures.

Performance targets are set for each franchised transit operator. The targets are formulated with regard to the operator's performance in the previous 3 years. The operators must compile data on each performance measure and submit a report to the Transport Department each year.

For each operator, actual achievements are compared with the targets. The transport department conducts reviews with operators to determine if adjustments need to be made. If an operator fails to meet the targets, causes are identified, and appropriate improvements are recommended.

If an operator continually fails to meet the minimum standards set forth by the Hong Kong Transport Department, the franchise can be taken away or not renewed, which has happened in the recent past.

KMB

The mission of Hong Kong's KMB is to provide safe, reliable, comfortable, friendly, and value-for-money bus services. While KMB does have a 5-year comprehensive plan, including financial, planning, and maintenance strategies, the ISO recertification process guides its performance measurement system process. KMB believes that there is a direct correlation between ISO certification, quality management, and superior customer service.

The ISO certification process requires the establishment and use of performance measures. At KMB, each department has specific performance measures that relate back to the ISO process. Each department has regularly scheduled meetings to review the numbers and trends. Both quarterly and annual performance targets are set for each department. The performance targets are primarily set by evaluating past trends, with an emphasis on setting achievable and realistic targets. Besides a desire to achieve the company's goals, improving performance every year is equally important.

While each department at KMB has set performance measures and targets, there is a strong emphasis within the company on operational performance, primarily safety and service reliability. Much of this is set by the franchise agreement with the Hong Kong Transport Department, but KMB attempts to go much beyond the required standards.

KMB sets a high standard for peak on-time performance, with a nearly 100% goal of on time depar-

tures from terminal locations. Similar high standards for vehicle reliability are targeted, with a minimum number of breakdowns that require passengers to be transferred. In 2008, KMB achieved 51,605 km between mechanical breakdowns, well above the set goal of 45,000 km. In terms of overall vehicle safety, KMB has a set standard of 3.35 million vehicle-km between accidents.

KMB achieved ISO 9001 certification in 1994. The company focused first on the performance of its operating and maintenance facilities, but eventually improved the performance of the entire system so that it was fully ISO 9001 compliant by 1999. KMB also recently met ISO 14001 environmental standards, which appears to satisfy a tenet established in its Corporate Social Responsibility Charter.

KMB uses an internal system, referred to as the executive information system (EIS), to record data and assess progress in key areas. The system provides a clear definition of every indicator and target established for a particular period. The EIS is audited by the regulator (Transport Department) to ensure targets established in KMB's 5-year (rolling) plan are being met. Each KMB department provides monthly progress reports to the board of directors, and progress is reviewed in depth at quarterly depot meetings and at annual management meetings.

Using the executive information system, KMB staff can continuously monitor performance. Staff members meet regularly to review both the quarterly and the annual performance targets, and each department head must submit performance reports to directors on a monthly basis. Performance measurements are reviewed and targets can be adjusted if necessary. The primary goal of this process is to continually improve KMB's overall performance.

All corporate departments' key indicators are included in the executive information system. The intent of the system is to facilitate communication and provide unification of all performance indicators.

KMB uses standard measures to ensure operating efficiency. These include mechanical reliability (measured in road calls), operational capability (measured by pullout rates—the scheduled number of bus departures in the peak direction during the morning peak period), safety (measured by accident rates), customer feedback management (measured in time it takes to respond to complaints), and service department indicators (measured by use of spare parts and technical and apprentice training achievements).

In many areas, targets are set to achieve "continuous" improvements rather than to respond to overarching strategic goals. Nevertheless, KMB identifies targets and employs measures to ensure that passengers are satisfied, which is assessed by a quarterly telephone survey. The survey includes questions that address system reliability (adherence to schedules), cleanliness, comfort, and so forth.

KMB has several processes to ensure the quality of the data, including both internal and external auditing. Under the franchise agreement with Hong Kong Transport Department, independent auditing of the regulatory requirements is necessary.

KMB is a for-profit company publicly traded on the Hong Kong Stock Exchange. Its routes often compete with other bus and rail routes, so fast and reliable service is vital if KMB is to successfully attract and retain customers. KMB relies on its performance measures to achieve this goal.

MTR

MTR uses a comprehensive integrated management system to measure performance. The foundations of the performance management system are linked to the company's strategy of safety, reliability, customer service, and cost efficiency.

MTR's performance management framework is divided into two objectives:

- Operating agreement performance requirements established by the Hong Kong Transport Department, and
- The company's performance goals, which are driven by MTR's business strategies and shareholder requirements.

The Hong Kong Transport Department sets standards that require MTR to meet customer's needs and expectations. These are written into MTR's franchise agreement, and the targets must be met annually. These regulatory measures monitor railway performance for three categories: train service (availability and reliability), station service (station equipment/customer interface), and passenger comfort and care.

For its internal performance management system, MTR utilizes the balanced scorecard method, which integrates nonfinancial performance metrics with traditional financial metrics to provide a more "balanced" view of organizational performance. MTR has been using the balanced scorecard method since

1999 and has recently integrated it into its strategic planning and budgeting processes.

MTR integrates three components into its balanced scorecard:

- Safety,
- Operating statistics, and
- Budget variances

These three elements link back to MTR's strategic plan and guide day-to-day management activities.

The annual strategic plan drives the performance measurement process. The strategic plan determines the goals and objectives for the company. Based on a top-down performance system, high-level measures and targets are set, with "cascading" measures then determined for each functional department.

For example, safety is one of MTR's objectives. High-level targets are set for overall accidents and injuries. These measures are monitored by senior management. More detailed performance indicators are set for each operational unit and geographical area. Then even more detailed safety measures are developed and used by each discipline and job category. The cascading performance measures allow each functional department to be directly involved in striving to meet the safety objective. This method also provides accountability and enables management staff to identify specific areas where performance is not being met.

MTR staff stated that their balanced scorecard method improves the understanding of business processes. An example was given of where the preventive maintenance target of 97% was not being met. Through comparing and analyzing the departmental performance measures, they found out they were not meeting their goal because of their existing training methods. Because of the long-term financial and passenger impacts attributed to a lack of preventive maintenance, alternative training procedures were developed.

MTR places a large importance on the defined measurement targets. Management believes that setting the "right" targets is important. If targets are too high, then they will prove too costly to achieve. If the targets are too low, then the company will not meet their passengers' expectations and requirements. MTR also uses the targets to motivate improvement. It was stated that precise and clear performance measures and targets help frontline employees understand the company's goals and business processes. MTR also uses its performance measures and targets to recognize good practice and achievements.

Monthly management meetings are held to review the key performance indicators. Every month, managers must explain any differences between actual and target performance and identify corrective actions that will lead to improvement.

MTR has set high standards and targets for its operating performance measures. This is partly a response to the high level of performance set by the Hong Kong Transport Department, but also to the objectives set forth in the company's own strategic plan.

MTR pledges to ensure trains are always maintained to provide safe and reliable service. The goal is to have less than one train failure per 500,000 km. MTR strives to ensure that at least 99.5% of all scheduled trips will be operated and at least 99% of trips will be completed within 2 min of schedule.

For service reliability, MTR's measures and targets include

- Train service delivery (provided service) $\geq$99.5%,
- Passenger journeys on time $\geq$99%,
- Train punctuality $\geq$99%, and
- Train reliability $\geq$500,000 car-km/incident.

For station equipment and customer comfort and care, MTR's targets are

- AVM reliability $\geq$99%,
- Ticket machine reliability $\geq$99%,
- Ticket gate reliability $\geq$99%,
- Ticket reliability $\geq$99%,
- Escalator reliability $\geq$99%,
- Passenger lift reliability $\geq$99.5%,
- Light rail platform octopus processor reliability $\geq$99%,
- Light rail on-vehicle air-conditioning failures $<$3 times/month,
- Temperature and ventilation $\geq$97% reliability on trains and $\geq$90% in stations, and
- Railway cleanlines $\geq$98.5% in train compartments and $\geq$99% on train bodies.

MTR uses a variety of data sources for the operational performance measures. Much of the data is collected through automatic sources connected with the train control system. For the temperature and ventilation, MTR has monitoring units at each station and train. For its customer satisfaction indicators, MTR makes use of frequent customer surveys.

Data quality is an important component of the MTR performance measurement system. In addition to its internal standards, MTR data are audited externally, as required by both the Hong Kong Transport Department and the Hong Kong Stock Exchange.

The balanced scorecard method has been extremely successful for MTR. Over the years, the company has been able to maintain a high level of service and sustain profitability. MTR staff says that the key to their success has been management's commitment to the performance measurement process and the employees buy-in to the company's overall strategic goals.

Singapore

Singapore's measurements are simple but effective, and center on the following:

- Train availability at 98%,
- On-time performance at 94%,
- Accidents limited to no more than two every 4 weeks,
- Ticket machines are operable 95% of the time,
- Escalators are in service 99.9% of the time,
- Elevators are in service 99% of the time,
- The number of service collisions is nil, and
- The number of fires at stations is nil.

The data collected include failures and delays, as well as loads and safety and are collected using a homegrown system. Within a day of each incident, the customer service department at SMRT contacts those who were involved in an incident to determine how they were affected and what could be done to avoid a similar situation in the future. The company relies heavily on public input, and their track layouts are designed for efficiency and effectiveness. Closed loop systems ensure safety, and train loading is measured in 15-min blocks for service development and planning. SMRT staff plan, implement, measure, and correct as necessary. Their analysis is done just as much after adding a train as it is done before. Their measurements are reviewed daily, and they can adjust service up to four times a year.

Many detailed reports feed into key categories that are based on the SMRT strategic plan. The measurements are collected from smartcards and from surveys. Their goals have been adopted by, and are supported by, their board of directors. Data are reported weekly and is adjusted for uncontrollable issues, which results in more objective statistics.

The Land Transport Authority plans to double the rail network by 2020, enhance capacity on existing lines by increasing train frequencies, and enhance safety by installing screen doors on all rail station platforms. The plan also calls for creating a central bus network with enhanced traffic priority, including all-day exclusive bus lanes and other preferential treatments. The overall goal is for 85% of door-to-door transit trips to be made within 60 min.

LTA grants two franchise licenses to two rail operators. Currently these operating licenses are for 30 years. Under the agreement, the operators are to manage the transit system in accordance with specified operating performance standards. The performance standards relate to three primary functions—service quality, safety assurance, and equipment performance.

Under service quality, LTA defines standards for on-time performance, train service availability, passenger loading, severity of service disruptions, frequency of service disruptions, minimum train headways, and span of service.

For safety assurance measures, LTA defines four main standards—passenger injury rate, mainline service collisions, service derailments, and fire incidents. These measures have very high standards, with large penalties for failing to meet the targets.

The entire journey experience is important to LTA, including equipment performance at station platforms. Standards have been set for the reliability of general ticketing machines, automatic fare gates, and escalators and lifts.

Each of these performance measures relates back to LTA's goal of making public transport a choice mode. Frequent, reliable, and safe service is LTA's primary public transport policy goal.

There are large penalties associated with transit operators not meeting the standards set by LTA; for example, LTA had recently assessed a $300,000 fine on one of its rail operators for a 7-hr delay caused by overnight track work not being completed on time.

PTC has six quality of service performance categories:

- Reliability,
- Passenger loading,
- Safety,
- Availability of service,

- Integration and span of service, and
- Customer information.

Under each of these six categories are a variety of specific measures that each bus operator must achieve or else incur a financial penalty. For example, under the reliability category, minimum standards are set for three specific measures—actual to scheduled bus service operated on each route, headway adherence, and bus breakdowns.

PTC has set up a penalty framework, with fines for breaches in each of the quality of service standards. For example, a bus operator can incur a $100 penalty for each day on each route where the minimum reliability standards are not met and be assessed a $10,000 penalty for not meeting each monthly requirement.

The rail operations division uses numerous performance measures to monitor and improve its transit service. SMRT has two primary objectives with performance measurement—namely, to meet the regulatory requirements established by LTA and to provide customer satisfaction.

SMRT has an annual planning cycle that develops each division's performance measures and targets. To meet both the internal and external requirements, monthly and quarterly reports are produced.

The rail operating division performance measures focus on capacity, reliability, safety, and customer service. For customer service, the agency developed a "Customer Integrated Feedback System" that monitors and tracks customer complaints. SMRT requires that all issues must be resolved within 14 days and that a reply must be made within 3 days.

SMRT also uses its customer service system to track types of complaints and uses this information in formulating priorities for specific performance measures and tracking systems. Over the past few years, one of biggest complaints has been overcrowding. As a result, rail operations developed the "trainload estimation system." This system uses data from smartcards to estimate trip and station level passenger loads. This interactive tool allows SMRT staff to monitor system performance, and it graphically compares actual data with the performance standards. The passenger loading performance measure is such a main concern that senior management uses the graphical tool on a regular basis.

The SMRT rail operations division uses a variety of performance measures and standards as well. These include train availability, on-time arrival and departure at terminals, station equipment reliability, and accidents and safety.

SMRT also participates in, and utilizes the information gleaned from, a customer satisfaction survey conducted and analyzed by the Singapore Management University, which is based on the American Customer Satisfaction Index developed by the National Quality Research Center at the University of Michigan.

The rail operations division relies on a variety of automatically generated data for their performance measures. Besides using smartcard data for estimated loads, SMRT relies on a computer tracking system for logging incidents and delays and a web-based train deviation system that logs and shows train on-time performance. The data for the train deviation system comes directly from the central train control system. Data from all these systems is validated weekly.

SMRT has a monthly performance process that reviews the key financial and operating performance standards. Each month, division managers must report on each performance measure and trend. The intent of the meetings is to improve customer satisfaction and meet the high standards set forth by Singapore government.

In one of the team's meetings with SMRT staff, a senior manager noted, "there is no room for slack, because the Singapore government can take away the franchise." With the aggressive rail expansion plans by the Singapore government, SMRT also realizes it needs to perform at high level to compete for these franchises.

Kuala Lumpur

The study team met primarily with RapidKL's bus operations division. The bus operations division had reviewed its key performance indicators and had developed a new strategic performance measurement system for 2009. A "bus operations scorecard," which incorporated key performance indicators and targets, was developed with the intent to change behavior and improve quality of service.

The bus operations scorecard has four main areas of emphasis (pillars), and each pillar has one or more objectives:

- Internal process:
  - To achieve and monitor daily bus schedule (on-time performance);

  - To implement a bus ticketing system;
  - To develop standard operating procedures for operations; and
  - To fully satisfy operations quality standards.
- Financial goals:
  - To achieve the targeted budgeted revenue; and
  - To maintain operating costs within budget.
- Customer:
  - To provide safe and efficient bus service.
- Learning and growth:
  - To retain quality, skilled employees; and
  - To develop skilled employees.

A total of 21 key performance measures and targets were developed for these objectives. Management has realized that to be successful in achieving these targets, a limited number of key performance measures are required.

A consolidated effort from all departments is involved in meeting the performance standards. The intent is to monitor these targets monthly and to make adjustments and improvements as necessary.

It was impressive to hear the process that RapidKL went through to develop the bus operations scorecard and key performance indicators. Management recognized that the bus division was not operating at a high or satisfactory level, and through its corporate and strategic planning efforts it identified priority actions that would help the company improve and succeed.

The performance indicators were determined by utilizing what they had learned from their visit to Vancouver, peer evaluations, and benchmarking, as well as a comparison with Dublin's LRT (Luas). When asked how they measured performance and how the measurements relate to objectives, the staff answered that the measurements are based on contractual requirements, customer needs, shareholder experiences, and regulations.

The data collection method incorporates maintenance management systems, delays, on-time performance, stops, and number of work orders reflecting maintenance performance. RapidKL also benchmarks itself against SkyTrain and the AirTrain JFK, in addition to Luas, and has an automated data collection system with built-in quality checks and balances. They manage by measurements outside the standard deviation range.

RapidKL currently has a 99% cash fare basis, but the company is planning to significantly reduce that percentage. Their operators actually pay for any shortfall in fare collection at the end of each shift. The plan is to automate the entire process through a total integration with rail, while developing standard operating procedures, increasing revenues and customer satisfaction, and improving cleanliness. The company is embarking on a new training program for apprentices, who will eventually become bus captains (drivers). RapidKL is in the process of hiring consultants to measure and verify statistical data.

RapidKL provides operators with a base salary plus bonuses for the number of trips they perform, the number of customers who are left behind, attendance, punctuality, revenue, accidents/incidents, and customer complaints. Employee availability is a huge problem for RapidKL, with high rates of absenteeism and a staggering shortage of drivers and traffic regulators (being short 350 drivers and 150 traffic regulators).

Taipei

Taipei Metro

Taipei Metro operates the entire rail network in Taipei, which includes heavy rail and fully automated medium capacity rail. Strategic goals and objectives are part of the foundation of Taipei Metro. The financial and customer satisfaction success has been based upon a history of extremely reliable and efficient service.

Over the course of the study team's visit, Taipei Metro presented three separate performance management systems used to achieve their objectives: (a) responsibility centers, (b) quality management, and (c) reliability growth program.

Responsibility Centers

Taipei Metro's responsibility center system is a management tool for motivating employees to work collectively to reach the company's goals and objectives for the year. The organization is divided into different responsibility units, and each unit is assigned specific targets. Each unit is then evaluated and assigned a score based on its actual performance against the set targets each year. The motivating driver is financial. When the company earns a profit, its employees are rewarded with bonuses, and the bonuses are allocated across the responsibility units based on the scores earned by each unit. The intent

is for the unit to work as a team to reach the performance goals.

The initial step to developing the key performance indicators is to identify the company's business strategies and strategic objectives, so that each unit will understand what needs to be achieved to successfully execute the strategies. These strategies and objectives are identified in the annual business plan.

For 2009, Taipei Metro established six business strategies, as follows:

- Enhance customer service,
- Strengthen safety management,
- Fortify internal management,
- Improve transfer service,
- Develop diversified management, and
- Reinforce human resource development.

For each of these business strategies, Taipei Metro has developed individual objectives.

Enhance Customer Service:

- Enhance service quality,
- Enhance service attitude and efficiency,
- Provide high-quality metro environment, and
- Promote quality of life and improve community care.

Strengthen Safety Management:

- Reduce accident rate,
- Increase availability rate and system reliability,
- Improve equipment reliability,
- Enhance safety precautions, and
- Improve crisis management abilities.

Fortify Internal Management:

- Accelerate application of info-tech,
- Strengthen internal management system, and
- Improve employee productivity.

Improve Transfer Service:

- Increase customers' willingness to transfer,
- Establish comprehensive transfer service, and
- Expand operational scope.

Develop Diversified Management:

- Provide diverse socio-economic environment,
- Strengthen budget control,
- Expand reinvestment and affiliated business,
- Review important expenditures, and
- Provide Metro consulting service.

Reinforce Human Resource Development:

- Enhance employee satisfaction,
- Timely hiring and training of employees,
- Increase core professional ability, and
- Enlarge international exchange and learning programs.

Based on these business strategies, performance objectives are developed for each responsibility unit. All the performance indicators are developed in conjunction with each other, and are aligned with the company's strategic plan. Everyone then works collaboratively toward the objectives. Taipei Metro management believes teamwork is the key to successfully achieving the objectives. The financial reward is very attractive, with the bonuses being quite substantial (in some cases equalling 4 months of salary); this creates peer pressure to meet the targets.

Reliability Management System

One of Taipei Metro's top goals is "to be one of the best metros in the world." The staff takes this mission very seriously and has developed comprehensive performance metrics to measure performance. In order to achieve this goal, the company uses a performance system based on the four points of their quality policy, namely

- Safe,
- Reliable,
- Comfortable, and
- Fast service.

Overall, Taipei Metro has 34 high-level quality objectives and 85 division-level objectives for the four quality goals.

For the safety objective, Taipei Metro uses metrics on:

- Deaths and major injuries,
- Minor injuries, and
- Incidences of crime.

For reliable service, Taipei Metro's metrics involve trains and customer equipment, including

- Train reliability (train car-kilometers between delays of more than 5 min),
- Cars available for peak hour service,
- Train punctuality,
- Elevator reliability,

- Escalator reliability,
- Ticket vending machine reliability, and
- Gate, token, and easy card reliability.

To measure customer comfort, Taipei metro relies on five performance metrics:

- Train interior cleanliness,
- Train exterior cleanliness,
- Station cleanliness,
- Temperature and ventilation of its trains and stations, and
- Jerk rate (rate of change of acceleration) on the train.

For fast service, the following four metrics are used:

- Train service delivery,
- Peak hour headways,
- Off-peak headways, and
- Passenger inquiry response time.

Taipei Metro staff believes it is important to set realistic targets. Therefore, targets are based on the previous year's performance. Understanding that improvement is important, challenge values are also set for each performance measure. These challenge values are set based on the previous year's third-best-performance month.

Taipei Metro uses a variety of sources of data for the performance metric system. For train reliability and equipment performance, data are collected automatically from a variety of computer systems, including the central train control and the electronic fare machines. These data systems are validated monthly in accordance with the internal ISO 9000 audit process. Each month a project audit is performed on all equipment and systems, including the rolling stock, escalators, and station broadcast and radio systems. The results of the audit are reviewed by the quality assurance section and are presented at the bimonthly quality management system control meeting.

Every 2 months, directors from all the divisions and the vice president of Taipei Metro meet to review the performance of the quality objectives. Based on the review, any necessary corrective and preventive actions are identified and implemented, and recommendations for improvement are developed. The team also reviews customer feedback and the results of the project audit.

System Reliability Growth

Taipei Metro's commitment to reliable and fast service is evident in the company's system reliability growth program. This program was established by the president of Taipei Metro to ensure that system delays are minimized and that trains run on schedule and run as efficiently as possible.

The system reliability growth program was started in 2003 after a series of significant delay-causing incidents. In that year, Taipei Metro had a total of 83 incidents resulting in delays of more than 5 min, including six major incidents causing delays up to 1 hr. The program was designed to focus on the customers' highest concern—namely, reducing the number of train delay incidents in order to increase system reliability and service quality.

The program's objective is to reduce the occurrence of train delays of more than 5 min. In order to achieve this goal, every delay-causing incident is reviewed by an investigation team, consisting of the operations, safety, and maintenance departments. The review team conducts an "improvement and correction process" that investigates the direct or indirect cause of the delay. All factors are investigated, including human error, lack of preventive maintenance, and procedural errors. The team determines if the delay is an isolated case or a systematic problem and presents the findings at the weekly operation reliability review meeting.

At the weekly meeting, there is a review of weekly operations, including reports on individual incidents, as well as the status of ongoing improvement measures by each division. As evidence of the high priority placed on reducing delays, the president of Taipei Metro chairs these weekly meetings.

The program has been very successful. Taipei Metro has not only been able to significantly reduce delays, but has also increased the number of kilometers between incidents to 2,910 in 2009, up from 615 in 2003. Taipei Metro has also been rated the most reliable metro system among 26 CoMET and Nova consortiums[6] for 4 years running.

Taipei Metro staff attributed a number of factors to the success of the program. These include a firm determination and support by top management, a clear and simple stated goal, the continuing and effec-

[6] CoMET and Nova are transit international benchmarking consortiums. CoMET includes the world's large urban rail operators, and CoMET consists of medium sized urban rail operators. Taipei Metro is a member of Nova.

tive weekly review meeting, and a special award system for reliability target accomplishment.

In meetings with the team members, Taipei Metro President Dr. Huel-sheng Tsay said that the company places such a high emphasis on reliability because "reliability is the best indicator of quality." He pointed out that "reliability is a combination of good maintenance, good customer service, and safety" and that "reliability relates to profit."

During their visit with Taipei Metro, it was obvious that employees have bought into this performance management process and are working together to meet Taipei Metro's goal of providing the most reliable and efficient system in the world.

Taipei Metro's operational strategy is to expand relationships with customers, strengthen safety management, and strengthen internal management, while expanding transportation services, developing diverse businesses, and growing manpower assets. The internal supervisory mechanisms they use to control this are

- Strategic management—responsibility center achievement assessment;
- Daily ISO management—an internal control system to ensure compliance;
- Project management—stepwise assignment units and interdepartmental organization committees;
- Employee-motivated improvement—proposal system, quality control circle activities, and self-motivated research; and
- High-level diagnosis—management meetings and high level meetings.

All of the above are overseen by operational achievement assessments, governmental management plans, ISO investigation and certification, and operational maintenance and safety assessments.

Taipei Bus System

The Taipei bus system has nine measureable objectives:

- To achieve and monitor daily bus pre-planned and scheduled trips (number of buses available for service, percentage of daily buses, service levels by route, reduction in accidents, and the implementation of a bus capital overhaul program);
- To implement a bus ticketing system;
- To develop standard operating practices for bus operations;
- To fully satisfy operations quality standards (number of internal audits from divisions; percentage of summonses);
- To achieve the budgeted revenue (budget versus actual and a shortage-recovery plan);
- To maintain operating costs within budgets (actual versus budget and fuel consumption efficiency rate);
- To provide safe and efficient bus services to the public (customer satisfaction index, number of fatalities, cleanliness, and reduction of driver's misconduct);
- To retain quality, skilled employees (percentage of staff recruitment filled positions based on budget); and
- To develop skilled employees (staff training requirements, satisfactory completion of the division's periodic performance management cycle in a timely manner, and percentage of variance of actual training man-days versus target by division).

QUALITY CONTROL

The study team defined *quality control* as the extent to which organizations ensure the data they are collecting accurately reflects what it is supposed to measure. It also reflects the extent to which there is a system of checks and balances to ensure data integrity. It is about ensuring that the data being collected is accurate.

Hong Kong

Performance measurement data for KMB comes from mostly automated systems. Manual logs or forms exist but are rare and are quickly being replaced with direct input systems (using personal data assistants, or PDAs, for example) and automated direct measures (such as the automated fueling system). KMB staff did not report the accuracy statistics or detailed quality control procedures for automated data collection systems; however, their data collection systems appear to be quite advanced and mature. For example, the Octopus contactless fare payment system has been in place for several years and provides a stable source of ridership and fare information.

The strongest form of quality control for KMB comes from external sources. As a publicly traded company, KMB is subject to scrutiny from shareholders and the stock exchange. As a regulated franchisee, KMB is subject to inspection and audit by the Transport Department of Hong Kong. As an ISO 9001 and ISP 14001 certified company, KMB is subject to annual certification audits of its quality and environmental management systems.

KMB submits an annual report on performance to the Transport Department. The Transport Department audits and analyzes the report, conducts site observations, and conducts its own surveys. The Transport Department directly surveys customer satisfaction and vehicle condition. Each year, approximately 80 of KMB's buses are randomly pulled out of service for an unannounced inspection by the Transport Department. Since the consequences of providing erroneous information are high—the potential loss of the franchise—KMB has a big incentive to ensure that its performance information is accurate.

MTR

When asked about procedures for auditing and verifying performance information, MTR executives reported that they had multiple external auditing and verification requirements. Because MTR is listed on the Hong Kong stock exchange and the FTSE Sustainability Index, it's financial and sustainability results are subject to verification. In addition, MTR maintains ISO management systems, which require internal auditing of quality and environmental practices. The Hong Kong Transport Department verifies MTR's performance information and conducts its own customer satisfaction surveys.

The nagging issues of data accuracy and validation that plague many U.S. transit agencies, whether for passenger counting, reliability reporting, vehicle maintenance tracking, or costs, are not evident with MTR. This is probably due to MTR's level of investment in its automated measurement systems and databases and the maturity of its integrated management system. MTR began to adopt ISO standards in the early 1990s. It created its integrated management system in the mid 1990s and added the balanced scorecard in the late 1990s. The current structure of its management system is now over 10 years old—sufficient time to refine measures and data sources. MTR has built upon and refined its management system over the past 20 years. In contrast, many U.S. agencies have cycled through multiple, conflicting systems in that time.

Singapore

LTA owns and controls the EZ Link contactless payment system, which provides the regulator with direct access to information on ridership, trainload, and revenue. LTA and PTC perform regular independent audits of SMRT's performance. For example, PTC performs monthly random field audits of system condition and performance, yearly process audits, and triennial system audits. LTA performs an independent customer satisfaction survey of all transit operators in Singapore. On-time reliability information is extracted directly from the automated train control system.

Data from the electronic fare system is validated with passenger surveys. New services or schedules are modeled with a software program, implemented, measured, and compared with model projections. SMRT reports its performance to the public and is subject to audit by LTA, PTC, and the stock exchange. Station managers review system performance weekly, and senior management reviews performance information monthly.

Kuala Lumpur

Rapid KL recognizes that it needs to improve the amount and quality of performance information it supplies to management. The integrated ticket mechanism was implemented in 2009, and projects to automate bus reliability reporting are currently being planned. The Malaysian government does not have a program of verifying or auditing performance information, nor is there a program of independent assessment of service quality. Rapid KL does conduct customer surveys and reports results through the balanced scorecard system.

Taipei

Quality control of performance measures is achieved through a combination of external audits, internal audits and reviews, coordinator verification

of data, and reviews by the quality assurance section. As indicated in Figure 4, the Taipei city government monitors and evaluates safety and maintenance performance. Since departments and employees receive significant performance bonuses based on information in the performance measurement system, Taipei Metro has established several levels of review and verification of performance information. Departmental coordinators verify data as it is submitted to the performance information database. Annual performance reports submitted by departments are reviewed by a performance management committee. An internal audit of measures is performed as part of the ISO 9001 quality management system. A monthly process audit of individual systems is also performed.

The experience of improving train reliability showed how Taipei Metro systematically improved its performance information system while working to

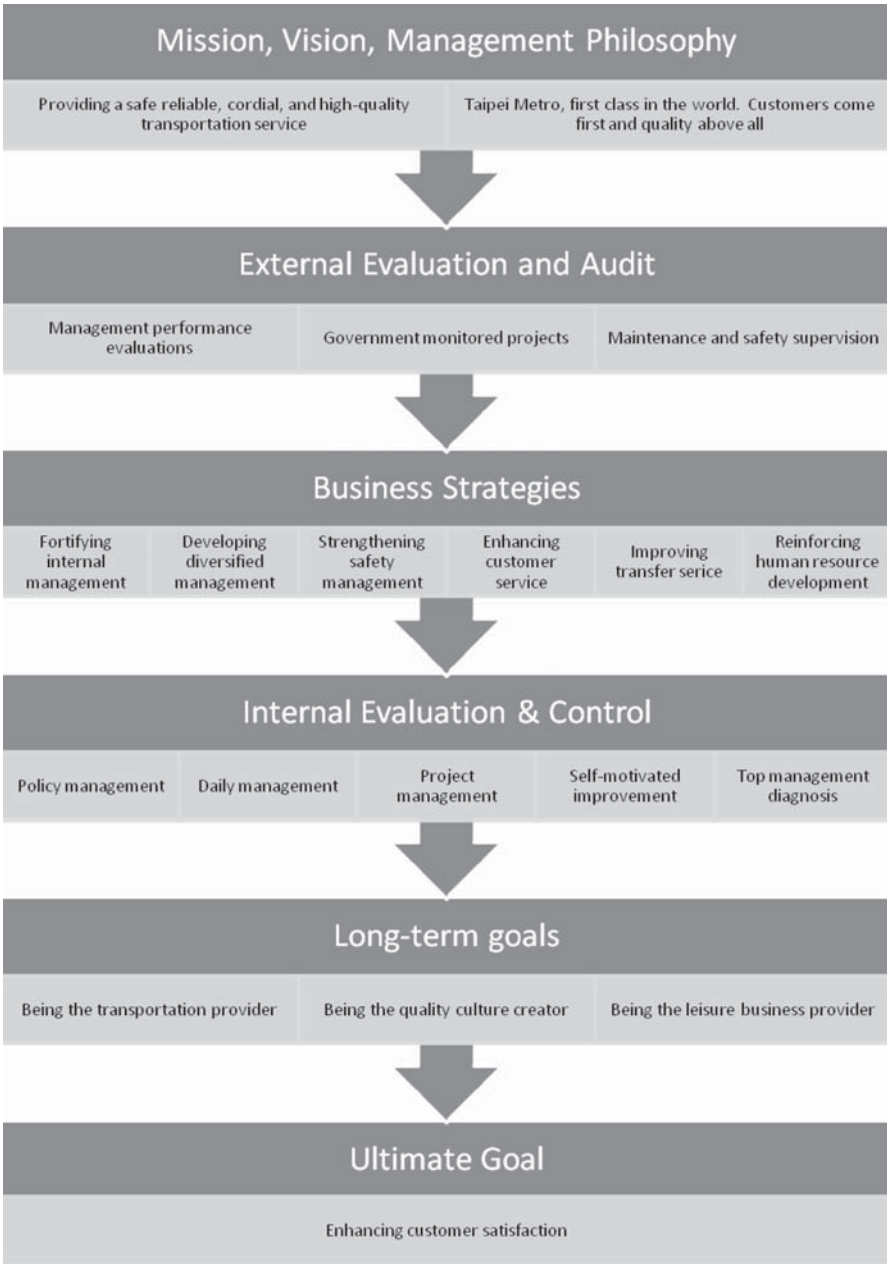

Figure 4 Top-level elements of Taipei Metro's performance management system.

improve service quality. In the beginning, several data elements were missing or inaccurate. For example, many train delays were falsely attributed to operator errors because the system could not distinguish vehicle faults from operator errors. In response, the operations management installed additional vehicle sensors to record all operator control inputs. Taipei Metro management was then able to identify and correct vehicle failures that had been previously obscured.

REPORTING STRUCTURE

Hong Kong

MTR

MTR produces an interim report, annual report, and summary report every year. These reports illustrate the fiscal health, organizational direction, and independent auditor's input. The interim report gives a snapshot. The annual report delves into 10-year data comparisons, human resources, remuneration, and reports from top management. MTR's quarterly "Performance Achievements" is a point of pride and is easily accessible online. A quick glance at the 2008 fourth quarter shows MTR actually exceeded expectations in areas such as train service delivery, passenger journey on-time performance, train punctuality, ticket machine reliability, and escalator reliability, all of which scored over 99%. Internally, there are communications from "top [management] to shop [floor]" and vice versa, all captured by scorecards for the division, department, and section.

Bus licensees compile data and submit it to the Transport Department annually, or more frequently as they see fit. An example of this is with the reporting of average number of bus defects found during spot checks by the Transport Department. Through annual spot checks, government regulators sample 2% of the entire fleet per week. All modes report on ridership and headways. Measurements are accessible on the MTR website, as well as in its annual corporate prospectus. Internally, each head of department sends monthly reports to the board of directors. Bus cleanliness reporting is based on direct complaints lodged, and that is recorded and reported by the marketing and planning groups that study issues concerning ridership.

The well-polished corporate image of these bus companies is publicized through awards that recognize their user friendliness, environmental stewardship, and even quality and popularity of their website. Achievements are reported through the company website and in company literature, as is the achievement of ISO certification in business processes.

KMB

KMB uses a software program to collect and analyze data for measuring continuous improvement. Management is responsible for reviewing the data on a monthly basis and holds monthly performance management meetings to discuss data trends and areas for possible course correction.

KMB then provides its stakeholders with extensive annual reports that show trends in operational indicators. Some of the common operational statistical information includes the following:

- Total number of passengers carried for the year (ridership),
- Total number of bus routes operated at the end of the year,
- Fleet size,
- Bus kilometers operated for the year,
- Total fleet capacity at the end of the year,
- Fleet age,
- Achievement of schedule (on-time performance),
- Average percentage of lost trips,
- Average fleet utilization for the year,
- Operational capability—percentage of actual number of bus departures compared with scheduled number of bus departures during peak hours,
- Average number of bus defects per vehicle for the year,
- Mechanical reliability,
- Average number of bus accidents (per million vehicle-kilometers),
- Total service rationalization items for the year (frequency reductions, vehicle reductions, and route reorganization),
- Total service improvement items for the year,
- Average number of customer complaints per million passenger trips,
- Total passenger liaison program (passenger attitude services and user group meetings attendance), and
- Bus shelter construction (number of bus shelters available at the end of the year).

Other operational performance statistics include revenues, operating cost, profits, and fixed asset reports.

Other avenues for reporting performance include the KMB website (www.kmb.hk). The website provides customers, stakeholders, and employees with vast amounts of information regarding KMB performance, as well as other corporate information.

Hong Kong Transport Department

There are two primary performance reporting structures in place within the Transport Department. First, the department holds performance meetings with the service providers/franchises to discuss the performance indicators in detail. The meetings identify achievements, as well as shortfalls, and identify root causes for performance measures; a discussion on continuous improvement is also held. As part of the license agreement, the Transport Department establishes a set of performance indicators for the franchise companies to report and follow. The performance management system in place ensures that all service providers are delivering service according to expectations. There are several categories that are used to report performance, including reliability (bus availability, lost trips), efficiency (bus utilization), safety, cleanliness, environmental friendliness, and user friendliness (customer complaints, passenger liaison meetings, passenger information at bus terminus, and passenger information at stops).

Second, the Transport Department has the responsibility to provide information to the general public regarding the status of strategic initiatives outlined in the sustainability plans. Data are collected frequently to assess strategy effectiveness and to determine future decisions regarding strategic initiatives. The Transport Department uses several avenues to disseminate information. The Transport Department has several publications that outline progress of initiatives. One such publication is *Hong Kong Transport 40 Years,*[7] which outlines a timeline of transport history and sustainable planning efforts. The second significant publication is titled *A Transport Strategy for the Future: Hong Kong Moving Ahead,*[8] which highlights the strategic plan that has been laid out by the Transport Department.

In addition, the Transport Department also has a website (www.td.gov.hk) that has a wealth of information for the general public.

MTR

MTR has very sophisticated mechanisms (technology) to report system performance. One of the more significant strategic management performance systems is the balanced scorecard reporting system.

The balanced scorecard was originally used at MTR as a test model in the company's engineering department because of the readily available data used for inputs. MTR executive management was very pleased at the results and intrigued with the possibility of using the balanced scorecard approach for elevating performance and continuous improvement; in 1999, the balanced scorecard was adopted throughout MTR.

The MTR balanced scorecard incorporates the traditional business perspectives, including the financial, customer, and internal process perspectives. In addition, MTR decided to name their human capital perspective "efficiency," incorporating human resource principles. The efficiency perspective includes objectives such as: competent staff, optimized manpower, and efficient organization. Because MTR is a vital public transportation element in Hong Kong, the company also decided to include a safety perspective, with the goal of elevating the safety commitments to the public.

MTR uses the principles of the balanced scorecard to develop its annual reports, announce performance objectives and measurements on its website (www.mtr.com/hk), and communicate the scorecard results to its own staff. In addition, the balanced scorecard has been extended to the desktop level, so that employees understand their contribution to performance management.

MTR continues its quest for excellence by participating in benchmarking groups such as CoMET and Nova.

Singapore

In Singapore, SMRT uses a more formal (and less public) mechanism for reporting performance, consisting of a set of monthly meetings held separately for three main areas of reporting: general perfor-

[7] *Hong Kong Transport 40 Years* is available at www.td.gov.hk/filemanager/en/publication/td-booklet-final-251108.pdf.

[8] *A Transport Strategy for the Future: Hong Kong Moving Ahead* is available at www.thb.gov.hk/eng/psp/publications/transport/publications/hk_move_ahead_txt.htm.

mance, financial performance, and operations performance. A monthly report for each of the three areas is then submitted to LTA, the regulator, with the required detailed performance statistics.

On a quarterly basis, the aggregated information on SMRT's operating and financial performance is published and distributed to the shareholders. SMRT also reports all of the performance measures in a year-end report to shareholders. Since the government of Singapore is the majority shareholder in SMRT, this report is also functionally a report to the government. SMRT is careful to represent the data accurately, but also to present its performance in the best light, highlighting important system performance trends over the past 5 years and giving particular emphasis to major accomplishments.

On the bus side, PTC has quality-of-service standards, which comprise six main factors: operations reliability, passenger loading, safety, service information, service availability, and service integration (span of service). These standards are required reporting items as part of the operator's route authority. Two items, headway adherence and average loading, are reported daily.

LTA demonstrates various ways of communicating success surrounding the three strategic thrusts. Because its master plan is a people-centered plan, LTA realizes the importance of keeping the public informed of the progress toward its goals. The master plan is posted on the Internet (www.lta.gov.sg/ltmp/LTMP.html). The LTA website (www.lta.gov) also provides a lot of information regarding performance in relation to its strategic initiatives. In addition, there is a quarterly newsletter, called *Connect,* that informs the public about initiatives and conveys other messages from LTA. LTA's annual report discusses yearly progress, financial information, and investments.

The Public Transportation Council is responsible for delivering performance measures on bus service. The PTC also publishes annual reports to demonstrate the performance of the bus service providers in Singapore.

SMRT reports a set of agreed-upon rail performance measures to PTC, including the following:

- Train arrivals (within 2 min of schedule),
- Train departures (96% within 2 min of schedule),
- Train service availability (at least 96%),
- General ticketing machine (downtime no more than 500 hours),
- Fare gate (downtime no more than 500 hours per 10,000 hours of operation),
- Escalator (downtime no more than 100 hours per 10,000 hours of operation),
- Lift (no more than 200 hours per 10,000 hours of operation), and
- Customer injury rate (no more than 0.4 injuries per million customers).

In addition, PTC also requires SMRT to publish performance standards regarding reliability, loading, safety, availability, and information/communication. If performance measures are not adhered to, PTC has the authority to impose fines on SMRT.

Kuala Lumpur

RapidKL compiles performance statistics for a variety of purposes. The most important is internal management. Service punctuality (on-time performance), a measurement of actual minutes of delay per train, is reported as an annual average in promotional materials, by line. Service reliability (expressed as a percentage) is also reported annually. Service frequency is reported as average headway for each of the weekday key time periods (such as morning peak and midday).

Safety and operating statistics specified as part of the 21 key performance indicators are reported quarterly to the board of directors and to the government for compliance purposes. RapidKL is currently in the process improving the data flow so that monthly reports can be developed for both internal monitoring and external reporting. To comply with its operating agreement with Prasarana, RapidKL must report these key indicators, and the indicators must meet the previously agreed-upon targets.

On the bus side, ridership and route productivity statistics are used internally to make bus route rationalization determinations. These statistics are currently also reported annually. Bus ridership has seen tremendous growth from 2006 to 2008—reaching 400,000/day, up from 130,000—as a result of fare initiatives and route restructuring. However, transit mode share continues to remain relatively low at 19% of all metropolitan area trips. Because of ongoing restructuring and investment, the number of buses in the active fleet and the number of bus routes are seen as important measures of progress and are reported annually.

Taipei

The Taipei city government's Department of Rapid Transit Systems staff compile most of their own performance data.

For the most part, Taipei Metro's performance measures are reported by the operating divisions. To ensure accuracy, electronic data systems are used to validate manually entered data, and the results are subject to audit by the divisional management, the senior management's internal audit office, and the industrial safety division, as well as municipal and national regulators. For data that can be automatically collected (predominantly automated fare collection and automatic train control systems), the electronic data system is used.

At Taipei Metro, a proactive approach is taken for quality and reliability management. Corrective actions related to declining performance indicators or conditions that may cause a decline in performance in the future are taken at many levels. For the manually collected data, the data collection process is itself an opportunity to take corrective action—the data collection is part of the quality management process. Automatically collected data (such as schedule performance) is monitored in real time through video feeds from more than 5,000 cameras throughout the system. This enables "rapid response teams" to be immediately dispatched to problem locations to address any incidents or possible delays in service.

The next level of review is a working group that meets periodically to address performance issues. For production-oriented measures, this is part of the quality management system process, and meetings are held monthly. For operations reliability, a special meeting is held weekly (on Friday mornings) to review all incidents for causes, direct and indirect, controllable and uncontrollable. This search for root cause, together with learning from after-the-fact incident analysis, has enabled Taipei to substantially reduce delay-causing incidents.

For the required regulatory reporting of the 21 key performance indicators, Taipei Metro meets monthly with the Taipei mayor's staff to go over the report and discern any apparent trends. Follow-up action items from the previous meetings are also discussed.

At the highest level, the quality management system staff hosts a bimonthly control meeting with directors from all divisions to review the status of corrective and preventive actions, customer feedback, and results of audits. At the same time, recommendations for improvements and other issues are discussed. Each director leaves the meeting with action items and targets for his/her own division in terms of what they can contribute to improving the overall system performance. If the present indicator is below goal, the difference is apportioned out and distributed among all responsible divisions. This gives each division a quantitative sense of ownership of the problem.

Because Taipei Metro is a quasi-private company, performance data (both financial and operating) are issued at the end of the year to shareholders. These annual reports are typically compilation of data from throughout the year.

Taipei Metro's quality management system promotes the efforts of service quality in accordance with ISO 9001:2008 standards. The quality management system is reviewed annually, with the company president serving as chair of the review meetings. Directors of all the different business units are required to attend the meeting. The quality performance indicators are reviewed and discussed, and any course correction needed is identified at this meeting. In addition, the passenger satisfaction survey is discussed. Quality indicators and regulatory measures are defined. Quality management system data are collected, audited, and then reported. Bimonthly meetings are held to discuss the data.

COURSE CORRECTION

This section describes the motivating factors for making course corrections, how the various agencies carry out course corrections, and the keys to successfully using performance information to make course corrections. The transit operators and regulatory agencies visited during the mission provided the following four reasons for using performance information to make course corrections:

- License and regulatory requirements,
- Attainment of agency goals,
- International standards and benchmarks, and
- Customer input.

License and Regulatory Requirements

Performance standards that were part of franchise license agreements and other regulatory requirements

were the most common reasons mentioned for course corrections. In Singapore, the Ministry of Transport regulates public transit services through two bodies: LTA and PTC. Together, these two agencies allocate license and operating agreements that allow private companies to run transit services. The license agreements set standards for operations, maintenance, safety, asset replacement, grants, and insurance through specified operating performance standards and require a safety and management system.

Currently, SMRT is licensed to operate bus, rail, taxi, and other public-transport services. To fulfill the license and operating agreement, SMRT submits monthly performance reports. LTA also conducts random spot and field audits. To meet service standards, SMRT reviews data weekly to determine if service adjustments are needed. SMRT staff said that they altered service four times in 2008. By analyzing trend data, SMRT can also adjust service to accommodate seasonal peaks or decreases. Given that service reliability standards are set in the license agreement, SMRT adjusts its maintenance management practices to avoid breakdowns and subsequent delays. If standards are not met, LTA and PTC will impose fines. For example, just before the study team's visit, SMRT was charged a fine for a 7-hour service disruption. Operators can provide an explanation for the low performance, which is reviewed by LTA and PTC, and can appeal to the Minister of Transport.

As part of its franchise agreement with the Hong Kong Transport Department, bus operator KMB must meet performance standards in six areas: reliability, efficiency, safety, cleanliness, environmental friendliness, and user friendliness. The Transport Department holds regular meetings with operators to review data, identify causes of low performance, and jointly establish corrective actions. KMB documents adherence to these standards in its annual report. To create an incentive to implement course corrections, bus captains (drivers) receive a monthly bonus related to safety performance and customer complaints. In addition, the performance appraisals for each of the senior directors consider KMB performance statistics. KMB is also subject to random audits, as documented in the performance measure "annual number of bus defects found during spot checks by the Transport Department."

For the nonlicensed transit services in Hong Kong, including MTR, the Transport Department provides oversight through the administration of the Road Traffic Ordinance, legislation for monitoring traffic flow and public transit operations, and legislation on vehicle safety requirements. To enforce these regulations, the Transport Department inspects vehicles for roadworthiness, issues speeding tickets, and prosecutes drivers of vehicles that have been cited for safety defects. The Transport Department also requires private transit providers to submit performance reports. On a monthly basis, the Transport Department publishes data on ridership, service miles, fleet size, and carrying capacity. The Transport Department also monitors accident data on a monthly basis. In response to accident data, the Transport Department may revise legislation, increase police enforcement of laws, adjust road designs, create educational programs, and/or initiate publicity campaigns.

The Transport Department's safety initiative is an example of how the regulatory agency implements course corrections. In response to high accident rates, the Transport Department developed a safety awareness campaign, with a goal of zero accidents (Figure 5).

The Transport Department credits its efforts, along with those of the transportation providers, with a 50% decrease in transportation deaths and a 40% decrease in serious injury accidents over the past 40 years. In other words, even if a transit provider does not have a franchise agreement, the oversight and guidance of the Transport Department is still relevant. One can conclude that agencies are making adjustments to ensure adherence to the transportation regulations established by the Transport Department.

Attainment of Agency Goals

The majority of agencies visited also stated that a key motivation for course correction was to make progress toward their strategic goals. One of the best examples of a strategy-based management structure was that of Taipei Metro (Figure 6).

Figure 5 Hong Kong Transport Department's logo to accompany its goal of "Zero Accidents on the Road."

Figure 6 Taipei strategic framework.

As illustrated in Figure 6, Taipei Metro has developed a mission, a vision, six strategic goals, and related objectives. Together these elements provide the strategic direction for Taipei Metro. Every year, each department develops its own performance measures for tracking their contribution to the agency's achievement of each objective and goal. Department-specific performance measures are guided by organizationwide measures. In addition, the Taipei government requires Taipei Metro to report on specific measures, and those are incorporated into each department's measures as appropriate. A committee reviews each department's measures, and the company president then gives final approval. Taipei Metro's mission and vision set the long-term direction for Taipei Metro and, as such, are not frequently changed. The strategic goals are also rarely adjusted. The strategic objectives and performance measures, on the other hand, change annually to reflect current business focus.

Every Friday morning, members of Taipei Metro's senior management team meet with the company president to review performance information. The meeting typically focuses on the number of incidents, the cause of each incident (malfunction, human error, procedure failure, maintenance, external, etc.), and the corrective action to be implemented. When Taipei Metro first began tracking performance information, establishing the cause of an incident was very controversial. As a result, tracking and surveillance equipment (more than 5,000 digital cameras in 70 stations) was set up as a tool for solving disputes. Now after each incident, all involved departments (e.g., operations, safety, and maintenance) document their assessment of the incident and then meet to discuss and establish responsibility for each incident prior to each week's Friday meeting with the president. If the incident appears to be a systemic problem, then a management alert is released. By linking a performance measure to agency goals, analyzing the data, and identifying corrective actions, Taipei Metro has seen notable improvement in the number of car-kilometers between every delay of more than 5 min (Figure 7). In addition, each employee can receive a bonus based on their department's performance. Taipei Metro's senior management views the bonus as a key motivator for employees to identify course corrective action throughout the year.

MTR (Hong Kong) is another agency that effectively makes course corrections based on agency goals and performance information. Every year, MTR holds a strategic planning workshop to establish goals, identify key business issues, determine its strategic direction, set performance targets, estimate budgetary needs, and outline an action plan. The outcome of these annual workshops is documented in MTR's customer service pledge. Progress is tracked through an integrated management system, which is an internal online performance system for managers. The reliability of service, availability of service, incident response time, and incident recovery time are all

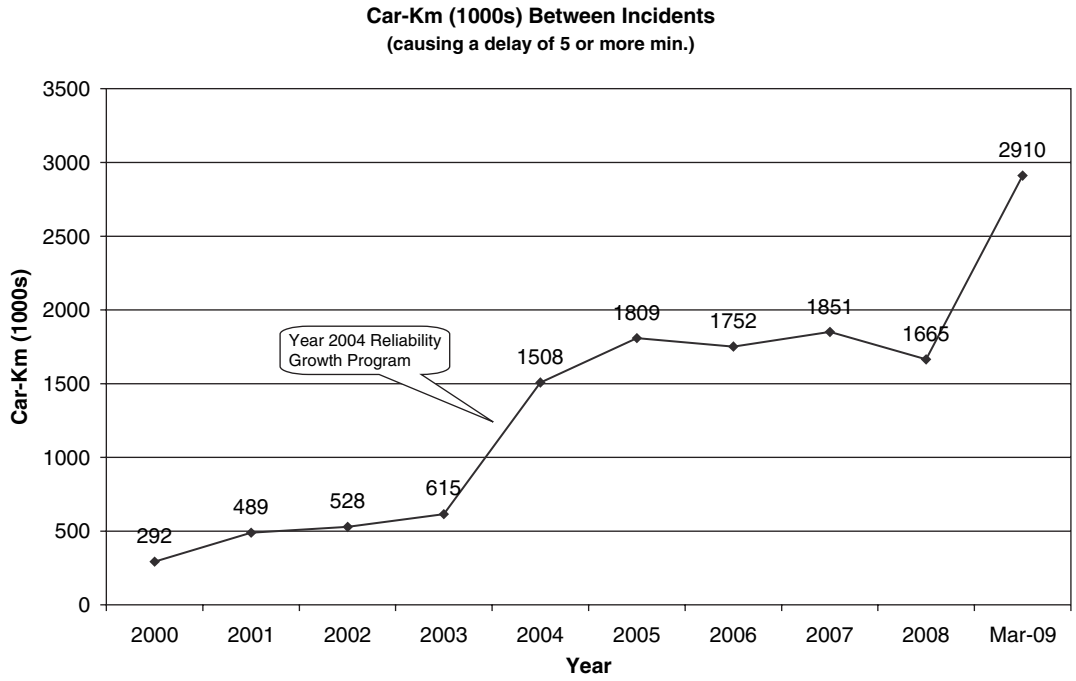

Figure 7 Trend data for Taipei Metro reliability measure.

tracked by system performance standards, while the customer service pledge outlines 18 customer-oriented measures. High-level targets are broken down into operational targets for each department. The division directors meet monthly to discuss performance information and evaluate progress toward the strategic goals. For example, the causes of service delays (rolling stock, track, signal, power) are analyzed to pinpoint the source and identify a remedy. MTR takes some elements of the integrated management system and produces a quarterly performance report that is distributed publicly at all MTR stations.

In some agencies, the connection between course corrections and strategic goals was not as clear. For example, just prior to the ITSP study mission, RapidKL had established strategic goals, objectives, performance measures, and targets with the assistance of a consulting firm. Their vision, "to provide an integrated, safe, reliable, efficient public transport service in the Klang Valley on a financially sustainable basis," is now posted on RapidKL's website. RapidKL has mainly been collecting performance information to meet provisions in their 10-year license to operate two light rail lines and bus services that account for 70% of total ridership in Kuala Lumpur. As part of the license agreement, RapidKL must submit a quarterly report that demonstrates to the government that they are meeting the performance targets set for 21 measures. However, during our visit, RapidKL staff stated that the performance targets were conservative and not difficult to meet. Historically, performance data were collected and analyzed mainly to support getting the buses out on the street. RapidKL would analyze data on bus ridership, mode share, fleet size, and number of routes to make bus route determinations. More recently, RapidKL has also begun to use performance data to manage assets. They have developed a computerized maintenance management system, which records data pertaining to repairs and maintenance work. The data are used to set maintenance schedules. RapidKL is considering tracking performance measures on a monthly basis, tying salary to performance, and eventually adjusting operating budgets based on monthly performance reports. Staff appeared enthusiastic about the concept but concerned about the time required to successfully track and use performance information to meet strategic goals and objectives.

The regulatory agencies visited during the mission also presented their strategic plans as motivations for transit operators to make course corrections. LTA in Singapore had recently released its *Land Transport Masterplan,*[9] which established a vision of

[9]http://app.lta.gov.sg/ltmp/index.asp

a more people-centered land transportation system that will meet the diverse needs of an inclusive, livable, and vibrant global city. The plan established three strategic goals: making public transport a choice mode, managing road usage, and meeting the diverse needs of the people. LTA also outlined several steps to accomplish each goal. For example, to achieve the goal of making public transit a choice mode, LTA will become the central bus network planner, buses will receive priority on roads, the rail transit system will be expanded, competition will be encouraged, and rider experience on public transit will be improved. The plan also included some performance targets, such as "increase public transit share from 56% to 70% by 2020." Although the master plan starts to establish a strategic direction for transportation in Singapore, there is little connection between the plan and the franchise performance requirements.

The Hong Kong Transport Department conducts comprehensive transport studies to establish the framework for the development of a "balanced transport strategy to facilitate the mobility of people and goods of Hong Kong in an environmentally sustainable manner."[10] The following seven goals were identified in the most recent study (1999–2016):

- Integrate land-use, transport, and environmental planning;
- Accord priority to railways;
- Coordinate and enhance public transport services;
- Provide transport infrastructure in a more timely fashion;
- Manage transport with new technologies;
- Give more emphasis to pedestrian needs; and
- Alleviate the environmental impact of transport to an acceptable level.

The Transport Department further refined Hong Kong's transportation focus through the strategic action plan, *Hong Kong Moving Ahead: A Transport Strategy for the Future.*[11] This document clarifies the strategic goals by outlining objectives and recommending strategies. For example, the goal of "according priority to railways" is further defined through the objective "railways will form the backbone of Hong Kong's transport system." To accomplish this objective, the Transport Department recommends several strategies, including locating future strategic developments along rail alignments, supplementing railway by feeder services using other public transport modes, increasing the number of park-and-ride facilities, and expanding the existing railway network. (HK$100 billion in railway expansions are planned.) The Transport Department has set a target that the share of public transit trips on rail should increase from 33% to between 40% and 50% by 2016. Although the *Moving Ahead* document clearly outlines strategies, there was no indication how the Transport Department was going to track progress of these strategies.

International Standards and Benchmarks

Several agencies visited during the mission proudly displayed ISO certifications. Originally developed for manufacturing, ISO standards are now applied to a wide range of industries, including transit. To receive ISO certification, an organization must adopt several management practices, including the following:

- Establishment of procedures for each key business process,
- Monitoring of processes to evaluate effectiveness,
- Data validation, and
- Inspection of outputs to assess quality and identify corrective actions where necessary.[12]

An external independent audit will confirm that formalized business processes in accordance to ISO guidelines are being applied.

KMB staff emphasized that they had received a corporatewide ISO 9001 certification for quality management systems and that several KMB depots had received ISO 14001 environmental management certification. To qualify for this certification, KMB must define, measure, and monitor performance criteria. For example, for each maintenance depot, KMB tracks mechanical reliability (average number of kilometers operated before a bus breakdown that requires passengers to be off-loaded). For service delivery, KMB tracks operational capability (percentage of actual bus departures versus scheduled bus departures). A KMB ISO steering commit-

[10] www.thb.gov.hk/eng/psp/publications/transport/studies/sts2.htm

[11] www.thb.gov.hk/eng/psp/publications/transport/publications/hk_move_ahead_txt.htm

[12] en.wikipedia.org/wiki/ISO_9001

tee meets to evaluate these and other measures to asses if any course correction actions are necessary. For example, in 2007 the number of accidents increased, so KMB formed a task force that met every 3 months to identify corrective actions. The annual budget was adjusted to provide additional resources to target the safety issues. KMB's Corporate Social Responsibility Charter states, "KMB applies and follows international standards to ensure that our activities are socially and environmentally responsible and that our performance meets authoritative global benchmarks. KMB is the only public bus company with both the ISO 9001 quality management system certification and ISO 14001 environmental management system certification." A clear motivation for course corrections was to stay in compliance with these ISO standards.

Another international benchmarking organization that was highlighted during the study mission was the Nova International Railway Benchmarking Group. Taipei Metro and SMRT are both members of Nova. "The number of car-kilometers between every 5-plus minute delay" is one of the 33 performance measures tracked by Nova. Taipei Metro has accomplished the best reliability record ever recorded in Nova's history—1.85 million car-km between two incidents. Clearly membership in Nova is a motivation for Taipei Metro to implement course corrections that prevent incidents from occurring.

Course Corrections—Customer Input

Several agencies noted that customer surveys were used to evaluate goals and performance and to identify when course corrections were necessary. For example, LTA annually conducts a customer satisfaction survey to evaluate the service standards set in the license agreements. The latest survey highlighted dissatisfaction with frequency of service, which ties directly to LTA's goal of "making public transport a choice mode." As a result, LTA will require transit providers to increase capacity by minimizing headways during peak period from 3 min to between 2 and 3 min and from 7 min to between 5 and 6 min during lunch periods.

MTR is another agency that conducts an annual customer survey to identify which improvements are most cost-effective. When MTR customers called for clean vehicles and less crowding, MTR quickly adjusted its cleaning schedules to improve the conditions of its vehicles, the easier of the two issues to address. In its quarterly performance report, MTR also highlighted improvements that had been made to platform circulation.

SMRT not only tracks customer inquiry response time, but also has set a target of 14 days to address customer issues. Tracking customer inquires not only enables SMRT to identify correction actions, but also allows them to identify adjustments to their customer service office staff and practices if necessary.

USING PERFORMANCE DATA TO REFINE STRATEGY

When asked how the transit operators and regulatory agencies made course corrections, none of the agencies said that they adjusted their targets. When asked if any target was lowered if performance indicators were not up to expectations, the general answer was "no, we just work harder."

From time to time, performance indicators are changed at the Hong Kong bus operator KMB. For example, a fleet reliability indicator was changed from "per number of trips" basis to a "per kilometer" basis to provide a more consistent measurement. In evaluation of performance, trend improvement from year to year is viewed as more important than measurement of absolute numbers or target achievement. According to senior operations management, this reflects an emphasis on continual quality improvement—targets are maintained as goals and their achievement pursued; however, it is considered more important that their performance indicator trends show improvement from year to year.

The MTR staff in Hong Kong reflected on the fact that they had to make their findings public to prove to their customers and the politicians that they are meeting their demands for more efficient services. Information gained from performance measurement is included in the annual report and in the sustainability report that shareholders receive annually.

SMRT officials in Singapore use data to make budgetary, policy, and personnel changes for future years. For example, because of reports on cleanliness, transit staff are now allowed to ticket riders who violate rules on drinking, smoking, and eating.

Because the performance measurement process at RapidKL is in its infancy, staff reported that they are still in the planning stage of developing a means for using data to alter policy and strategy.

At Taipei Metro, the quality management system plan is reviewed annually by a high-level committee. In addition, unit heads review data when determining annual budget requests.

Course corrections can also provide an opportunity to re-evaluate performance measures to make sure that the best measure is being used. RapidKL shared an example of this type of change: They began tracking bus driver performance based on "number of trips completed," with the intent that corrective action could be identified if a bus driver did not maintain the schedule. However, this led to some bus drivers rushing past stops, without picking up passengers, as a means of ensuring they met the daily trip quota. In response, RapidKL changed the performance measure to "revenue per day," which created an incentive for drivers to pick up more passengers. This example highlights the importance of bringing in qualitative elements into performance evaluation. Managing solely by numbers can result in nonfavorable outcomes.

There are many benefits to using performance information to identify course corrections. Simply stated, by tracking performance, an agency can identify and remedy a problem. For example, MTR uses performance-based management to clearly communicate business values, keep employees accountable, and provide the best service to its customers. Taipei Metro uses performance measurement to motivate staff to adjust their behavior throughout the year to sustain high levels of agency performance; the better their department performs, the higher their salary.

Based on the experience of the agencies visited during the ITSP study mission, the following characteristics support the effective use of performance information to guide course corrections:

- Link performance measures back to strategic goals and objectives,
- Have the support of senior management,
- Regularly schedule meetings to evaluate performance,
- Focus on a limited number of measures,
- Communicate the results internally and externally,
- Present course corrections in a motivational way, rather than in a punitive way, and
- Include qualitative narrative to accompany the metrics.

The data collected can be used to develop longer term strategies needed to improve the business. These changes can take place at the policy level or can be simple modifications to company goals, but in any case the desired result is continual improvement in overall organizational management processes.

From time to time, performance indicators are changed at KMB. For example, a fleet reliability indicator was changed from "per number of trips" basis to a "per kilometer" basis to provide a more consistent measurement. In evaluation of performance, trend improvement from year to year is viewed as more important than measurement of absolute numbers or target achievement. According to senior operations management, this reflects an emphasis on continual quality improvement—targets are maintained as goals and their achievement pursued; however, it is considered more important that their performance indicator trends show improvement from year to year.

CONCLUSION

Systems in all four cities visited appear to follow a common model: establish goals and objectives, develop strategies for meeting those objectives, define performance criteria and targets, measure progress, and develop inputs for future objectives. At all systems, customer satisfaction was at the top of the priorities. This objective is closely aligned with regulatory desires, as well as profitability.

Most of the systems integrated other standards such as ISO and benchmarking as a means to establish measures, but it was not always clear how these standards were integrated with internal strategies or those set by government regulators. In addition, most of the performance targets were set based on prior year performance rather than targets responding to specific goals and objectives. This would indicate that for most systems, continuous improvement, while somewhat vague, is a fundamental goal but not always clearly articulated in an organization's strategies.

APPENDIX A—STUDY MISSION TEAM MEMBERS

(Affiliations listed were current at the time of the study mission.)

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APPENDIX C—ABBREVIATIONS

AVM—add-value machine
CoMET—Community of Metros
CTS—comprehensive transport studies
EIS—executive information system
EMU—electrical multiple unit
IC—integrated circuit
ISO—International Organization for Standardization
KMB—Kowloon Motor Bus Co. (Hong Kong)
LRT—light rail transit
LTA—Land Transport Authority (Singapore)
MRT—Mass Rapid Transit system (Singapore)
MTR—MTR Corp. (Hong Kong)
PDA—personal digital assistant
PTC—Public Transport Council (Singapore)
SMRT—SMRT Corporation (Singapore)
TCPTO—Taipei City Public Transportation Office
TRTC—Taipei Rapid Transit Corporation (Taipei Metro)

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