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Macau

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Overview

Macau has transformed itself over the past two decades from a manufacturing-based economy to one that is now dominated by the services sector. In particular, the liberalization of the gambling industry in 2002 has led to massive investments that have helped boost activity in numerous areas of the economy, particularly construction, the hotel sector and tourism.

Since it was returned to China from Portuguese administration in 1999, the Macau Special Administrative Region (SAR) has recovered from the Asian financial crisis and SARS, and is now one of the most vibrant economies in the world, with an average annual growth of 14.5 per cent recorded between 2001 and 2005. This growth is expected to continue over the next few years, as a number of high-profile projects are completed and foreign investment shows no signs of waning.

Macau is situated at the Pearl River Delta on the southeast coast of Mainland China, only 60 km southwest of Hong Kong. Home to 500,000 residents, Macau's roughly 28 sq km land mass consists of the Macao peninsula and the islands of Taipa and Coloane. The land area has actually been enlarged by more than 50 per cent since 1912 through land reclamation projects, which are continuing.

Prior to 2002, all of Macau's casinos were controlled by the STDM syndicate. In March 2002, the government awarded three new casino concessions, one to an STDM subsidiary and the other two to Wynn Resorts of Las Vegas and Galaxy Casino Company of Hong Kong, which has since given a sub-concession to the Venetian Group of Las Vegas. This in turn stimulated private investment of around USD 1.55 billion in various casino projects, hotel resorts and other tourist infrastructure, while

Population	508,473 (2006)
GDP per capita	USD 24,274 (2005)
Key economic sectors	Gaming, Tourism, Construction
Fixed telephone lines	174,400 (2005)
Mobile phone penetration	111 per cent (2005)
Internet subscribers	88,694 (2005)
Internet household penetration	66 per cent (2005)
Annual internet usage	79.2 million hours (2005)
Internet international bandwidth	1,125 Mbps (2004)

Source: *WTO Trade Policy Review*, Macau Government.

several billion dollars of investment are planned for between 2006 and 2010.

Today, Macau's services sector accounts for around 90 per cent of GDP, while manufacturing has fallen to just 4.3 per cent of GDP in 2005. Gaming and related tourism services constitute the core of the economy, with gross gaming receipts accounting for 49 per cent of GDP in 2005 and direct taxes on gaming providing 75 per cent of government revenue in 2006. Because of these revenues, the government can afford relatively low taxes, which also attracts private investment. Traditionally, governments in Macau have allowed the private sector to be the prime economic driver, including for information technology development.

Despite the success of the gaming sector and related tourism, the government has recognized that relying too heavily on any one industry can be a dangerous strategy—as demonstrated by the devastating effect of SARS on tourism in 2003. As a backup, it has started to undertake measures to encourage the diversification of the economy, such as incentive schemes for the industrial and commercial sectors that have not benefited from the growth in tourism and gaming. Initiatives include loan schemes for small and medium-sized enterprises (SMEs) and the construction of the Macau-Zhuhai Transborder Industrial Park, which aims to take advantage of the Closer Economic Partnership Agreement (CEPA) concessions signed in 2003 to access the Mainland Chinese market. Preference in the allocation of sites has been given to projects offering new technology, high value added, or similar benefits to Macau's industrial development.

The government is also looking at the promotion of Macau as a destination for meetings, incentives, conventions and exhibitions (MICE).

ICT infrastructure

Most telecommunication services in the past were provided under a monopoly concession by Companhia de Telecomunicacoes de Macao (CTM). That concession was revamped in 1999 in the lead up to partial liberalization of the telecom sector. Liberalization has been successful in broadening communications infrastructure, particularly mobile and Internet services, which were opened to competition in 2000 and 2002, respectively.

CTM still has a monopoly concession over local fixed and international services and leased lines until 2011. The company is a private joint venture and its shareholders are Cable and Wireless (51 per cent), the Portugal Telecom Group (28 per cent), CITIC Pacific (20 per cent), and the Macau government (1 per cent). The Macau government has resisted World Trade Organization (WTO) recommendations to open up the remainder of its telecommunication services to competition and/or foreign players until after 2011.

The Internet sector was the first to be opened to competition and there are now 10 Internet service providers (ISPs) compared to just two at the end of 1999. There are also eight Internet content providers. There were a total of 88,694 Internet subscribers at the end of 2005, against just 17,169 in 1999, according to information from government authorities. The Internet household penetration rate is 66 per cent.

Macau now has five mobile phone operators. In July 2002, the first three GSM licences went to CTM and two offshoots of Hong Kong operators: Hutchison Telephone and SmartTone Mobile. Kong Seng Paging was also given a licence to operate as a mobile virtual network operator (MVNO), which means it offers mobile services to consumers using leased capacity from other mobile operators. There were 532,758 mobile subscribers at the end of 2005, giving a penetration rate of more than a hundred per cent. In 1999, there were only 118,101 mobile subscribers.

In 2006, Macau Unicom, a subsidiary of Mainland operator China Unicom, was granted a licence to operate CDMA2000 1X service. It initially offered a roaming service for visitors from Mainland China, but also plans to offer local service. It was also the first of the three 3G licences awarded by the government. The other two 3G licences were for W-CDMA networks and were awarded to CTM and Hutchison Telephone. Both SmartTone and Kong Seng Paging had also bid for 3G licences but were unsuccessful. The first 3G services are expected to begin commercial operation in 2007/2008.

Macau operates two satellite earth stations connected through an Intelsat satellite and has high-capacity fibre optic links to Hong Kong and Mainland China through Zhuhai in Guangdong province. It is also connected to the Sea-Me-We3 submarine cable system and the China-US cable for international bandwidth. International Internet bandwidth was 1,125 Mbps at the end of 2004, compared to just 19 Mbps in 1999.

In terms of broadcasting, there are five television stations and two radio stations in Macau. There is additional strong competition from neighbouring Hong Kong, whose broadcasting and media services are popular with Macau residents.

The government is also undertaking a study on the feasibility of establishing a second fixed or wireless network for the provision of broadband services, but no framework or licences have been put forward.

Enabling policies

The following are enabling policies that will affect ICT developments in Macau, some of them indirectly and others more directly.

Science and Technology Development Fund

The Science and Technology Development Fund was set up in 2004 to promote new technologies and enhance scientific knowledge and capacity. It provides funding for science-related education, research and project development.

Productivity and Technology Transfer Centre

The Macau government is aiming to promote the concept of lifelong learning through vocational training and retraining within the community. The Macau Productivity and Technology Transfer Centre provides advanced training in languages, information technology and textiles.

The Closer Economic Partnership Agreement (CEPA)

CEPA is one of the more important policies for Macau, although its coverage is much wider than ICT. It is designed to liberalize trade in all goods and services and to facilitate trade and investment between Macau SAR and Mainland China.

Ties with Portugal

A Framework Agreement on Cooperation exists between Macau and Portugal based on their historical ties. It is intended to

promote cooperation in economics, finance and science, as well as serve as a platform for trade between China and Portuguese-speaking countries. The past two Forums on Economic and Trade Cooperation between China and the seven-member Community of Portuguese-speaking Countries were held in Macau; the third will be also held in Macau in 2009.

Macau-Zhuhai transborder industrial park

Opened in December 2006, the Macau side of the Macau-Zhuhai industrial park is the second such facility after the Concordia Industrial Park. Information technology is one of a number of sectors that will be catered to in the park, which is expected to facilitate cross-border trade in goods and services.

Key national initiatives

e-Macao

e-Macao is a project to build a foundation for electronic government in Macau through readiness assessment, software research and development, and capacity building for the government workforce.

The e-Macao project started in July 2004. By June 2006, it had completed a comprehensive survey of 44 government agencies, developed three prototype systems to deliver representative public services online, trained close to 200 government staff in relevant technical and management skills, and organized 22 seminars and workshops to raise the level of awareness about

ICT and the gaming industry

With all the noise and excitement associated with a typical casino, most people probably do not stop to think of the technology that is involved. In fact, technology and communications infrastructure are cornerstones of the gaming industry—and will be so increasingly in the future.

Take the Wynn Macau, the hotel and casino complex that opened last year and which follows in the steps of the famous Las Vegas Wynn establishment. It has a staff of 50 IT specialists to handle the requirements of the casino and hotel complex. Each of its 200 gaming tables is loaded with technology, while the cages that dispense cash and receive deposited chips have been described as a bank branch where funds and assets can be moved from one place to another.

In the hotel there is Wi-Fi coverage in all rooms as well as wireless controls in some suites for lighting, drapes and AV equipment that rides on the Wi-Fi network. In the future, the Wi-Fi network will cover the entire property and allow for the use of wireless POS and wireless gaming machines.

Staff members are fitted with an employee ID that can track their movement within the complex as well as restrict access to secure areas or provide intelligence by sending data back to a data warehouse. For example, the data can help to plan staff meal times so that they maximize cafeteria operations. Staff attendance is automatically tracked for various purposes. There is an automated uniform-distribution system where employees drop uniforms into a slot at the end of their shifts, after which the uniforms are laundered and replaced on the racks. When the employee returned for the next shift, a touch of their ID card would bring that unique uniform for collection via the automatic rack.

The Wynn Macau has also developed its own technology that has since been used by the sister establishment in Las Vegas. For example, it developed an automated system to mark down results in a game of baccarat. Tables were modified to incorporate result displays and produce cards pre-printed with the history of the game in progress to hand out to newly-arrived patrons. The result has increased interest in the game because when people see a banker run or a player run on the result displays, it entices them to sit down.

Casinos in Macau are also big users of Radio Frequency ID (RFID) technology. At the Wynn Macau, RFID chips are embedded inside the gaming chips, which allow them to be uniquely identified. Even if someone could copy an RFID and somehow figure out the encryption keys used, it would not be registered in the database and hence would not be recognized. RFID also allows the casino to track the lifecycle of a chip across the gaming floor, see how often it is exchanged at a cage and generally know how and where the chips are being circulated.

Source: Summarized from an interview with Andre Ong, CIO of Wynn Macau, by Stefan Hammond, the editor of *Computerworld Hong Kong*. Full article at <http://www.cw.com.hk/computerworldhk/article/articleDetail.jsp?id=402472>

electronic governance. Project activities in 2006 concentrated on building prototype software infrastructure for e-government and supporting rapid development and run-time execution of various Electronic Public Services (EPS).

The first phase of the project was officially completed on 30 June 2006. Funding for the project was from the Macau government via the Macau Foundation. The United Nations University International Institute for Software Technology (UNU-IIST) was the lead partner. The second phase of the project has been approved by the government and extended for three more years until the end of 2009. Besides managing and executing its own portfolio, UNU-IIST's role is to provide advice to the e-Macao Project on e-government development in Macau and chair its technical committee.

More information can be found at the project portal at www.emacao.gov.mo.

UNeGOV.net

The UNeGov.net—Community of Practice for Electronic Governance initiative, was established in order to transfer the experience gained through the e-Macao Project to other parts of the world, particularly to developing countries. The aim is to build a global community of practice composed of experts and practitioners interested in developing, sharing and applying concrete solutions for e-governance.

The initiative was announced at the World Summit for the Information Society in Tunis in 2005. Additional network-building workshops have since been held in Bethlehem (Palestine), San Luis (Argentina), Bahia Blanca (Argentina), Kathmandu (Nepal), Abuja (Nigeria) and Ulaanbaatar (Mongolia). Some workshops were followed by a three-day school on the foundations of e-governance. More workshops and schools are planned with an international conference on e-government to be hosted by UNU-IIST in Macau in 2007.

In 2006, UNeGov.net developed four thematic areas resulting in new research, development and organizational transformation projects: Strategic IT Planning for Public Organizations, a collaboration with the Macau Institute for Tourism Studies; Semantic Interoperability for Electronic Government, a collaboration with Microsoft; Software Infrastructure Development for e-Government, a collaboration with the Macau government; and Software for Communities of Practice.

Most of the projects are also part of the UNU-IIST project portfolio for the new e-Macao Program. More information can be found from the community portal at www.unegov.net.

Regulatory environment

In March 2006, a new independent regulator was created, the Bureau of Telecommunication Regulation, which took over from the Office for Development of Telecommunications and Information Technology. Its duties include regulation, supervision and promotion of telecommunications services and ensuring fair competition in the telecom sector. Other responsibilities are the granting of new mobile and Internet licences, promoting the competitiveness of the telecommunications market and safeguarding the rights of users.

Regulations and licensing requirements are specified under the Basic Telecommunications Law. All mobile licenses are valid for a period of eight years, while qualified companies can apply for a license at any time to operate Internet services for renewable five-year periods. Internet licensees are not allowed to operate online gaming businesses. Companhia de Telecomunicacoes de Macao (CTM) has a monopoly on fixed-lines until 2011.

One of the stated goals of the government is to ensure a competitive environment. For example, ISPs are free to establish new pricing schemes unless they are found to be anti-competitive or against the public interest. According to Article 8 of the Basic Telecommunications Law, all forms of cross-subsidization or other practices that go against competition or user freedom are prohibited.

The Macao Network Information Center (MONIC) administers the registration of '.mo' country-code domain names (ccTLD). MONIC has been operated by the University of Macau since 1992.

Content and services

The Library of the University of Macau (<http://library.umac.mo/lib.html>) subscribes to over 24,000 e-journals and maintains a collection of more than 20,000 e-books. It plans to increase its online databases and full-text databases.

Many customs declarations are now made through an electronic data interchange system. The government's stated goal is for all customs clearance procedures to be paperless in the near future. Most license applications and approvals can now be done electronically.

The Macau SAR Government Portal (www.gov.mo) is provided in Cantonese, English and Portuguese. It offers government news, city information and e-services and has areas for citizens, tourists and merchants. It is also a useful gateway to the public sector, with links to almost all government agencies and departments.

The Macau Computer Association (MCA) was established in 1983 for people who are interested in computer science and applications. It has organized a number of major ICT events and was also a co-organizer of the sixth Asia Pacific ICT Awards (APICTA) 2006, which was held in Macau SAR for the first time.

Teledifusao de Macau (www.tdm.com.mo), a free-to-air television and radio broadcaster, also offers programmes in streaming video formats from its website, mostly in Cantonese and Portuguese, although there are also English news broadcasts online. Audio files from Radio Macau are also available.

Open source community

A promising open source initiative known as the Global Desktop Project unfortunately stalled in January 2007. The project ran for two years and was a major effort to increase the number of open source software programmers in developing countries.

The Global Desktop Project was brought to the UNU-IIST in Macau by Scott McNeil in 2005. However, funding after 2007 was conditional on outside funding that did not come through. UNU-IIST said that despite initial encouragement and considerable effort, including meetings with the chief executive in Macau and the Minister of Science and Technology in China, funds were not found and McNeil left UNU-IIST to seek another home for the project.

UNU-IIST says that it remains committed to open source software development in developing countries. In future, it plans to develop courses related to open source and put them online. It also has an ongoing project with Microsoft on interoperability between open source and proprietary software.

Intellectual property rights

In a report to the WTO in May 2007, the Macau government noted that there have been important developments in the enforcement of intellectual property rights laws over the past five years. Its copyright and industrial property laws were overhauled in 1999, and since 2004, the examining entity for patent applications has been the State Intellectual Property Office of the People's Republic of China. As a result, invention patents granted in the mainland can now be extended to Macau SAR.

The number of trademark applications increased from 1,696 in 2001 to 4,651 in 2005, and applications for patents and models and designs increased in proportion, although from much lower levels. The system for the registration of rights is essentially the same as in the EU, having been based on that of Portugal.

The Macau Customs Service, created in November 2001, has strong powers to prevent and punish violations of intellectual property rights. The government reports that more than 30 illegal producers have been closed down and 25 production lines seized. The sale of optical discs is also strictly controlled, with retailers needing to obtain advance authorization and discs required to carry an individual Source Identification Code. The Macau Customs Service was awarded the Sixth Annual Global Anti-Counterfeiting Award by the Global Anti-Counterfeiting Group in 2003.

Future trends

By most estimates, Macau's economy will continue to expand, with many new projects planned for the coming years. While it does not have ambitions to become an ICT hub in the way other economies in the region do, notably Malaysia, Singapore and Hong Kong, there will still be a need for greater ICT infrastructure and skills in Macau. In fact, it would be easy to underestimate the level of ICT infrastructure and skills needed in the gaming industry. The increase in number of hotels, tourists and casinos is also driving demand for communication services. Many of the major ICT vendors have set up a direct presence in Macau in the last year because of growing demand. These vendors which previously worked through third parties, often shipping in experts from Hong Kong, include Cisco, Microsoft and HP.

However, according to many in the ICT sector, there is already a skills shortage and the situation could get worse, particularly when some of the major new hotels and casinos open. This has been a problem in the past too, as casino workers are often offered higher salaries, making it hard to recruit people not just for IT but also for the government and banking sectors.

The Macau government has acknowledged the need to diversify away from the gaming and tourism sectors, but that may not be so easy given the amount of investment coming in and the recruitment difficulties. Often touted is the promotion of Macau as a destination for meetings, incentives, conventions and exhibitions (MICE). MACAU has been relatively successful in attracting major conventions and events, including the 2006 Asia Pacific ICT Awards (APICTA), which aims to stimulate ICT innovation and facilitate technology transfer. APICTA has 15 member economies: Australia, Brunei, Hong Kong, India, Indonesia, Korea, Macau, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Thailand, Vietnam and China.

Macau faces extensive competition from neighbouring countries, particularly Hong Kong, Mainland China and Singapore. However, Macau's advantage is that it is visa-free for around

64 countries and has an Individual Travellers Scheme that allows residents from 44 Chinese cities to travel to Macau. As a result, the immigration process is easier for MICE attendees. In addition, most of the major hotel and casino projects are also promoting business conventions.

Thus, the prospects look bright for Macau SAR. If it can manage to diversify further and encourage the development of ICT skills, Macau's prospects would look even better.

References

- Hammond, S. (2006a). Macau: expansion drive. *Computerworld Hong Kong*, 1 May 2006. Retrieved from <http://www.cw.com.hk/computerworldhk/article/articleDetail.jsp?id=323191>
- Hammond, S. (2006b). Jetfoil to Fisherman's Wharf. *Computerworld Hong Kong*, 1 August 2006. Retrieved from <http://www.cw.com.hk/computerworldhk/article/articleDetail.jsp?id=362218>
- Hammond, S. (2007). Bold steps in Macau. *Computerworld Hong Kong*, 1 February 2007. Retrieved from <http://www.cw.com.hk/computerworldhk/article/articleDetail.jsp?id=402472>
- Reed, M., George, C., and Hoi, W. (2007). *UNU-IIST annual report 2006*. Retrieved from <http://www.iist.unu.edu/newrh/III/1/docs/techreports/report351.pdf>
- Report by Macao, China. (March 2007). *WTO trade policy review*. Retrieved from http://www.wto.org/english/tratop_e/tpr_e/g181_e.doc
- Report by the Secretariat, Macao, China. (March 2007). *WTO trade policy review*. Retrieved from http://www.wto.org/english/tratop_e/tpr_e/s181-00_e.doc