For discussion on 14 November 2005

Legislative Council Panel on Education

Grant to support the modernization and development of the Hong Kong Examinations and Assessment Authority's examination systems

Purpose

1. This paper seeks advice of Members on a proposal to provide the Hong Kong Examinations and Assessment Authority ("HKEAA") with a capital grant of about $155.33 million to support the modernisation and development of its examination systems.

Background

2. HKEAA is a statutory body established in 1977 under the HKEAA Ordinance (Cap. 261). Its statutory responsibility is to conduct the specified examinations of the Hong Kong Certificate of Education Examination ("HKCEE") and the Hong Kong Advanced Level Examination ("HKALE"). It operates on a self-financing basis and does not receive any recurrent subvention from the Government. HKEAA is governed by a Council appointed by the Chief Executive with members drawn from various sectors, including tertiary institutions, schools, business and the Government.

3. HKEAA also runs a number of assessments including the Territory-wide System Assessment, Language Proficiency Assessment for Teachers; and a range of professional and international examinations, such as the General Certificate of Education (GCE) Examinations, and the Test of English as a Foreign Language (TOEFL).

Problem

4. Hong Kong's two public examinations (HKCEE and HKALE) are well respected internationally for their rigour and high academic standards. However, while HKEAA has a history of reliable and cost-effective administration of its examinations, the systems utilized by HKEAA to administer public examinations have become antiquated. Public confidence in these systems has been sorely tested in recent years and needs to be restored. This proposal seeks funding to modernise

HKEAA's examination systems for HKCEE and HKALE in line with developments elsewhere. It also seeks to provide the basic infrastructure to enable HKEAA to conduct the current public examinations and to pave way for the new Hong Kong Diploma of Secondary Education ("HKDSE") to be introduced in 2012 under the new academic structure for senior secondary education in a timely, efficient and reliable fashion, as well as to provide a wider range of assessment services for the people of Hong Kong.

Outdated IT infrastructure systems and services

5.　　　　An external expert review completed in early August 2005 concluded that much of HKEAA's computing hardware is obsolete and that the computer systems need redesigning and rewriting so that they can operate in real time (rather than through batch processing) on a common platform, allowing integration of systems and use of modern database software. There is also an urgent need to upgrade capacity, accessibility, reliability and security of HKEAA's network, which has already been stretched to the limit and is unable to support an onscreen environment for processing examinations, an essential requirement for meeting challenges ahead.

Lack of automation

6.　　　　There is little automation of examination processes. Manual processes, including the manual counting of examination scripts in the examination centres, physical distribution to and collection from markers of examination scripts, and manual checking of marks awarded to candidates, are costly, inefficient, insecure and prone to human errors.

7.　　　　Currently, markers collect original examination scripts from HKEAA and mark them at home, at school and in other places. This means that it is almost impossible to have any real-time supervision of the marking process and one can only tell whether a marker has been harsh, lenient or inconsistent after all the marking has been completed, by which time the options for remedying the situation are limited. There is no backup for the original scripts and the movement of scripts between HKEAA, markers' homes and their places of work mean that original scripts could be lost in the process, leading to serious consequences. In fact, almost every year a small number of the original scripts were lost. There are also incidents of markers who mark in inappropriate places to which the public have access, or who mark at home where family and friends may gain access to the original scripts. When they have finished, individual markers add up the scores manually and enter them on a score sheet. The scores are then entered into the computer system. Because of the manual processes involved, errors are found in the manual addition or recording of scores or incorrect use of forms. Every year, HKEAA recruits a team of some 300 checkers from tertiary institutions to check the scores with a view to identifying and correcting data preparation errors. This checking process is again manual and time-consuming and despite rigorous supervision of the checking process some errors inevitably remain

and go undetected unless picked up through the appeal process.

Length of time taken to process examination results

8.　　　　Manual processes also extend the time taken to process examination results.　The Education and Manpower Bureau (EMB) is keen to see a later start of the public examinations to allow more time for teaching and learning.　Meanwhile, the University Grants Committee (UGC) funded institutions on the other hand have expressed their wish to obtain earlier access to the results of candidates of the HKALE to facilitate their admission processes.　There are thus pressures from both sides to reduce the time taken in processing the examination results.

Inadequate security and supervision of examination centres

9.　　　　The public examinations administered by HKEAA are conducted in examination centres provided by schools.　The security of examination papers prior to their being dispatched to schools is an ongoing issue.　In fact, the Courts have recently heard an attempted theft case.　Another major issue is the supervision of the examinations and communications with examinations centres in order to deal with incidents (e.g. emergencies or non-compliance with examination regulations) that require immediate action by centre supervisors.　There is an urgent need to provide stronger support to invigilators and centre supervisors, most of them being teachers, to handle and minimize examination irregularities.

Proposal

10.　　　　The Secretary for Education and Manpower proposes to make a capital grant to HKEAA to support the proposed measures, as set out below, to modernise the examination support systems.　The proposed measures fall into three areas, namely -

i.　　　　The modernisation and development of HKEAA's IT infrastructure;

ii.　　　　The introduction of centralized onscreen marking and the establishment of onscreen marking and processing centre(s) at convenient location(s); and

iii.　　　　Measures to enhance the security and supervision of public examination operations.

11.　　　　The first of these measures will be undertaken in line with the recommendations of the report of the external expert review committee, the later was appointed by the Secretary General of HKEAA in March 2005 to review and make recommendations to improve HKEAA's IT infrastructure and systems.　The measures will seek to upgrade the IT infrastructure of HKEAA through replacing obsolete hardware and adopting web-based platforms and new standards in project management, system design, development tools and quality assurance systems to provide basic support for the development challenges of HKEAA over the coming

years.

12.　　　The second will allow examination scripts to be first electronically scanned and then marked onscreen by markers at centralized venue(s).   Computers will be used to allocate questions to markers, capture scores and monitor the quality of the marking process.   These measures would address a range of problems such as security of scripts and supervision of marking quality and would be in line with developments overseas and in most of the large Mainland provincial examination boards.

13.　　　The third will seek to improve examination security and supervision in line with best practice elsewhere.   The measures would involve the use of Radio Frequency Identification (RFID) tags to monitor the movement of examination papers, online computers, video/web cameras, barcode technology and other security devices to enhance examination security, effective communications with and supervision of examination centres.

Justification

14.　　　The proposals in paragraphs 10-13 above are intended to address both the immediate short-term problems faced by HKEAA and the longer-term intention of becoming a world-class provider of examination services.   The outcome will be greater capacity to manage a range of different examinations, including the new HKDSE, reduced manual processes to speed up and enhance the reliability of examination processes, and solutions to address the problems as elaborated in paragraphs 4 to 9.   The benefits are summarised below.

Modernization and development of IT infrastructure and systems

- Updated IT infrastructure will improve reliability and security of systems and flexibility in accommodating new examinations and changes to existing examinations.
- Integrated system architecture will reduce processing time and save costs.
- Web-based platforms will improve service quality and efficiency.
- Internet access will improve accessibility to services and information by students, parents and the public.
- Onscreen data capture and information services will reduce teachers' workload (e.g. submission of School-based Assessment[1] results).
- Automation of computer processing, administrative work and controls will improve internal communication, efficiency, and responsiveness and minimise the incidence of human errors.

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[1]　School-based Assessment results will contribute towards the overall assessment of candidates in all subjects in future and is being implemented for HKCEE Chinese Language and English Language subjects in 2007.

Centralised onscreen marking

15.　　　　One of the most important developments in the administration of public examinations by examining bodies worldwide in recent years has been the refinement of technology to allow marking to be conducted onscreen.　This involves the digital imaging of examination scripts and the use of powerful software to deliver individual questions to markers, through a bank of networked computers.　The software enables a variety of means for real-time quality control of the marking of papers, the elimination of a great deal of physical handling of scripts and automatic addition of marks.　The proven benefits of this technology and the anticipated benefits arising from the creation of the onscreen marking and examination processing centre(s) include:

- Backup of scripts once they have been scanned, thus eliminating the problem caused by missing scripts.
- Timely delivery of scripts to markers enabling a prompt start to the marking process.
- Security of scripts and avoidance of marking in public places
- Real-time monitoring of markers' performance.
- Capacity for prompt remedial action in cases where markers are found to be lenient, harsh or inconsistent.
- Increased speed and accuracy resulting from being able to mark by question.
- Flexibility in allocating different questions to different markers, capitalizing on specialist knowledge.
- Marking and capture of marks in one single process to save time and eliminate errors in mark entry and manually adding marks.
- Eliminates script movement between markers in double marking or check marking, thus improving security and speed (an important consideration given the anticipated increased need for double marking in subjects such as Chinese Language and Liberal Studies).
- Opportunities to reduce processing time allowing a later start and/or an earlier release of results.
- More information available on the marking of each question for later feedback to schools and teachers.
- Easy storage of examination scripts and the possibility of on-demand access by candidates to their scripts.
- A ready source of data and scripts for research and analysis.

16.　　　　The establishment of onscreen marking and examination processing centre(s) at convenient location(s) will provide accessibility and convenience to more than 5,000 teachers and academics who serve as markers each year.　Outside the annual public examination period, the onscreen marking and examination processing centre(s) will be fully utilised throughout the year for other examinations and assessments such as the Territory-wide System Assessment and the 200 or so international and professional examinations which HKEAA administers for its clients.

Enhanced security and supervision of public examination operations

17.   Application of RFID technology and the installation of Close Circuit Television (CCTV) and Access control systems at all secure stores will help prevent question papers from being stolen.   Bar code technology will help prevent loss of and track scripts.   The installation of web/video cameras and Internet communications in examination centres will enable better supervision of examinations and ensure prompt response to incidents that arise.   This will also provide stronger support to invigilators and centre supervisors in handling and reducing examination irregularities.

18.   Modernising Hong Kong's public examination systems has become an urgent priority.   The costs of undertaking the necessary work cannot be absorbed by deploying HKEAA's existing resources.   HKEAA has been set up as a self-financing organization and its main funding source is the fees charged for the two main public examinations.   With the examination fees frozen for seven consecutive years since 1999 and the introduction of a fee increase by 5% in 2006, HKEAA has yet to achieve full cost recovery and is still incurring a loss in the operation of public examinations.   The current income stream of HKEAA is unable to support the additional funding requirements for the modernisation.   HKEAA is having genuine difficulties to meet the additional capital funding requirements for the proposed improvement measures, and a grant from the Government is necessary to support HKEAA in implementing these proposed measures.

Schedule of implementation

19.   Modernisation and development of the IT infrastructure will be implemented by phases over approximately 4 years.   The project needs to start immediately with a new IT system in place and migration and enhancement of the mission-critical applications by 2007.

20.   Onscreen marking and examination processing centre(s) need to be in place on a timeline that enables HKEAA to build sufficient experience in onscreen marking to ensure a smooth transition to full implementation for the HKDSE in 2012. This means that the centre(s) need to be established with systems and equipment in place by 2007.

21.   Before the full implementation of onscreen marking, HKEAA will implement the digital scanning of examination scripts for about 70% of current subjects (accounting for about 90% of all scripts) in 2006.   At the same time, a pilot run of onscreen marking will be carried out.   Based on the results of the pilot run, onscreen marking policies and procedures will be further refined and implemented for the HKCEE Chinese and English language subjects in 2007.   More subjects will be included in subsequent years, paving the way for full implementation by 2012.

22.	In 2006, HKEAA will install CCTV and Access Control systems at all its secure stores. It will also explore the feasibility to use RFID technology to prevent question papers from being stolen. In 2007, it will start to install and pilot run the monitoring and communication systems at examination centres, including the use of barcode technology to check examination attendance and count examination scripts, and the installation of web/video cameras. It will also explore the feasibility of recording oral assessments with a view to enabling post hoc checking of disputed judgments about candidates' performances.

23.	A chart summarising the timeline for completing the proposed measures is given in Enclosure 1.

Financial implications

24.	A tentative breakdown of the proposed capital grant is as follows:

	Measures	**Estimated Cost ($ million)**
(i)	Modernisation and development of IT infrastructure and systems	65.55
(ii)	Centralised onscreen marking	
	• IT hardware and software	39.86
	• Scanning service and image storage hardware for the 2006 public examinations	15.24
(iii)	Enhanced security and supervision of public examination operations	34.68
	Amount of proposed grant	**155.33**

25.	The proposed funding of $65.55 million for modernization and development of IT infrastructure and systems will be used for replacing the computer hardware and software so that they will run on a common platform, redesigning the computer network (with a total of 56 applications and linking offices at 4 different locations), migrating legacy applications and data, enhancing existing applications (when necessary), and developing new applications.

26.	The proposed funding of $39.86 million for IT hardware and software for centralized onscreen marking will be used to acquire scanners, computer hardware and software, computer network and equipment, as well as to develop application systems for scanning and onscreen marking of examination scripts, and implementation.

27.	We have committed at the 12 September 2005 Special Education Panel

meeting, in the context of explaining the incident of misreporting HKCEE English Language (Syllabus B) Oral paper results in 2005, that we aim to ensure there is no missing scripts in 2006 and to run a small on-screen marking pilot which requires immediate investment in scanning technology. To overcome the lead-time constraints, as well as to gather experience using scanning and onscreen marking hardware and software, and to meet the examination schedule, HKEAA will contract out the scanning service for the 2006 public examinations. The contractor will be required to work in HKEAA's premises under HKEAA's supervision. The proposed funding of $15.24 million is for contracting the scanning service, printing of bar code labels and purchasing the image storage hardware.

28.   The proposed funding of $34.68 million for enhancement of public examination operations will be used to acquire, including the necessary installation and testing, a variety of equipment to improve the supervision of public examination operations including notebook computers, web/video cameras, barcode scanners, audio cards for computers and security equipment.

29.   The recurrent consequences arising from the above IT infrastructure will be fully borne by HKEAA.

30.   There may be additional funding requirements for accommodation needs of the onscreen marking centre(s). We will set out the costs when seeking funding approval from the Finance Committee.

31.   We will seek Members' views when the timing is more mature to assess the requirements for the HKDSE systems.

Monitoring the use of the Grant

32.   HKEAA is aware of the importance of introducing changes to systems in a careful and controlled manner, with proper testing of any changes before full implementation. In addition, it is sensitive to the impact of these proposed changes on the thousand of teachers and other personnel who assist in the examination process, including the more than 5,000 markers and a similar number of centre supervisors and invigilators. To ensure quality and smooth execution of the measures, HKEAA Council has approved –

- The setting up of a new Information Technology Committee ("ITC") to advise on and monitor IT matters, which will include the proposed measures.

- The restructuring of HKEAA's Information Systems and Services Division (ISD) with a view to enhancing the supervision and monitoring, as well as the necessary checks and balances in ISD. In particular, the development and operations functions will be segregated and the management structure of the division realigned to support the segregation.

- The establishment of a Quality Assurance Unit, that will bring together the current, dispersed quality assurance, internal audit and risk management functions to provide more effective check and balance, and will report directly to the Secretary General of HKEAA.

33.   In order to ensure smooth implementation of the improvement measures, the Secretariat will strengthen its staff development strategies starting 2005/06. Staff development programmes on (a) refresher training for IT staff; (b) sensitivity training; (c) incident management; (d) refresher training on security and confidentiality protocols; (e) management training; and (f) new staff induction will be organized. A strengthened training policy for the enforcement of procedures and security protocols has been put in place.

34.   In addition to the renewed effort on staff development, HKEAA will strictly enforce the procedures for incident management, with the built-in elements of authorization, verification, documentation and reporting. HKEAA will cultivate a more collaborative environment with closer communications at both the management and operation levels in the ISD, so as to efficiently deliver the proposed measures.

35.   The monitoring work will be conducted under the existing governance structure, that is, the HKEAA Council and its ITC and Finance and Audit Committee (F&AC). The ITC will scrutinize and monitor the planning and delivery of the proposed measures whereas the F&AC will monitor the use of the proposed grant. The Council will monitor the overall implementation from a strategic and macro perspective.   HKEAA will keep separate accounts for the transactions relating to the grant and return to the Government any surplus after the completion of the proposed measures.

36.   In respect of the Government's role of monitoring, EMB is represented on the Council and the two committees. HKEAA is required to submit its annual estimates of income and expenditure and programme of its proposed activities to the Administration for approval, and to table its annual audited accounts and report of activities at the Legislative Council every year, under the HKEAA Ordinance (Cap. 261).

The Way Forward

37.   Subject to Members' comments, we plan to submit the funding proposal to the Finance Committee for approval.

Education and Manpower Bureau
November 2005

Enclosure 1:   Implementation Schedule of the Proposed Measures

		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
A	***Modernization and development of IT infrastructure***						
A1	Replacement of computer hardware and peripheral	▓	▓	▓	▓		
A2	Replacement of computer software	▓	▓	▓	▓		
A3	Improvement of data centres	▓	▓	▓	▓		
A4	System migration and data conversion	▓	▓	▓	▓		
A5	System enhancements	▓	▓	▓	▓		
B	***Centralised onscreen marking centre(s)***						
B1	Installation and testing of IT hardware and software		▓				
B2	Scanning operation and related work for 2006 public exams	▓	▓				
C	***Enhancement of the security and supervision of public examination operations***						
C1	PC/Notebook computers ready for use at exam venues		▓				
C2	Video/web cameras ready for use at exam venues		▓				
C3	Barcode scanners ready for use at exam venues		▓				
C4	Audio cards in PC/Notebook computers ready for recording oral assessments		▓				
C5	Installation of CCTV and access control systems at secure storerooms	▓					
C6	Installation of RFID antennas/readers at secure storerooms	▓					
C7	Installation and testing	▓	▓				