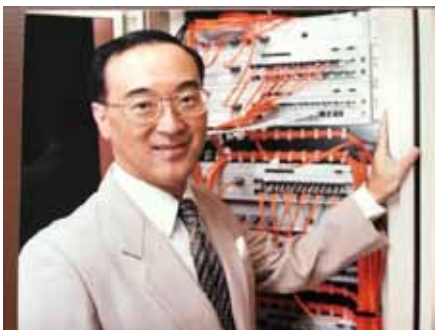
Review & Prognosis of Government ICT Development 1967-2020+
「香港政府資訊科技發展和展望」（1967-2020+）



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Synopsis: This paper outlines the development of computerisation and informatisation of the **HK Government Civil Service** from its inception in 1967 to the present day. Based on a general model of cycles of the 4-staged development of computerisation this overview covers the key components of the digitisation process, products, disciplines and organisational aspects of the ICT industry and Government administration; and perspectives of future development.

Content

1. The era of modern computerisation or informatisation commenced in the early 1940's with the Enigma Machine application for decoding German intelligence messages on launching offensives at the western front during World War II through processes of deduction and induction algorithms. This was an example of the leverage in data processing by representing data in **bits** instead of the previous notation of atoms in calculation. Computerisation progressed for business transactions in the fifties.

Stage I – Initiation Stage of Computerisation in HK Government (1967-73)

2. In **mid-1967** the Initiation Stage in the computerisation of the HK Government commenced with picking up the pace of world progress in leveraging the computer as a new transformational tool for administrative systems under the **Organisational Surveys Unit (OSU)** of the **Colonial Secretariat** which specialised in organisational and efficiency changes initially through work study and value for money studies. Computer-based applications using computer algorithms were used to replace the previous card processing by Hollerith card punching, sorting and tabulation machines for Trade Statistics processing introduced in the early 60's. The first two computer-based systems with the punched card as input were **Trade Statistics** and the **School Certificate Examinations Systems** followed by the **Payroll** application of **Treasury** and the **Joint University Student Finance Scheme** implemented by the **OSU**.

3. The IT discipline originated as a branch of the Engineering disciplines of Electrical and later Electronic Engineering. In 1969 Mr. Armstrong Wright of Public Works Department and J Tse developed the **Expenditure Control System** for Construction Projects and used **Program Evaluation Review Techniques (PERT)** including Critical Path Analysis for Construction Projects including **Waterfront Road** (linking Central to Causeway Bay) and Aberdeen Tunnel.

4. In turn, the IT discipline borrowed from Engineering the **Project Management techniques** of Project Planning and Control especially for the then scarce resources of computer hardware, software, use of computer expertise in application development and testing.

Stage IB – Initiation Stage with advances in computer infrastructure;

5. The next break-through followed the significant advances in computer infrastructure in memory **speed**; Exchangeable Magnetic Disc replacing tapes and paper tapes to provide for random on-line storage access instead of serial processing mode of processing; mark sensing device for source on-line data capture; the use of **high-level languages** (Cobol, Fortran, Algol (Filand) replacing Assembler language for efficiency of coding; and the operating environment enabled by virtuality of the **Operating System** (OS).

6. The **HK Population Census of 1971** leveraged these technology advances and sophisticated algorithms for validation, imputation and tabulation and achieved the record-breaking production of results and population projections within about four months of Census invigilation.

Stages 2 – Contagion (1973-81)

7. In March 1973 the **Data Processing Division** of the **Finance Branch** was established with Lee Tate as the first Data Processing Manager to be centrally responsible for catching up with the huge backlog of applications from Government Departments. This prompted the upgrade to the **ICL New Range Computer 2988** (1976) with Teresa Tse, the Planning Manager, who led her team to provide the computing environment for Government on-line applications.

8. Meanwhile, the **Water Billing and Information System (WIS) for the Water Authority** led by John Tse was implemented by modifying an IBM-based package from Tres of Texas, and outsourced to run on China Light's IBM mainframe. Lee Tate certainly avoided the pitfalls of the Not-Invented-Here syndrome of developing applications from scratch.

9. In 1974 the rank of **Project Manager** (1974) was introduced and a solid foundation was laid in respect of staff career development, formalised management controls and standards for project management of more organisational complexity and technological sophistication. In 1978 the **Government DP Grade Staff Association** was incorporated with John Tse as Founder Chairman for all IT staff in the Government. Decades after, however, the Government often chose to hire external staff to fill Key positions instead of promoting from within by means of mentoring and grooming of local professionals.

10. Supported by the proven strategic role of computerisation in key user Departments, Lee Tate managed to establish the basis for the quest for renaming DPD as G**overnment Data Processing Agency (GDPA)** in 1982, an independent Agency for IT reporting to the **Director of Administration** of the Government Secretariat.

Stage 3 – Control and Consolidation (1981-87)

11. Stage 3 saw the computerisation cycle evolving both by control and consolidation in the central GDPA and also by **organisational devolution** to Government Departments as the need for both computer power and manpower led to decentralised IT functions at Departments requiring in-depth knowledge of departmental policy and operations besides IT expertise.

12. Stage 3 overlapped with Stage 4 depending on the differential degree of readiness and maturity of the progress of computerisation at the GDPA and Government Departments. From 1984, two Government departmental IT/IS strategies both managed by John Tse, laid the foundation of the IT/IS function of respectively the **Housing Authority** and the future **HK Hospital Authority**.

13. In 1986/87, the Government IT expenditure (excl. staff costs) was $122.5 mil. comprising GDPA 26.7 mil., Housing 24.9 mil., Immigration 22.8 mil., Treasury 14 mil., and Inland Revenue 11.8 mil. Decentralisation created in-department computer services divisions headed by seconded Directorate staff from GDPA (as Head of Grade), notably **HK Housing Authority** (John Tse), **Inland Revenue Department** (IRD) (Teresa Tse) and **Police** (Alan Dixey).

Stage 4 – Integration of Data Resource and Department IT Strategies (1987-98)

14. In 1986, the GDPA was upgraded to the **Information Technology Services Department (ITSD)** with Dr. Colin Greenfield, the former Commissioner of Census and Statistics, as Director. In 1988, the Consultancy Report on Government IT Policies and Strategies with Teresa Tse as Co-ordinator recommended IT strategic planning to all Government Departments for the implementation of data- and function- sharing within and between Departments.

15. By end-1991 the **Government Super Data Centre** Project formulated by John Tse had an IBM mainframe installed for the ever-increasing network, security and data requirements. In Dec 1995 the Government Information Centre (GIC) was established on the Internet.

16. By 1997 **Departmental Information Strategy Plans (ISS)** were implemented in nine government Departments for efficiency and substantial benefits, e.g. the implementation of the **Immigration ISS** led by Teresa Tse saved in 1995 over 600 posts costing $126 mil.

17. By 1997 the community Electronic Trading Service (CETS) enhanced the Restricted Textile Export Licenses implemented by John Tse's Team in 1982 by allowing Traders to submit licence applications by Electronic Data Interchange (EDI).

HK Hospital Authority IT/IS Strategies (1992-2017)

18. Informatisation of healthcare services as business transformation and clinical professional practice support through ICT automation and **organisational learning**, adaption, and multi-disciplined behavioural changes is a much less spectacular though more lengthy process than the accompanying development, testing and implementation of IS and much more critical and complex than the buying of hardware and software vendor services.

19. In early 1992, the IT Division of the newly incorporated HK Hospital Authority **(HA)** launched a 3-staged **HA IT/IS Strategy** in support of the new corporate business strategy. This Strategy was based on the evolution of from a 'centralized' systems architecture for Hospital Information System (HIS) to a 'distributed' and '**open**' systems architecture connecting through the **HA HIN (HA Health Information Network)** the territory-wide workstations to the operational and informational **data bases** of patients, HR, finance and logistics. In Stage 1, the **Integrated Patient Administration System (IPAS)** was implemented within a world record of 18 months in all 38 public hospitals and 54 Specialist Outpatient Clinics of HA.

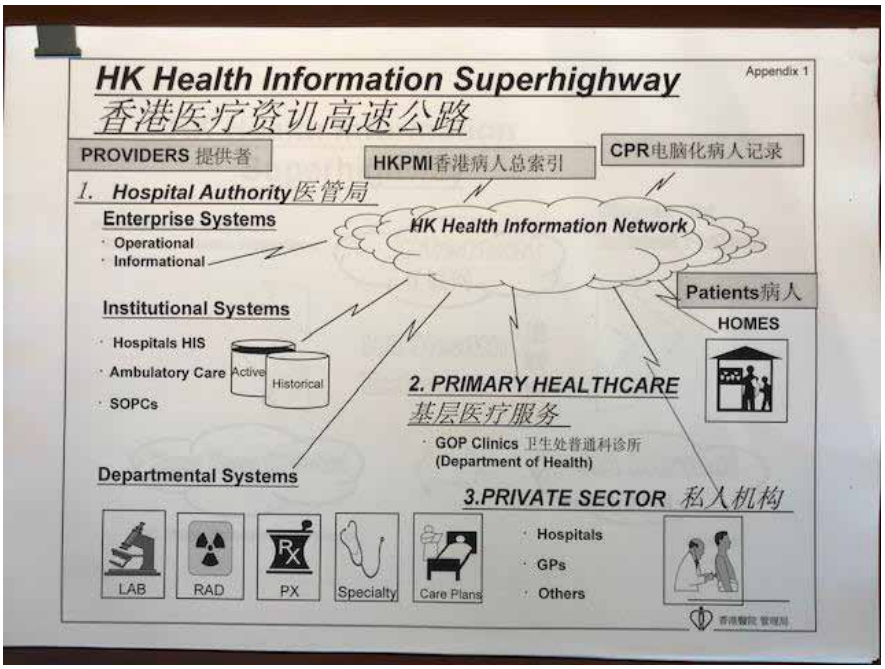

Diagram 1: **Hong Kong Health Information Super Highway**

20. In August 1995, this first **HA IT/IS Strategy (1992-2002)** was enhanced with the incorporation of: (a) the "HA Integrated **Clinical Management Systems (CMS)** Architecture" and the advanced foresight of **'The HK Health Information Super Highway'** which denotes " a seamless web of communication network, computers, databases, **medical devices** and consumer electronics that will put vast amounts of information at healthcare providers' and eventually end-users' and patients' fingertips." This First Strategy provided the foundation of the infrastructure context and content for the next three 5-year (2002-07); (2007-12); and (2013-2017) HA IT strategies. These were needed for the HA to sustain its leading position among the world leaders in leveraging IT in the global journey to achieve the vision of 'Connected health'.

21. In 1997 a review for value for money conducted by an external consultant with a suitably broad base of experience concluded, "In a very short period of time, considering the complexity of the task HA ITD has planned, developed and implemented the fundamental building blocks of a world class IT/IS system at approximately one-third the comparable cost in the US."

Stages and Cycles of the Computerisation of Government Services & HA

22. The above **4-staged computerisation** depicts the first cycle of computerisation of the Government, the **Housing Authority** and **Hospital Authority.** The next cycle generally overlaps with the last Stage of the preceding cycle to leverage new innovations in IT, data communications, internet +, cloud computing, big data and AI…

23. There exists a hierarchy of components comprising government policies, cycles and stages of informatisation, IT/IS strategies and projects. Each component needs to have the respective post-evaluation based on previously agreed and open Key Performance Indicators (KPI) of Equity, Economy, Efficiency, Effectiveness, Outputs and Outcome.

HA IT Strategic Plans – the Next Cycle (2012/13 to 2016/17)

24. The public funding on IT expenditure from 1991 to 2012 accumulated to US$343 million. The 5-year total IT one-off investment for this Plan (from 2012/13 onwards) was **HK$817 million** including **$375 million** for **clinical systems**. Besides the territory-wide HER (connected healthcare) system for which the HA provides consultancy and implementation support to the Government, the HA IT plan now covers the following 3 key areas: Clinical Systems including CMS III Advanced; Business Support IS; and the HA ITS technical infrastructure to be much enhanced to leverage the advanced technologies (incl. private-cloud computing) and risk reduction practices to meet the patient- and community- centred healthcare and business support services demands requiring the access to information anytime, anywhere by authorized users.

25. According to the Profile and Plan of Connected Health in Hong Kong (2009-2017), HA is now recognized world-wide for the extensive and direct use of IT by clinicians enterprise-wide and realising significant benefits. Below is an extract from the Hong Kong Profile of the 2011 report on **Connected Health** Study.

*"With funding from the Hong Kong SAR government—and leadership, development, implementation and outreach from the Hong Kong Hospital Authority (HA)—public providers have developed and embraced a wide range of successful **health information exchange (HIE)** tools. The tools are **homegrown systems** developed module by module with a high level of clinician input and ownership and, most important, built to support clinician workflow."*

*"All 41 public hospitals and 122 outpatient clinics (incorporated the General Outpatients Clinics formerly under the Health Department) use these common integrated clinical IT systems and are connected to enable data sharing. All public care settings access and add to an enterprise-wide **electronic patient record (ePR)** for all patients. Clinicians on the public side see the benefits of healthcare information technology tools daily and donate their time to expand and enhance the HIE tools."*

2018-20 Papers by the Secretary of Innovation & Technology Bureau and GCIO

26. In 2018, Mr. Nicholas Yang, Secretary of **Innovation and Technology Bureau**, obtained the Government Financial Budget approval for the investment of $50 billion for Innovation & Technology initiatives. The **OCGIO (Office of the Chief Government Information Officer** upgraded from the ITSD) provided the planning of digital infrastructures and the applications Including the e-ID with over 110 **e-Government** services and the '**HK Smart City**' Blue-print.

27. During the last two years the Hong Kong economy has witnessed a three-pronged serious threat, notably the phenomenal global Covid19; the politics of the US Election Year and the resultant longer termed decoupling of the US economy from China; and the internal political division. Government ICT policy and the ICT industry have to collaborate to face the challenges with innovation and long-term policy relevant to the future IT manpower needs, nation, region and the world for sustained growth.

28. In September 2020 Mr. Alfred Sit, Secretary for Innovation and Technology, urged the HK IT Industry to follow the **National 14th 5-year Plan** and to seize the opportunities of the development of the Bay Area, for accomplishing the role of Hong Kong as the Innovation & Tech Centre of the Area. This development goal has been assisted by the enactment of the National SAR Security Act. Mr. Victor Lam, CGIO reported on the digital programs in the fight against the **COVID19** Pandemic including: COVID19 Web-site & Apps; e-bracelets; on-line learning platform; distant business plan; Health Pass; and digital ID. The Government will lead and co-ordinate the HK ICT Industry in services and business opportunities for HK to survive the new environment of the Pandemic.

29. In October 2020 the Central Government published the "**Development Plan for furthering the role model of Shen Zhen** in the development of China Socialism for the Nation (2020 -2025)" <深圳建設中國待色社會主義先行示範區綜合改革試點實施方案>. The HK Administration Report on 2021 Plan will further complement the HK development and international business strengths with the opportunities of the Shen Zhen, Bay Area and National policies especially in areas of innovation, high tech, financial tech, HR, industries and market economy.

30. The current ICT market already includes: enhanced satellite communication, open mobile OS, big data, cloud computing enabling the applications like cross-discipline information sharing; City Intelligent Operation Centre **(IOC)**.

Further Innovations in 5G, AI, IOT, and Satellite communications

31. Since 2002 **Artificial intelligence (AI)**has emerged in 4 overlapping waves of development, namely:
- Wave 1 - **Internet** AI (since 2002, mainstream 2012): using AI algorithms as recommendation engines (comprising collaborative filtering and content-based recommendation or both for aligning recommendation with consumer preferences) ;
-Wave 2 – **Business** AI (since 2004 big-data business by like Palantir and IBM Watson) for the finance sector with clear metrics to optimize; analytics for due diligence; and medical applications;
- Wave 3 – **Perception** AI – algorithms grouping the pixels (from a photo or video) into meaningful clusters especially through the sensors, smart devices. This is a new blended environment OMO, online-merge-of offline. A notable world example could be the Sing Pass of the Singapore Government (with facial recognition) originated in 2018.
- Wave 4 – **Autonomous** AI: from complex data sets with newfound sensory powers for extending both understanding and shaping the world, thus representing the culmination of the three preceding waves and fusing machine optimization.

32. It has taken 25 years from 1995-2019 to witness the growth since 1995 of market cap of the internet sector by 1000 times. The future paradigm shift in productivity would be attributed to AI. From 2010 to 2035 the devices per person would have grown from 2/person to 100/person resulting in the IOT connecting 1 trillion devices, thus advancing the creation of Artificial General Intelligent (AIG) in about 2040 with intelligence comparable to humans.

Concluding Remarks

33. Through global co-operation and competition and our own strengths of the **'One Country, Two Systems'**, there will be the light for us to achieve at the right timing with our courage, serenity and wisdom. However, the new ICT initiatives must originate from the undaunting, entrepreneurial spirit of emancipating, as far as possible, from the tyrannies of the here, the now and the bureaucracies of administrative machineries ever-dominated by administrative, academia and political perpetuators not open to reform.

34. This account of Government IT aims to insert the story of the IT function in the story of Government administrative machinery of the modern era as the IT function has indeed become an indelible part of What's Hong Kong and should not merely be seen as an adjunct of the HK story.

Author's ICT Experience Profile:

Ir. John S Y TSE joined the Civil Service in 1966 and retired as Assistant Director of ITSD in 1991 to join the HK Hospital Authority as Deputy Director (IT) until 1999. As a pioneer/ founder of Government ICT, John was former CIO of Government Departments and statutory HK Authorities (Water/Housing/Hospital); Former Chairman of Government Advisory Committee on IT Applications; Former Senior Adviser of China e-Commerce Association; Chairman of HK 1997 Web-site; former President of HK Computer Society and HK IT Managers Club; Founder Co-ordinator of HKIT Joint Council; Founder Chairman of Government IT Professional Staff Association, HKU iCom - eCom M.Sc. Alumni Association, Peking University China Trade Alumni Association; Former Vice President of Harvard Club in HK; Hon. Director of China Overseas Association…)

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義工服務沒因疫情嚴峻停止 – 王祖興先生

圖：筆者與將派發予有需要人士的防疫用品

義工服務沒因疫情嚴峻停止

數週前一位平素喜歡組織義務工作服務的朋友來電，向我解釋因疫情嚴峻等的原因，他已有差不多接近一年沒有舉辦社會服務活動，又說「很難做，不知道如何做」或者「缺乏資源」、又或者「年紀大，是高危一族，怕受感染，會病死.....」為理由退卻展開社關工作。我告訴他說：「我不是問你在疫情中可以做什麼或策劃什麼大計，而是問你應該做什麼，應該做的就要去做。」

確實於此疫情肆虐嚴峻期間，不少社會服務停頓，原因是絕大部分社會服務機構欲保護服務使用個案，免因此而將疫症傳給服務使用者或自己的員工。當中停止的服務的，包括每天到戶上照顧老弱傷殘者的上門探訪及送飯服務。試問服務使用者如何可於疫情期間有餐溫飽，以維持生命！更遑論他們可能需要其他的服務呢！縱使世界因為疫情而停頓，但服務使用者日常仍然需要生活及生存。

現今的社會需要以承擔作為使命，在疫情肆虐嚴峻期間置有困難者而不顧，實可恥之甚。試問於此危難急需要照顧的人，在此疫情環境下，他們的慘況又有幾許社會人士知道呢？可幸世上尚有熱心人仕，據我所知，包括由專業人士及更生人士共同組成之「大嶼山扶輪青年服務團」，自去年十二月起至今，照常按月登門為行動不便的獨居長者及少數族裔家庭服務。自2011年起向基層派飯的「深水埗明哥」，在疫情之下也堅持派飯行動等。

要安排義務工作，拯救有需要幫助的社群，不懂得也要去學。一個有憐憫和同情心的人，定會用行動關心弱勢社群，令他們感到人間有情，於此疫情人人自覺危險時，怎會離棄他們而不顧呢？對於有些朋友有感動推動義務工作，但是茫無頭緒或缺乏資源不知道如何去做，我建議可以聯合教會或與專業社會服務機構合作，務求提供可持續的而有效的社會服務，在疫情中修修補補，希望照顧被政府忽視了的漏洞。

隨着醫療專家認為仍需多等十二至十八個月才有治病的疫苗面世，香港社會現階段疫情的狀況可能繼續維持不變。試想一下，一名獨居和行動不便的老伯，因為患有高血壓、糖尿等慢性疾病，而需要定期到普通科門診覆診。但受經濟能力所限，他沒法聘請家傭照顧。若無親戚朋友陪伴，這位老伯便會難以在疫情的影響下獨自外出覆診，有礙管理個人健康。長遠來說，亦會衍生其他的社區問題。

要解決類似上述的問題，固然可以要求政府、醫護人員、非政府機構等單位加緊合作，構建覆蓋更全面的基層醫療網絡。同時，也不應忽視民間力量，因為街坊鄰里也可成為支援網絡的一分子，把社區的無形力量轉化為社會資本。可是，醫護人員現正忙於與疫情交戰，非政府機構服務停頓，假若街坊鄰里、大專院校、工商機構等界別的義工，因疫情嚴峻而裹足不前，弱勢人士也不容易受惠。這正是本會介入服務社群的好時刻。

粗略數算幾項本會涉足義務工作的優勢：首先，本會集合了不同政府部門「約滿」(不是退休)的專才，具備豐富的閱歷及人際網絡、經濟穩健、處事成熟、善於與人溝通，普遍對工作有承擔，所以很多會員至今仍在社會上擔任受薪工作。其次，會員普遍健康狀況較上一代好，亦有較高的教育水平，可以把他們的專業知識、技術、經驗薪火相傳。再者，有絕佳的組織能力，可發揮過去所累積的人脈籌辦大型活動、會議和專題講座等。

由此可見，本會會員是寶貴的人力資源，仍可大有作為。現時疫情嚴重下進行義務工作服務，除了因應限聚令作出不同安排，亦會因應情況而提高戒備，包括使用手套、眼罩、口罩、透明雨衣等物品，做好保護。同工加強防護，在幫助別人期間同時保障自己。在疫情下仍出動，是希望利用靈活機動的方法，惠及社會上一些沒有被照顧的階層，亦相應提高本會之聲譽，為周邊及後來者樹立一個正確的榜樣。

回到本文首段我朋友的來電，我最後歡天喜地告訴了他：「**義工服務沒因疫情嚴峻停止**」。

二零二零年八月三十日

世界三大跨國瀑布

在此與大家分享世界三大跨國瀑布之特色及氣勢:(1) **尼加拉瓜大瀑布 (Niagara Falls)** 2007年5月;(2) **南美伊瓜蘇瀑布 (Iguaza Falls)** 2008年3月;(3) **南非維多利亞瀑布 (Victoria Falls)** 2007年2月。經歷了三個不同國家之瀑布群有以下之體會:三大瀑布都各有千秋! 在不同國家之地理環境有不一樣的河流分佈、故此會有不同的景像、有澎湃的;氣勢非凡的;彩虹處處的等等、真令人大開眼界!

(1) **尼加拉瓜大瀑布 (Niagara Falls)** 是由三座位於北美洲五大湖區尼加拉瓜河上瀑布的總稱,平均流量為2,407立方公尺/秒,與伊瓜蘇瀑布、維多利亞瀑布並稱,尼加拉瓜大瀑布以美麗的景色,巨大的水力發電能力和極具挑戰性的環境保護工程而聞名於世,是非常受遊客歡迎的旅遊景點。

整個瀑布跨越加拿大的安大略省和美國的紐約州,構成南部的尼加拉瓜峽谷。三座瀑布按規模從大到小分別為馬蹄瀑布,美國瀑布,布里達爾維爾瀑布。其中,馬蹄瀑布位於美國和加拿大的邊境,美國瀑布全部位於美國境內並由山羊島分隔開。布里達爾維爾瀑布也在美國境內,由月亮島從美國瀑布隔開。尼加拉瓜河流只有6%的水從美國瀑布流下,其他94%的水是從馬蹄瀑布流下,下游形成了一個湖,主航道是美加領水分界。馬蹄瀑布由於水量大,濺起的浪花和水氣有時高達100多米,大風吹過時,水花可及很遠,如同下雨般。冬天時,瀑布表面會結一層薄薄的冰。而當陽光燦爛時,產生折射效果,便會營造出一座甚至好幾座七色的彩虹。

尼加拉瓜河連接伊利湖和安大略湖並分隔美國紐約州和加拿大安大略省,在流經寬約350公尺的**美國公羊島 (Goat Island)** 時跌入斷崖,並一分為二,形成馬蹄瀑布與美國瀑布兩個瀑布。布里達爾維爾瀑布與其他瀑布由**月亮島 (Luna Island)** 隔開。**馬蹄瀑布 (Horseshoe Falls)** 為大瀑布,也稱**加拿大瀑布 (Canadian Falls)**,橫跨美加兩國,占尼加拉瓜河約90%的水量,河水呈青色。瀑布呈半環型,寬670公尺,落差57公尺。

美國瀑布 (American Falls) 為中瀑布,在東側美國境內,占尼加拉瓜河約10%的水量。

我們乘搭這樣的遊船進入瀑布邊沿感受震撼及澎湃之感覺、真的令人難忘

世界各地遊客正在欣賞加拿大瀑布

(2) **南美伊瓜蘇瀑布 (Iguaza Falls)**,是位於巴西巴拉那州和阿根廷邊界上的伊瓜蘇河,從巴西高原輝綠岩懸崖上落入巴拉那峽谷形成的瀑布。現時成為聯合國世界自然遺產的一部分。

伊瓜蘇瀑布實為一組瀑布群,由275股大小瀑布或急流組成,總寬度2.7公里,比尼亞加拉瓜瀑布寬4倍,落差由平均60公尺至最高82公尺。年均流量1,750立方公尺/秒,雨季時瀑布最大流量為12,750立方公尺/秒,這時大小飛瀑也匯合成一個馬蹄形大瀑布。

伊瓜蘇瀑布群位於伊瓜蘇河上。伊瓜蘇河在與巴拉那河匯合前約23公里有一座高崖,因而造成落差為72公尺的瀑布群。其實,高崖的成因是由於巴拉那河的河谷是由南至北走,而伊瓜蘇河的河床岩層卻正好與巴拉那河垂直。因此,巴拉那河承受的河水沖刷遠較伊瓜蘇河高。在積年累月的侵蝕下,巴拉那河漸漸變得越來越低,從而造成寬達2700公尺的伊瓜蘇瀑布群的形成。