ITEM FOR FINANCE COMMITTEE

HEAD 156 – GOVERNMENT SECRETARIAT :
EDUCATION BUREAU
Subhead 950 Hong Kong Examinations and Assessment Authority
New Item "Development of the Hong Kong Diploma of Secondary Education
Examination system"

> Members are invited to approve a capital grant of $152.309 million for the Hong Kong Examinations and Assessment Authority to develop the Hong Kong Diploma of Secondary Education Examination system and upgrade its hardware and software facilities to support the delivery of the new public examination.

PROBLEM

The Hong Kong Examinations and Assessment Authority (HKEAA) needs funding to develop the new Hong Kong Diploma of Secondary Education (HKDSE) Examination system as well as to upgrade its existing hardware and software facilities for the delivery of the new public examination.

PROPOSAL

2.   The Secretary for Education proposes to create a new commitment for the purpose of providing a capital grant of $152.309 million to HKEAA for –

(a)   the development of the HKDSE Examination system with enhanced systems hardware and software;

(b)   the upgrading of hardware and software for the Onscreen Marking (OSM), Examination Personnel Management (EPM) and oral examination recording systems; and

(c)   the installation of FM radio signal repeaters at 67 examination centres.

JUSTIFICATION

Need to develop the HKDSE Examination system

3.   At present, HKEAA has two examination computer systems, one for Hong Kong Certificate of Education Examination (HKCEE) and one for Hong Kong Advanced Level Examination (HKALE). The examination systems are made up of batch computer programs that are designed to run in sequence according to different stages of the examination cycle. The programs cover various major tasks throughout the examination cycle, including candidate registration, examination administration, marks processing, results generation, reporting and appeal processing.

4.   As the HKDSE Examination will operate with new requirements significantly different from those of HKCEE and HKALE, it cannot be supported by the above two HKCEE and HKALE systems.   Major differences between the requirements for the HKDSE Examination and those of HKCEE / HKALE are as follows –

(a)   candidate registration – both the HKCEE and HKALE systems adopt a uniform approach in handling registration of different subject entries. For the New Senior Secondary (NSS) curriculum supported by the HKDSE Examination, apart from the 24 NSS subjects, there are also Applied Learning (ApL) and Other Languages subjects. Each candidate may select up to eight subjects, consisting of four core NSS subjects plus four elective subjects from any of the above three categories.   As there can be numerous combinations of examination subjects, the HKDSE Examination system needs to develop an entirely new data structure for defining candidates' profile;

(b)   School-Based Assessment (SBA) – while only some HKCEE and HKALE subjects have adopted SBA, SBA will apply to almost all subjects for the HKDSE Examination incrementally from 2012. The HKDSE Examination system therefore needs to cater for the SBA requirements which vary from subject to subject. It should be equipped with software capable of supporting subject-specific SBA requirements and accommodating a wider range of subjects;

(c)   Applied Learning – at present, there are no ApL subjects in HKCEE and HKALE. Candidates may enroll on ApL subjects for HKDSE Examination.   Course providers of ApL subjects will provide HKEAA with the marks of these candidates in batches. The HKDSE Examination system should be designed and developed with a new function that can support the processing of ApL marks received from course providers;

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(d)   multimedia course work of ApL and SBA – the HKDSE Examination system needs to capture, process and store multimedia course work submitted by ApL course providers and schools for moderation and grading purposes;

(e)   marks processing and grading – unlike the HKCEE and HKALE, the HKDSE Examination will adopt the standards-referenced reporting system for NSS subjects (using levels of performance). In addition, other reporting systems will be adopted for ApL subjects (using 'Attained' and 'Attained with distinction') and Other Languages subjects (using grades A to E). The HKDSE Examination system should therefore be capable of supporting the introduction of these new reporting systems; and

(f)   statistical modeling, analysis and reporting – the HKDSE Examination will apply new statistical models to process marks in the standards-referenced grading process.

5.   The HKDSE Examination system should also be designed with other essential functions to support the effective administration of the HKDSE Examination.   These include examination session and centre allocation, examination personnel management, script tracking and reporting, complaint and irregularities management, and appeal case management.   A synopsis of the functions that the HKDSE Examination system has to perform is set out in Enclosure 1.

Encl. 1

6.   We have considered the option of modifying or enhancing the existing HKCEE and HKALE systems to cater for the above new requirements but concluded that this option is neither technically feasible nor cost effective. In terms of system architecture (hardware and software), the existing HKCEE and HKALE systems are one to two generations away from the latest system architecture. For instance, the host-based HKALE system is an old information technology (IT) architecture, with a central computer processing all the tasks in a centralised manner and users getting access to the system through dump terminals. The client server-based HKCEE system is one generation from the current web-based system architecture, with a central server and personal computers at user end. As vendors no longer support the redevelopment of the application software built on the architecture of these two systems, the only viable technical option available to HKEAA is to develop the HKDSE Examination system on the latest web technology platform. In addition, in meeting the needs of the rapidly changing environment, the new generation of application software has to be run on more powerful computers with larger data storage capacity. However, the hardware of

both the HKCEE and HKALE systems is too slow in processing speed and too small in capacity to properly and efficiently accommodate the needs of new generation software. The HKDSE Examination system has to be developed with new hardware with stronger processing power in order to sustain its performance and stability in running new generation software.

7. Moreover, since there will be simultaneous administration of HKCEE / HKALE and HKDSE Examination in 2011, 2012 and 2013 (please see the table below), it would not be possible to enhance the current systems for the HKDSE Examination without affecting the operation of the HKCEE / HKALE. In view of the foregoing, there is a need to develop a new HKDSE Examination system.

	2010	**2011**	**2012**	**2013**
HKCEE	Last offer	For private candidates (including repeaters)	-	-
HKALE	Third last offer	Second last offer	Last offer	For private candidates (including repeaters)
HKDSE Examination	-	Submission of SBA and ApL marks; Candidate registration	First offer	Second offer, with increasing subjects with SBA

Need to upgrade the systems hardware and software for OSM, EPM and oral examination recording systems

8. HKEAA introduced onscreen marking in 2007 with the support of the OSM system. The existing OSM system allows for scanning of paper-based scripts, online booking of onscreen marking centres by markers and onscreen marking of scanned scripts. It is built with the interface to operate with HKCEE, HKALE, Territory-wide System Assessment (TSA) and Language Proficiency Assessment for Teachers (LPAT) systems. The existing hardware of the OSM system can cater for 30 subjects only (HKCEE, HKALE, TSA and LPAT together). The hardware of the OSM system needs to be strengthened to process 34 subjects and provide for more double marking after the launch of the HKDSE Examination. Moreover, in 2012 and 2013 when HKALE and HKDSE Examination will both be conducted, the number of subjects will exceed 40.

9. The existing EPM system processes recruitment as well as assignment of, and payment to, examination personnel, including markers and invigilators. Its hardware capacity needs to be enhanced to support a growing database of examination personnel expected under the HKDSE Examination.

10.	In addition to their hardware facilities, the software of the OSM and EPM systems would also need to be upgraded and enhanced to cope with the additional functions required for the HKDSE Examination (such as processing item marks in greater details, nomination of invigilators and centre supervisors by schools) and to integrate with the HKDSE Examination system.

11.	The oral examination recording system aims to produce a more prudent and fairer oral examination, and to handle appeals from candidates. It has been implemented in some local examinations and HKEAA plans to extend it to public examinations. Furthermore, due to the tight examination time schedule and the overlapping of the examination period for the HKALE and HKDSE in 2012 and 2013, more centres will be required for conducting the oral examination of both HKALE and HKDSE. Additional hardware is hence required for the oral examination recording system to cater for the extension of the recording system to public examinations and the provision of more examination centres during the overlapping period as explained above.

Need to address the problem of unclear signal of radio broadcast listening examinations

12.	The listening examinations of Chinese Language and English Language subjects of the HKCEE and HKALE are broadcast on Radio Television Hong Kong Radio 2. Candidates are required to bring their own FM radios with earphones to the examination centres. In identifying suitable examination centres for listening examinations, HKEAA needs to ensure that there is an adequate number of examination centres located throughout Hong Kong to accommodate reasonable accessibility for candidates, that the radio signal reception of the centres is of acceptable quality, and that disturbance to school lessons / activities is kept to the minimum.

13.	At present, the number of school halls of participating schools in HKCEE with acceptable quality of radio signal reception for conducting listening examination is not sufficient to cater for the candidature size. Taking the 2008 HKCEE English Language subject as an example, the number of school halls required for the 105 500 candidates was 522, while there were only 349 school halls with acceptable quality of radio signal reception for conducting listening examination. As not all the 349 schools could release their halls for the examination on the day in question due to various reasons, 114 schools, apart from releasing their school halls, had to be closed to provide other rooms for the examination, resulting in disruption to the lessons / activities of these schools which is undesirable.

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14.   We estimate that there will be about 80 000 candidates in the 2012 HKDSE Examination, requiring about 400 school halls. Projecting the candidature size beyond 2012 and using 2015 as an example, the number of halls required will be increased to 447. Even assuming that all the above 349 school halls with acceptable radio signal reception quality can be made available, there still remains a shortfall of 51 and 98 halls in 2012 and 2015 respectively. To minimise the number of schools to be closed and the disturbance caused to the school lessons / activities, we see a need to expand the pool of examination centres by improving the radio signal reception quality of 67 school halls which are rated as "poor" or "very poor" in radio signal reception quality and not used as listening examination centres. We therefore propose to install FM radio signal repeaters[Note] in these 67 schools. HKEAA will continue to work closely with the school sector to gauge their support in providing school halls, other suitable multi-purpose halls, and classrooms if necessary, for the examination. Depending on the time required for the purchase and installation of the equipment, HKEAA may be able to advance the installation for use in HKCEE without the need to wait for the launch of the HKDSE Examination.

15.   We have considered the alternative of using other venues (such as community centres, premises under the management of the Leisure and Cultural Services Department and lecture halls or gymnasiums in tertiary institutions) for conducting listening examinations but the option is considered not feasible. It will be difficult, if not impossible, to hire sufficient halls in the desired locations and with the required radio signal reception quality on a single day. The need for paying hiring charges for these venues in accordance with the applicable charging policies may also not be cost effective as compared with the proposed one-off investment. Apart from the above, the deployment of school teachers to serve as centre supervisors / invigilators at outside venues may not be desirable for the school administration.

/**BENEFITS** .....

[Note]   FM radio signal repeater is a combination of a radio receiver, amplifier and transmitter that receives a weak or low-level signal, amplifies and then transmits it at a higher level or higher power. The receiver will be installed at the roof top of the examination centres and the radio transmitter be installed at the examination halls so that the radio signal received will be amplified and relayed to the examination halls. The radio transmitter will also be configured to eliminate blind spots. Clear reception of radio signal will be ensured, thus facilitating a fairer listening examination.

BENEFITS

Development of the HKDSE Examination system

16.　　　　As explained in paragraphs 3 – 7 above, we consider it operationally necessary to develop a new HKDSE Examination system with stronger processing power and larger storage capacity, in order to deliver the requirements of the HKDSE Examination. The development of a new system based on an improved workflow of the examination cycle and tasks as well as the latest technology will also bring about added benefits including the availability of online registration. The use of web-based technology will allow online services through the Internet. In future, candidate registration and SBA marks submission can be carried out online, thereby saving efforts in manual data input and checking, and contributing to improved efficiency and accuracy.

Hardware and software upgrade for the existing OSM, EPM and oral examination recording systems

17.　　　　As explained in paragraphs 8 – 11 above, the hardware and software upgrade for the above three systems will enable the full implementation of onscreen marking under the HKDSE Examination, support an expanding database of examination personnel and enhance fairness of the oral examination.

Installation of FM radio signal repeaters at examination centres

18.　　　　As explained in paragraphs 12 – 15 above, the installation of FM radio signal repeaters at 67 schools will increase the supply of schools with acceptable quality of radio signal reception as listening examination centres, taking into account the need to provide a sufficient territorial spread of examination centres and to minimise disruption of school teaching and activities.

FINANCIAL IMPLICATIONS

Non-recurrent expenditure

19.　　　　Subject to Members' approval, we will provide a capital grant of $152.309 million for HKEAA to implement the project. The funding will be provided to HKEAA on a reimbursement basis. A breakdown of the capital grant is set out below –

/**Project** .....

	Project items	Estimated cost ($ million)	
(I)	**Development of the HKDSE Examination system**		**110.369**
(A)	System design and implementation services	64.475	
(B)	Hardware	20.798	
(C)	Software	25.096	
(II)	**Hardware and software upgrade for existing systems**		**30.885**
(A)	OSM system	27.379	
(B)	EPM system	2.019	
(C)	Oral examination recording system	1.487	
(III)	**Installation of FM radio signal repeaters at examination centres**		**11.055**
	Total		**152.309**

20.   On item I(A) above, the estimate of $64.475 million is for the acquisition of services provided by external service providers and contract staff to deliver the HKDSE Examination system. The services include system analysis and design, application development, system integration, system monitoring, tuning, installation, testing, training, and other implementation related services.

21.   On item I(B) above, the estimate of $20.798 million is for the acquisition of hardware to deliver the HKDSE Examination system. The hardware includes various types of servers (database, application, web etc.), storage, network and security equipment (firewalls, routers etc.), system backup, workstations, printers, and other peripherals.

22.   On item I(C) above, the estimate of $25.096 million is for the acquisition of software to deliver the HKDSE Examination system. The software includes various development tools, different types of server software (database, application, web etc.), system operating software, and database management system.

23.   On item II(A) above, the estimate of $27.379 million is for the acquisition of hardware and software for the OSM system, including system licenses, various servers, as well as storage, network and security devices.

24.   On item II(B) above, the estimate of the estimate of $2.019 million is for the acquisition of hardware and software for the EPM system.

25.   On item II(C) above, the estimate of $1.487 million is for the acquisition and installation of 186 sets of oral recording equipment.

26.   On item III above, the estimate of $11.055 million is for the acquisition and installation of FM radio signal repeaters for 67 examination centres.

27.   The projected cash flow is set out below –

Financial year	Cash flow ($ million)
2009-10	26.163
2010-11	61.190
2011-12	48.261
2012-13	14.518
2013-14	2.177
Total	**152.309**

Encl. 2   A further breakdown of the above estimates, together with the projected cash flow, is set out in Enclosure 2.

28.   Subject to Members' agreement, we will include relevant provisions in the annual Estimates of the respective years.

Recurrent expenditure

29.   The project will entail annual recurrent costs of $17.440 million, which will be partly offset by recurrent savings of $7.894 million per annum in incidentals such as the maintenance costs of the existing systems, and efficiency gain from saving in overtime and temporary staff costs, etc. The net additional recurrent costs of $9.546 million will be fully borne by HKEAA.

/IMPLEMENTATION .....

IMPLEMENTATION PLAN

30.　　　To ensure timely delivery of the HKDSE Examination system in 2012, HKEAA plans to invite tenders for the project in the first quarter of 2009 so that the system development work can start no later than the third quarter of 2009.

31.　　　The examination cycle of the first HKDSE Examination in 2012 will start in the third quarter of 2011 with submission of SBA marks and candidate registration. This will be followed by subject examinations, onscreen marking, processing of marks and grading of results for release in the third quarter of 2012. The cycle will end after completion of appeal reviews by the end of the third quarter of 2012. HKEAA will fine tune the system and address any run-in issues in the light of operational experience gained from implementing the HKDSE Examination system. This fine-tuning process may take about two to three years. The critical deliverables and the delivery dates are set out in the table below –

		Deliverables
1.	Third quarter of 2011	Completion of the SBA sub-system for capturing SBA marks. Completion of the candidate registration sub-system for capturing and processing registration data.
2.	Fourth quarter of 2011	Completion of upgrading and testing of OSM and EPM systems for full scale onscreen marking of HKDSE Examination scripts.
3.	First quarter of 2012	Completion of installation and testing of FM radio signal repeaters at examination centres.
4.	Second quarter of 2012	Completion of marks processing and results grading sub-systems to capture and process raw marks for results grading using the standards-referenced reporting approach.
5.	Third quarter of 2012	Completion of the sub-systems for supporting the release of results and appeal reviews for 2012 HKDSE Examination.
6.	Fourth quarter of 2015	Completion of fine-tuning of the system, and of addressing any run-in issues, based on experience from implementing the HKDSE Examination system.

32.	To implement the HKDSE Examination system successfully, HKEAA will ensure that both the internal staff and the external examination personnel and stakeholders (including teachers, centre supervisors and invigilators, markers and other personnel) are well informed and trained on their roles. HKEAA will launch publicity for the change, and hold briefing sessions for examination personnel and stakeholders.

33.	HKEAA is aware of the importance of ensuring smooth implementation of the new HKDSE Examination system, and will conduct proper testing of the system before full implementation. In carrying out the migration plan, if any, HKEAA will ensure that all data stored in existing computer systems will be removed by means of de-magnetisation and the hard disks physically destroyed before they are disposed of. HKEAA will ensure that these physically destroyed hard disks and other unserviceable microcomputers and accessories such as printers, monitors, routers and modems will be disposed of in accordance with the relevant government procedures.

Encl. 3
34.	A detailed implementation schedule for the project is set out in Enclosure 3.

MONITORING THE IMPLEMENTATION OF THE PROJECT

35.	The existing governance structure (i.e. HKEAA Council, its Information Technology Committee (ITC) and Finance and Audit Committee (F&AC)) will play significant roles in monitoring the implementation of the project. HKEAA Council will supervise the proposed project from a strategic and macro perspective. The ITC will form a Steering Committee, to be chaired by the Chairman of HKEAA with representative(s) from the Education Bureau (EDB), to monitor the planning and delivery of the proposed project, whereas the F&AC will monitor the use of the proposed grant. HKEAA will keep separate accounts for the transactions relating to the grant.

36.	In respect of the Government's general monitoring role, EDB is represented on the HKEAA Council and its committees. HKEAA is also 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 (LegCo) every year, under the Hong Kong Examinations and Assessment Authority Ordinance (Cap. 261). As regards specific monitoring of the use of the proposed grant and the progress of the project, the Government will, apart from being represented on the Steering Committee, require HKEAA to report to it on a regular basis.

PREVIOUS FUNDING PROVIDED TO HKEAA

37.   In recent years, with the approval of the Finance Committee (FC), HKEAA has been provided with $136.7 million to support its assessment development and research activities (the AD&R Grant) and $198.87 million to support the modernisation and development of its examination systems (the IT Modernisation Grant). These two grants are intended for distinct purposes and do not overlap with the current funding proposal to develop the HKDSE Examination system.

38.   The AD&R Grant approved vide FCR(2003-04)65 on 27 February 2004 provides funding for HKEAA to enhance its assessment development and research activities with a view to revamping our public examination and assessment system amongst other things. The original implementation schedule for activities funded by the grant was up to 2009. The Administration has been providing this Committee with annual reports on the progress of the use of this grant. As mentioned in the last such report vide FCRI(2008-09)6 of July 2008, the use of the grant will be extended beyond the original five-year period. Latest estimate from HKEAA is that the grant will be used up to at least the 2011/12 school year to cater for the development of the NSS curriculum and assessment, as well as the application of the NSS assessment methodologies to the new HKDSE Examination to be implemented in 2012. The main revision of schedule lies in the areas of the preparation of subject materials for standards-referenced reporting and the implementation of SBA. HKEAA has already developed and implemented the standards-referenced reporting and SBA methodologies for the 2007 and 2008 HKCEE Chinese Language and English Language subjects. These methodologies will be adopted in the HKDSE Examination.

39.   The IT Modernisation Grant approved vide FCR(2005-06)33 on 2 December 2005 is to support HKEAA's modernisation of its outdated IT infrastructure and highly manual examination processes. Out of the $198.87 million, $136.2 million was for introducing centralised onscreen marking and enhancing security and supervision of public examination operations. The remaining $62.67 million was for modernising HKEAA's IT infrastructure and systems. Using these resources, HKEAA has developed an IT infrastructure that includes two data centres with mutual back up, and networking with failover capability. This IT infrastructure has paved way for accommodating the HKDSE Examination system. All the above improvement measures will continue to be used upon the introduction of the HKDSE Examination, and only minimal part of the Grant has been spent on improving the HKCEE and HKALE systems so that they can sustain continuous operation until the HKCEE / HKALE come to an end (please see paragraph 7 above).

/**PUBLIC** .....

PUBLIC CONSULTATION

40.   We consulted the LegCo Panel on Education on the proposed project at its meeting on 8 December 2008. Members supported the rationale and need for the project, but asked for further information on the cost-benefit analysis for the proposed installation of FM radio signal repeaters and any alternatives considered, usage of the AD&R Grant and the IT Modernisation Grant and detailed cost breakdown of the proposed project. We have provided the Panel with the required information, which is also incorporated in this paper.

BACKGROUND

41.   HKEAA is a statutory body established in 1977 under the Hong Kong Examinations and Assessment Authority Ordinance (Cap. 261). Its statutory responsibility is to conduct the two existing public examinations (namely the HKCEE and the HKALE) and the new HKDSE Examination. It also runs a number of other assessments including the TSA, LPAT, and a range of professional and international examinations (such as the General Certificate of Education Examinations, and the Test of English as a Foreign Language). HKEAA operates on a self-financing basis and does not receive recurrent subvention from the Government.

42.   Under the new academic structure to be implemented starting with the first cohort proceeding to Secondary 4 in the 2009/10 school year, the HKDSE Examination will replace the existing HKCEE and the HKALE. When seeking funding approval from the FC on 2 December 2005 vide FCR(2005-06)33 for the modernisation of HKEAA's outdated IT infrastructure and examination systems, we indicated that we would need to seek additional funding for implementing measures necessary for the HKDSE under the new academic structure in due course.

Education Bureau
January 2009

**Synopsis of the functions of
the proposed new HKDSE Examination system**

Examination operations

1. Candidate registration

This function captures and consolidates registration data of school and private candidates (such as personal particulars and subject entries from various sources, including the Web-based School Administration and Management System of the Education Bureau and self-made applications). It performs validation checks to ensure data accuracy, and reports invalid entries for follow up and amendment. It then calculates examination fee for and generates demand note to each candidate, captures payment data, and performs validation checks. It also generates correspondences to schools and candidates, and produces entry statistics for subsequent tasks in the examination workflow.

2. School-Based Assessment processing

This function captures each candidate's School-Based Assessment (SBA) marks, and performs validation checks and marks moderation. The moderation caters for the SBA requirements that vary from subject to subject and the moderated SBA marks will be used in the subsequent Marks Processing and Grading function (please see paragraph 7 below). This function also generates correspondences to schools and candidates, and produces school / class SBA statistics.

3. Examination session and centre allocation

This function produces the examination table, allocates candidates to examination centres and sessions, prints out the admission forms, estimates amount of resources / materials required (e.g. question papers, answer books), prints out labels and forms for the examination logistics, calculates the charges for using the examination centres, generates correspondences to schools and candidates, and provides examination information such as timetable and centre location to parties concerned (e.g. schools and relevant government departments).

In performing the above tasks, this function needs to capture from various sources a wide range of information, such as the capacity and conditions of school halls and classrooms, as well as candidates' preference of centre locations and their special needs for examination arrangement. Based on the information so collected, it develops solutions to meet the requirements of various deliverables (e.g. deriving the requirements of oral examinations including minimum group size and male / female ratio).

4. Examination personnel management

This function estimates the requirements for different types of examination personnel (e.g. examination centre supervisors, invigilators, markers, etc), and consolidates the attendance as well as performance information of the examination personnel. It then passes the requirements and the past attendance and performance information to the Examination Personnel Management System (through an interface) which processes the recruitment as well as assignment of, and payment to, the examination personnel.

5. Script tracking and reporting

This function validates the number of answer scripts collected from examination centres against the number of scripts scanned, and the latter against the attendance records to identify any discrepancy timely in order to increase the chance of locating any missing script.   It also generates validation reports and correspondences to schools / candidates for any discrepancy which needs to be drawn to schools / candidates' attention.

6. Applied Learning assessment processing

This function captures candidates' Applied Learning (ApL) entry data such as course information and providers. It captures each candidate's ApL marks, and validates his marks and information against his registration details.   It then moderates the ApL marks for subsequent grading and reporting of ApL results in the Marks Processing and Grading function (please see paragraph 7 below). It also generates correspondences to course providers, schools and candidates, and produces ApL statistics.

7. Marks processing and grading

This function performs marks processing and grading for all subjects.

For the 24 New Senior Secondary (NSS) subjects, the function processes marks captured from multiple-choice papers, written papers, listening and oral examinations, and performs moderation of the SBA marks. In the process, marks are weighted and adjusted by applying statistical models. This function generates results using the standards-referenced approach and reports the results by five levels of performance from level 1 to level 5 (the highest level with 5** to indicate those with the best performance and 5* to indicate the next top group).

For ApL subjects, this function captures candidates' marks submitted by ApL course providers, performs moderation of the marks, and reports results as "Unattained", "Attained" or "Attained with distinction".

For Other Languages subjects, this function captures candidates' results graded by the Cambridge International Examinations, and reports the results by grades from A to E.

8.   Certificate processing and printing

This function reports examination results in different ways / formats for NSS, ApL and Other Languages subjects, prints HKDSE Examination result notices and certificates, and allows retrieval of examination results for printing documents such as Statement of Results and Certification of Results as a service to candidates.

9.   Statistical modeling, analysis and reporting

This function produces examination entry and results statistics, comparison of results between years and other statistics / reports for various purposes such as the publication of the examination report. It applies statistical models to process marks and maintain the comparability of standards between subjects and years under the standards-referenced approach.

Examination services

10. Complaint and irregularities management

This function captures all evidence collected, and records the investigation and course of action taken for reported complaints and irregularities. It then provides consolidated information to facilitate the committee(s) concerned in making decisions, records the decisions made and performs marks / grade adjustment accordingly.

11. Appeal case management

This function captures all "appeal cases" and manages the workflow of processing these cases. It triggers the processes of re-marking and checking the marks of re-marking against a set of upgrade criteria, presents the cases to the committee(s) concerned to consider whether an upgrade is to be awarded, and records the decisions made. If an upgrade is considered justified, it will adjust marks / grade, update educational institutions concerned on the upgraded subject grade of individual candidate, and re-print results notices. This function also captures all "appeal review cases" (for candidates dissatisfied with the decision on complaints / irregularities concerned or aggrieved with the appeal process) and manages the workflow of processing these cases.

**Estimated expenditure and cash flow for the development of
the Hong Kong Diploma of Secondary Education (HKDSE) Examination System**

	Project items	Total estimated expenditure ($'000)	Financial year				
			2009-10 ($'000)	2010-11 ($'000)	2011-12 ($'000)	2012-13 ($'000)	2013-14 ($'000)
(I)	**Development of the HKDSE Examination system**						
(A)	**System design and implementation services**						
(1)	**Examination operations**						
(a)	Candidate registration	21,222	1,291	9,315	9,282	1,183	151
(b)	School-Based Assessment processing	7,439	452	3,779	3,048	107	53
(c)	Examination session and centre allocation	3,566	217	1,332	1,940	51	26
(d)	Examination personnel management	6,616	402	2,471	3,601	95	47
(e)	Script tracking and reporting	1,960	119	732	1,067	28	14
(f)	Applied Learning assessment processing	3,719	226	1,430	1,983	53	27
(g)	Marks processing and grading	8,578	522	1,797	3,964	2,233	62
(h)	Certificate processing and printing	795	48	16	292	433	6
(i)	Statistical modeling, analysis and reporting	1,546	72	24	17	17	1,416
	Subtotal for (A)(1):	**55,441**	**3,349**	**20,896**	**25,194**	**4,200**	**1,802**
(2)	**Examination services**						
(a)	Complaint and irregularities management	3,492	212	71	1,284	1,900	25
(b)	Appeal case management	3,788	230	77	1,412	2,042	27
	Subtotal for (A)(2):	**7,280**	**442**	**148**	**2,696**	**3,942**	**52**
(3)	**Training**	1,754	107	242	541	541	323
	Subtotal for (A)(3):	**1,754**	**107**	**242**	**541**	**541**	**323**
	Subtotal for (A):	**64,475**	**3,898**	**21,286**	**28,431**	**8,683**	**2,177**

	Project items	Total estimated expenditure ($'000)	Financial year				
			2009-10 ($'000)	2010-11 ($'000)	2011-12 ($'000)	2012-13 ($'000)	2013-14 ($'000)
(B)	**Hardware**	**20,798**	**9,717**	**9,717**	**546**	**818**	**0**
(C)	**Software**	**25,096**	**12,548**	**12,548**	**0**	**0**	**0**
	Subtotal for (I):	**110,369**	**26,163**	**43,551**	**28,977**	**9,501**	**2,177**
(II)	**Hardware and software upgrade for existing systems**						
(A)	**Onscreen Marking system**	27,379	0	16,428	10,951	0	0
(B)	**Examination Personnel Management system**	2,019	0	1,211	808	0	0
(C)	**Oral examination recording system**	1,487	0	0	892	595	0
	Subtotal for (II):	**30,885**	**0**	**17,639**	**12,651**	**595**	**0**
(III)	**Installation of FM radio signal repeaters at examination centres**	11,055	0	0	6,633	4,422	0
	Subtotal for (III):	**11,055**	**0**	**0**	**6,633**	**4,422**	**0**
	Grand total:	**152,309**	**26,163**	**61,190**	**48,261**	**14,518**	**2,177**

Implementation schedule of the development of the Hong Kong Diploma of Secondary Education Examination (HKDSE) system

	Items	2009 Q1	Q2	Q3	Q4	2010 Q1	Q2	Q3	Q4	2011 Q1	Q2	Q3	Q4	2012 Q1	Q2	Q3	Q4	2013 Q1	Q2	Q3	Q4	2014 Q1	Q2	Q3	Q4	2015 Q1	Q2	Q3	Q4
(I)	**Development of the HKDSE Examination system**																												
(A)	**System design and implementation services**																												
(1)	**Examination operations**																												
(a)	Candidate registration			X	X	X	X	X	X	X	X	X	X																
(b)	School-Based Assessment processing			X	X	X	X	X	X	X	X	X	X																
(c)	Examination session and centre allocation			X	X	X	X	X	X	X	X	X	X																
(d)	Examination personnel management			X	X	X	X	X	X	X	X	X	X																
(e)	Script tracking and reporting			X	X	X	X	X	X	X	X	X	X																
(f)	Applied Learning assessment processing			X	X	X	X	X	X	X	X	X	X																
(g)	Marks processing and grading			X	X	X	X	X	X	X	X	X	X	X															
(h)	Certificate processing and printing			X	X	X	X	X	X	X	X	X	X																
(i)	Statistical modeling, analysis and reporting										X	X	X																
(2)	**Examination services**																												
(a)	Complaint and irregularities management													X	X	X	X												
(b)	Appeal case management													X	X	X	X												
(3)	**Training**					X				X	X	X					X	X		X									
(4)	**Post-implementation fine-tuning**																	X	X	X	X	X	X	X	X	X	X	X	X
(II)	**Hardware and software upgrade for existing systems**																												
(A)	**Onscreen Marking system**									X	X	X	X																
(B)	**Examination Personnel Management system**									X	X	X	X																
(C)	**Oral examination recording system**													X	X	X													
(III)	**Installation of FM radio signal repeaters at examination centres**													X	X	X													