

8.11 Cost Estimation of Educational Equipment for Proposed Projects

Educational equipment with their cost estimation is listed as follows:

Table A-8.11.1 Equipment list for pilot programs

Table A-8.11.2 Equipment list for editing, printing and bookbinding for textbooks

Table A-8.11.3 Equipment list for audio-visual for production system

Table A-8.11.4 Equipment list for audio-visual for multi media classroom

Table A-8.11.5 Equipment list for audio-visual for library (and local learning centers)

Table A-8.11.1 Equipment List for Pilot Programs

1. Hospitality and Tourism		¥/US 110			
No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Multimedia PC	300,000	2,727	10	27,273
2	Software	200,000	1,818	10	18,182
3	Printer	200,000	1,818	3	5,455
4	Projector for teaching	1,500,000	13,636	1	13,636
5	Handy Video Camera	500,000	4,545	5	22,727
6	VTR	100,000	909	5	4,545
7	Other supplementary equipment	1,000,000	9,091	1	9,091
	Sub-total				100,909

2. Information Technology & communications

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Multimedia PC	300,000	2,727	84	229,091
2	Software	300,000	2,727	84	229,091
3	Printer	200,000	1,818	4	7,273
4	Projector for teaching	1,500,000	13,636	4	54,545
5	Equipment for LAN	1,500,000	13,636	1	13,636
6	Server Equipment	2,000,000	18,182	1	18,182
7	Internet connectivity	2,400,000	21,818	1	21,818
8	Other supplementary equipment	1,000,000	9,091	1	9,091
	Sub-total				582,727

3. Business IT

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Multimedia PC	300,000	2,727	42	114,545
2	Software	200,000	1,818	42	76,364
3	Printer	200,000	1,818	2	3,636
4	Equipment for LAN	1,500,000	13,636	1	13,636
5	Server Equipment	2,000,000	18,182	1	18,182
6	Internet connectivity	2,400,000	21,818	1	21,818
7	Other supplementary equipment	1,000,000	9,091	1	9,091
	Sub-total				257,273

4. Wood processing technology

4.1 Kiln drying

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Steam type Dry Kiln	25,000,000	227,273	1	227,273
2	Vacuum Dry Oven	500,000	4,545	1	4,545
3	Electric oven	300,000	2,727	2	5,455
4	Vacuum pump	120,000	1,091	2	2,182
5	Electric thermo-hygrometer with recorder	350,000	3,182	2	6,364
6	Digital thermo-hygrometer with recorder	150,000	1,364	2	2,727
7	Thermal-couple set	150,000	1,364	2	2,727
8	Thermal anemometer	200,000	1,818	2	3,636
9	Portable colorimeter	350,000	3,182	5	15,909
10	Refrigerator	200,000	1,818	1	1,818
11	Wood moisture tester	200,000	1,818	2	3,636
12	Electronic balance	150,000	1,364	2	2,727
13	Top loading balance	50,000	455	2	909
14	pH meter	250,000	2,273	2	4,545
15	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				289,000

4.2 Design of furniture

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total.Cost(US\$)
1	Drafting board (A1 size)	15,000	136	40	5,455
2	Lighting table (A2 size)	50,000	455	3	1,364
3	Drafter (A1 stand, etc.)	300,000	2,727	20	54,545
4	Drawing instrument (20 kinds of compasses)	50,000	455	40	18,182
5	Drawing aid (10 kinds of rulers)	20,000	182	40	7,273
6	Printing apparatus	900,000	8,182	1	8,182
7	Universal duplicator	1,200,000	10,909	1	10,909
8	Cabinet for drawing (A1 size)	200,000	1,818	1	1,818
9	CAD/CAM system				
	9-1 Personal computer system	350,000	3,182	5	15,909
	9-2 Software (AutoCAD, etc.)	300,000	2,727	5	13,636
	9-3 Printer (A3 size)	350,000	3,182	5	15,909
10	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				157,727

4.3 Pattern development

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Planer	1,500,000	13,636	1	13,636
2	Band sawing machine	750,000	6,818	1	6,818
3	Universal circular saw bench	1,200,000	10,909	1	10,909
4	Chisel mortiser	1,000,000	9,091	1	9,091
5	Molding machine	2,500,000	22,727	1	22,727
6	Router	2,150,000	19,545	1	19,545
7	Lathe	2,500,000	22,727	1	22,727
8	Dovetail machine	3,250,000	29,545	1	29,545
9	Universal fret saw	450,000	4,091	1	4,091
10	Universal belt sander	950,000	8,636	1	8,636
11	Press	3,000,000	27,273	1	27,273
12	Bench drill	250,000	2,273	2	4,545
13	Bench grinder	80,000	727	2	1,455
14	Universal tool grinder	2,500,000	22,727	1	22,727
15	Portable dust collector	300,000	2,727	2	5,455
16	Portable power router	100,000	909	2	1,818
17	Portable power planer	70,000	636	2	1,273
18	Portable power jig saw	50,000	455	2	909
19	Portable power drill	30,000	273	2	545
20	Set of hand tools for wooden working (plane, chisel, hammer, etc.)	250,000	2,273	10	22,727
21	Setoff measuring tools for wooden working (ruler, caliper, marker, etc)	100,000	909	10	9,091
22	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				250,091

Total (4.1+4.2+4.3)

696,818

5. Post harvest and food processing

5.1 Food processing

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	O-type vacuum seamer	1,200,000	10,909	1	10,909
2	Automatic heating sterilize equipment	10,000,000	90,909	1	90,909
3	Steam generation system equipment	1,000,000	9,091	1	9,091
4	Cooling Tank	40,000	364	1	364
5	Double bottom Caldron	200,000	1,818	2	3,636
6	Balance (1kg)	10,000	91	1	91
7	Balance (100g)	8,000	73	2	145
8	Balance (500g)	10,000	91	1	91
9	Balance (10kg)	10,000	91	1	91
10	Gas range	100,000	909	1	909
11	Vacuum packing machine	1,000,000	9,091	1	9,091
12	Thickness meter	20,000	182	1	182
13	Tension tester	3,500,000	31,818	1	31,818
14	Paper cutting machine	5,000	45	1	45
15	Gas permeation test equipment for film	10,000	91	10	909
16	Sugar ratio meter	40,000	364	1	364
17	Juice extractor	60,000	545	1	545
18	PH meter	200,000	1,818	1	1,818
19	Vacuum can tester	6,000	55	1	55
20	Hand type can tester	12,000	109	1	109
21	Can opener	8,000	73	1	73
22	Micrometer	40,000	364	6	2,182
23	Vernier caliper	5,000	45	3	136
24	Fine saw for metal	4,000	36	1	36
25	Electrical constant temperature drier	300,000	2,727	2	5,455
26	Refrigerator	300,000	2,727	1	2,727
27	Freezer	500,000	4,545	1	4,545
28	Projector	800,000	7,273	1	7,273
29	Electronic thermometer	80,000	727	1	727
30	Electrical furnace	200,000	1,818	1	1,818
31	Electrical artificial incubator	120,000	1,091	2	2,182
32	Electrical fixed temperature geyser	50,000	455	2	909
33	Infrared light moisture meter	100,000	909	1	909
34	Stopwatch	20,000	182	1	182
35	Distillation apparatus	150,000	1,364	1	1,364
36	Direct indication balance for chemical	350,000	3,182	2	6,364
37	Slidacs	20,000	182	2	364
38	Centrifugal separator apparatus	150,000	1,364	1	1,364
39	Other supplementary equipment	1,000,000	9,091	1	9,091
	Sub-total				208,873

5.2 Food packaging

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Mullen's bursting tester	950,000	8,636	1	8,636
2	Bending tester for paper board	2,750,000	25,000	1	25,000
3	Sponge compression tester	350,000	3,182	1	3,182
4	Abrasion fastness tester	700,000	6,364	1	6,364
5	Film welder	1,450,000	13,182	1	13,182
6	Strapping tools	65,000	591	5	2,955
7	Static compression press	8,250,000	75,000	1	75,000
8	Fork lift	4,500,000	40,909	1	40,909
9	Small revolving drum	9,500,000	86,364	1	86,364
10	Elmendorf tearing tester	650,000	5,909	1	5,909
11	Hand burner	15,000	136	5	682
12	Balance (Platform type)	450,000	4,091	2	8,182
13	Thermometer with recorder	300,000	2,727	1	2,727
14	Water penetration meter	1,250,000	11,364	1	11,364
15	Impact resistance tester for film	1,500,000	13,636	1	13,636
16	Cooling water bath	625,000	5,682	1	5,682
17	Water vapour permeability tester	300,000	2,727	1	2,727
18	Film thickness gauge	200,000	1,818	1	1,818
19	Compression tester for corrugate paper board	2,150,000	19,545	1	19,545
20	Other supplementary equipment	800,000	7,273	1	7,273
	Sub-total				341,136

Total (5.1+5.2)

550,009

6. Manufacturing technologies

6.1 Metal works of basic forging

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Anvil (150kg)	150,000	1,364	6	8,182
2	Blacksmith forge (cokes)	500,000	4,545	3	13,636
3	Blacksmith furnace (LPG)	1,500,000	13,636	3	40,909
4	Pneumatic drop hammer	8,500,000	77,273	1	77,273
5	Set of blacksmith 's forging tools	50,000	455	6	2,727
6	Swage block (120kg)	100,000	909	6	5,455
7	Grinding and polishing machine for specimen	1,500,000	13,636	1	13,636
8	Hot mounting press for specimen	750,000	6,818	1	6,818
9	Metallurgical microscope	500,000	4,545	1	4,545
10	Set of standard metal micro structure	300,000	2,727	1	2,727
11	Durometer (universal hardness tester)	300,000	2,727	1	2,727
12	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				183,182

6.2 Well drilling

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	CNC drilling and milling center	9,000,000	81,818	1	81,818
2	Radial drilling machine	6,500,000	59,091	1	59,091
3	Upright drilling machine	2,000,000	18,182	2	36,364
4	Multi-spindle drilling machine	1,500,000	13,636	1	13,636
5	Tapping and drilling machine	750,000	6,818	1	6,818
6	Bench drill	250,000	2,273	3	6,818
7	Drill grinder	3,500,000	31,818	2	63,636
8	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				272,727

6.3 Industrial Design

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Drafting board (A1 size)	15,000	136	40	5,455
2	Lighting table (A2 size)	50,000	455	3	1,364
3	Drafter (A1 stand, etc.)	300,000	2,727	20	54,545
4	Drawing instrument (20 kinds of compasses)	50,000	455	40	18,182
5	Drawing aid (10 kinds of rulers)	20,000	182	40	7,273
6	Printing apparatus	900,000	8,182	1	8,182
7	Universal duplicator	1,200,000	10,909	1	10,909
8	Cabinet for drawing (A1 size)	200,000	1,818	1	1,818
9	CAD/CAM system				
	9-1 Personal computer system	350,000	3,182	5	15,909
	9-2 Software (AutoCAD, etc.)	300,000	2,727	5	13,636
	9-3 Printer (A3 size)	350,000	3,182	5	15,909
10	3D modeling and engraving machine	6,500,000	59,091	1	59,091
11	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				216,818

6.4 Industrial Management

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Personal Computer	300,000	2,727	10	27,273
2	Software	200,000	1,818	10	18,182
3	Printer	200,000	1,818	2	3,636
4	Projector for teaching	1,500,000	13,636	1	13,636
5	Digital VTR and picture monitor	350,000	3,182	2	6,364
6	Digital camera	150,000	1,364	1	1,364
7	Other supplementary equipment	500,000	4,545	1	4,545
	Sub-total				75,000

Total (6.1+6.2+6.3+6.4)

747,727

Table A-8.11.2 Equipment list for editing, printing and bookbinding for textbooks

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	D.T.P. system				
	1-1 Special Personal computer system with software	3,000,000	27,273	4	109,091
	1-2 Flatbed scanner with software	8,600,000	78,182	1	78,182
	1-3 Image setter	13,200,000	120,000	1	120,000
	1-4 Film processor	4,000,000	36,364	1	36,364
	1-5 DS Plate punch	740,000	6,727	1	6,727
	1-6 DS Film punch	170,000	1,545	1	1,545
	1-7 Consumable	1,400,000	12,727	1	12,727
2	Plate making system				
	2-1 PS Vacuum plate printer	5,500,000	50,000	2	100,000
	2-2 Vat and sink	350,000	3,182	1	3,182
	2-3 Light table	150,000	1,364	2	2,727
3	Printing system				
	3-1 Four color offset press	46,930,000	426,636	1	426,636
	3-2 Tow color offset press	17,800,000	161,818	1	161,818
	3-3 Single color offset press	22,000,000	200,000	1	200,000
	3-4 Color viewer	750,000	6,818	2	13,636
	3-5 Plate puncher	900,000	8,182	2	16,364
	3-6 Consumable	1,000,000	9,091	1	9,091
4	Book making system				
	4-1 Paper collator horizon	4,950,000	45,000	1	45,000
	4-2 Paper folding machine	5,420,000	49,273	1	49,273
	4-3 Wire stitching	6,800,000	61,818	1	61,818
	4-4 Perfect book binding	6,210,000	56,455	1	56,455
	4-5 Paper guillotine	7,600,000	69,091	1	69,091
	Sub-total				1,579,727

Table A-8.11.3 Equipment list for audio-visual for production system

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	A/V studio production system	300,000,000	2,727,273	1	2,727,273
2	Outdoor shooting system	15,000,000	136,364	2	272,727
3	Video tape editing system				
	3-1 A/B Rool editing equipment	35,000,000	318,182	1	318,182
	3-2 Tape-to-tape editing equipment	10,000,000	90,909	3	272,727
	3-3 Tape to DVD/VCD creation equipment	10,000,000	90,909	2	181,818
4	DVD/VCD duplication system	10,000,000	90,909	1	90,909
5	Video standard and format conversion system	20,000,000	181,818	1	181,818
6	Data base (low capacity)	20,000,000	181,818	1	181,818
7	Other supplementary equipment and materials	5,000,000	45,455	1	45,455
	Sub-total				4,272,727

Table A-8.11.4 Equipment list for audio-visual for multi media classroom

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Multimedia personal Computer with DVD and CD-ROM drive	300,000	2,727	1	2,727
2	Software	200,000	1,818	1	1,818
3	Printer	100,000	909	1	909
4	CCD video projection system for teaching	5,000,000	45,455	2	90,909
5	Multi system VHS VTR player and picture monitor	150,000	1,364	2	2,727
6	Audio cassette tape player	50,000	455	2	909
7	Audio amplifier and speaker	50,000	455	2	909
8	Other supplementary equipment and materials	300,000	2,727	1	2,727
	Sub-total				103,636

Table A-8.11.5 Equipment list for audio-visual for library (and local learning centers)

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	Multimedia personal Computer with DVD, CD-ROM drive and headphone	300,000	2,727	10	27,273
2	Software	200,000	1,818	10	18,182
3	Printer	100,000	909	2	1,818
4	VHS VTR player & picture monitor and headphone	150,000	1,364	10	13,636
5	Audio cassette tape player and headphone	100,000	909	10	9,091
6	Equipment and license for LAN	1,500,000	13,636	1	13,636
7	Server Equipment	1,500,000	13,636	1	13,636
8	Internet connectivity	2,400,000	21,818	1	21,818
7	Other supplementary equipment and materials	1,000,000	9,091	1	9,091
	Sub-total				128,182

8.12 Human Resource Development and its Cost Estimation

8.12.1 Priority projects and human resource development

Human resource development is the most crucial factor for the successful reform of the technical education sub-sector. Among four proposed priority projects discussed in Section 8.4, three projects, excluding Development of pilot programs, have human resource development components, as shown in Table A-8.12.1.

Table A-8.12.1 Priority projects and their cost items

	Human resource development			Hardware investment			Operation and maintenance		
	Consultant and expert invitation	Overseas training	Domestic training	Building construction	Equipment installation	Building maintenance	Equipment maintenance	Personal cost for teachers	Personal cost for adm staff
1 Development of pilot programs Hardware development				○	○	○	○	○	○
2 Institutional development for introduction of CBT CBT related organizations GHANTA (NCTE) ITABs (NABPTEx) NQA (NAB)	○ ○ ○	○ ○ ○	○ ○ ○						
3 Capacity building of managerial and teaching staff in polytechnics Managerial staff development Teaching staff development	○ ○	○ ○	○ ○						
4 Development of teaching materials CBT resource development center Managerial staff development Teaching materials development Distance learning Technical staff development Center construction Multimedia class room Local Learning Center	○ ○ ○	○ ○ ○	○ ○ ○	○	○ ○ ○	○	○ ○ ○	○ ○ ○	○ ○ ○

8.12.2 Proposed training schemes and their costs

The following four training schemes are proposed:

- (EI) Expert Invitation: International experts are invited for 3 months to transfer managerial skills and technological know-how.
- (OT-1) Overseas Training: Ghanaian counterpart staff have training for three months in developed countries outside Africa.
- (OT-2) O.T., Overseas Training: Ghanaian counterpart staff have training for three months in some African countries, which have already introduced the CBT approach, such as South Africa.
- (DT) D.T., Domestic Training: Ghanaian participants have training for one month in Ghana.

Unit costs of each training schemes were estimated to be US\$ 80,000, US\$ 23,500, US\$ 12,700 and US\$ 700, respectively, as shown in Table A-8.12.2. As for overseas training, it is assumed that half of the participants have training by (OT-1) and the other half has training by (OT-2). These training schemes are defined as units in a human resource development planning in the following section. For instance, in case of expert invitation for one year, it is considered for four units (12 months/3 months = 4).

Table A-8.12.2 Estimation of unit cost for training schemes

Program		Unit cost	Unit	Sub-total	
EI	Expert invitation program				
	Air ticket	(US\$/person)	6,500	1	6,500
	Per diem	(US\$/day/person)	150	90	13,500
	Fee	(US\$/month/person)	20,000	3	60,000
	Total	(US\$)			80,000
OT-1	Overseas training in developed countries				
	Air ticket	(US\$/person)	2,500	1	2,500
	Per diem	(US\$/day/person)	150	90	13,500
	Fee	(US\$/month/person)	2,500	3	7,500
	Total	(US\$)			23,500
OT-2	Overseas training in countries in Africa				
	Air ticket	(US\$/person)	700	1	700
	Per diem	(US\$/day/person)	100	90	9,000
	Fee	(US\$/month/person)	1,000	3	3,000
	Total	(US\$)			12,700
DT	Domestic training				
	Transportation	(US\$/person)	100	1	100
	Per diem	(US\$/day/person)	10	30	300
	Fee	(US\$/month/person)	300	1	300
	Total	(US\$)			700

8.12.3 Human resource development planning

The following three human resource development plans are proposed to strengthen capabilities to provide technical education in polytechnics. Contents of consultation by international experts and subjects of overseas training are summarized in Table A-8.12.3 and A-8.12.4, respectively.

Table A-8.12.3 Contents of consulting by international experts

Consultation Subjects	
1 Institutional development for introduction of CBT	<ul style="list-style-type: none"> Managerial staff <ul style="list-style-type: none"> CBT related organization <ul style="list-style-type: none"> Define roles and functions of GHANTA, ITAB, NQA Design and develop appropriate relationship between ministries and industries Set up a national TVET framework that is capable of becoming progressively less dependent on government Develop competency for selected industrial areas Develop training packages and assessment methods Pilot polytechnics <ul style="list-style-type: none"> Define roles and functions of selected pilot polytechnics Develop management scheme for finance, personnel, teacher development and student/graduate information Re-educate existing teachers and recruit new teachers from industries
2 Capacity building for managerial and teaching staff in polytechnics	<ul style="list-style-type: none"> Managerial staff <ul style="list-style-type: none"> Set up administrative and managerial framework to operate pilot programs Design operation of pilot program from personnel, financial and academic viewpoints Develop selection criteria of enrolment and assessment criteria of course completion Teacher <ul style="list-style-type: none"> Transfer the latest knowledge and skills for instruction of selected subjects Transfer know-how of training assessment Develop training materials
3 Development of teaching materials	<ul style="list-style-type: none"> Managerial staff <ul style="list-style-type: none"> Teaching materials development <ul style="list-style-type: none"> Develop appropriate procedure to develop teaching materials Set up a national institutional framework to develop teaching materials Define roles and functions of DLRC and design its management system Distance learning <ul style="list-style-type: none"> Develop appropriate scheme to introduce distance learning scheme Set up a national institutional framework to develop distance learning Design management system of distance learning Develop strategies to increase participants in distance learning and its financial simulation Technical staff <ul style="list-style-type: none"> Instruct editing and printing system for textbooks Instruct video production system Teach how to use audio visual equipment for multi media classrooms. Teach how to use audio visual equipment for libraries

Table A-8.12.4 Subjects of overseas training

Training Subjects	
1 Institutional development for introduction of CBT	
Managerial staff	
CBT related organization	<ul style="list-style-type: none"> Learn relevant policy framework on how competency standards are designed and delivered Learn roles and functions of CBT relevant organizations and industries Learn relationship of CBT relevant organizations and industries Learn CBT operation on how to maintain competency standards, assessment guidelines and national qualification Learn mechanism of monitoring and quality auditing for training organizations Study the process of mapping competency standards
Pilot polytechnics	<ul style="list-style-type: none"> Study how industries work in partnership with training organizations to provide attachment and offer assessment Study operations of training organizations which substantially supplement government funding, with fee income Learn procedures relating to developing learning strategies and assessment procedures Learn development mechanism of training packages and assessment techniques
2 Capacity building for managerial and teaching staff in polytechnics	
Managerial staff	<ul style="list-style-type: none"> Learn development method of instruction materials and assessment Learn how to make collaborative scheme with industries for mutual use of assets Learn administrative and managerial framework to operate pilot programs Learn operation of new program from personnel, financial and academic viewpoints Study selection criteria of enrolment and assessment criteria of course completion
Teacher	<ul style="list-style-type: none"> Upgrade specific industrial skills and knowledge
3 Development of teaching materials	
Managerial staff	
Teaching materials development	<ul style="list-style-type: none"> Study appropriate procedure to develop teaching materials Learn appropriate national institutional framework to develop teaching materials Learn management scheme to develop, produce and distribute teaching materials
Distance learning	<ul style="list-style-type: none"> Study appropriate scheme to introduce distance learning scheme Study how to set up a national institutional framework to develop distance learning Learn financial and personnel management system to operate distance learning Learn strategies to increase participants in distance learning and to improve financial conditions
Technical staff	<ul style="list-style-type: none"> Learn editing and printing system for textbooks Learn video production system Learn how to use audio visual equipment for multi media classrooms, Learn how to use audio visual equipment for libraries

(1) Institutional development for introduction of CBT

The objective of this component is to provide trainings for the administrative and managerial staff of CBT related organizations such as MOE, NCTE, GHANTA, ITAB and NQA.

The earlier phase up to 2004 is a preparation stage to introduce the CBT approach, for which two international experts, i.e., (1) Institutional development expert and (2) Financial development expert are invited in a short-term basis. Their major tasks are the followings (The details are discussed in Appendix 9.1):

- Establishment of the Ghana National Training Authority (GHANTA) section within National Council of Tertiary Education (NCTE)

- Establishment of Industrial Training Advisory Boards (ITABs) of six selected industrial areas
- Development of teaching materials production plan
- Capacity building for all relevant organizations and activities above mentioned.

The second phase from 2005 to 2006 is a preparation stage to make a full start of eight selected pilot programs in polytechnics. In this period, the following trainings are planned:

- Three international experts are assigned for comprehensive support to each of NCTE, NABPTEX and NAB for two years on a full time basis.
- Overseas trainings are planned for one representative from each of the formal sector, the informal sector and the labor union each year. This is necessary for the industrial sector to understand how the CBT approach is efficiently implemented by the public-private partnership and what the mutual benefits are. The three international experts arrange recipient institutions abroad.
- Domestic trainings are planned for one representative from students and community leaders in each eight regions, which have pilot programs. This is necessary, since the CBT approach becomes possible only if a wide range of society understands the CBT approach and cooperates for its development. The three international experts implement domestic trainings.

(2) Capacity building of managerial and teaching staff in polytechnics

This human resource development plan consists of managerial staff training and teaching staff training for selected eight pilot programs. Managerial staff training includes (1) internal school management such as personnel, financing, administration, facility maintenance, inventory, marketing and business incubator management (2) external school management such as industrial linkage, industrial attachment, joint research, recruitment, venture business development and fund raising and (3) academic management such as training package development, module development and joint course works. Teaching staff training includes (1) pure academic trainings to catch up with the latest technologies and know-how from advanced countries and (2) trainings to understand teaching method and teaching materials development for the CBT approach. The implementation of this plan starts one year prior to a full start of pilot programs until 2010 in the following ways:

As for human resource development for managerial staff,

- One international expert is assigned to transfer managerial know-how and knowledge of the CBT approach to managerial staff in all polytechnics. In addition, the expert provides one-month domestic trainings at each polytechnic, as described below. This is implemented in 2006.

-
- A CBT coordinator of each polytechnic participates three-month overseas training in 2006, in order to understand practical CBT schemes developed in advanced countries with experiences of the CBT approach.

As for human resource development for teaching staff,

- Six international experts for each pilot program are assigned in order to provide teachers' training for pilot programs for one full year in 2006. Their tasks includes technology transfer of teaching skills, course design, development of teaching materials, coordination with recipient industries for practical trainings and so on. The input of international experts becomes half in the following year and continue until 2010.
- Two teachers of each pilot program have 6-months overseas training to learn teaching skills and knowledge for the CBT in 2006. The input of overseas training becomes half in the following year and continue until 2010.
- Ten teachers of each pilot program have one-month domestic training to understand the CBT approach in 2006, which are provided by the expert mentioned above. The same domestic trainings are scheduled from 2007 to 2010, which are provided by some of participants of domestic training in 2006.

(3) Development of teaching materials

This program consists of managerial and technical staff training. Managerial staff training has two objectives, (1) teaching materials development and (2) distance-learning. Technical staff acquire various skills and know-how for teaching materials development, including printing, editing, studio operation, camera operation, lighting, video shooting, programming, digital video editing and so on.

The earlier phase up to 2004 is a preparation stage to introduce the CBT approach, for which two international experts, i.e., (1) CBT resource development expert and (2) Textbook/workbook production expert are invited in a short-term basis. Their major tasks are the followings (The details are discussed in Chapter 9 and Appendix 9.1):

- Development of teaching materials production plan
- Establishment of small-scale printing document production unit under NCTE and start of teaching materials production (See Chapter 9 and Appendix 9.2 for details.)

The second phase from 2005 to 2010 is a preparation and implementation stage of eight selected pilot programs in polytechnics. In this period, the following trainings are planned:

- Two international experts are assigned in 2005 and 2006 as a full time basis. One for managerial training has tasks for development of appropriate procedure and national institutional framework for teaching materials development. Another one for technical training has tasks for technical transfer in terms of editing and printing for textbooks/workbooks and video production for A/V materials. The input of international experts becomes half in the following years and continue until 2010.
- Four managerial staff and four technical staff have three-months overseas trainings with the same objectives above in 2005 and 2006. The overseas training becomes half in the following years and continue until 2010.
- One managerial staff and one technical staff from eight polytechnics have one-month domestic training every year from 2006 to 2010, which are implemented the international experts with the same objectives above.

(4) Cost estimation for the proposed human resource development plan

The overall cost estimation to implement these human resource development plans is summarized in Table A-8.12.5.

The total estimated cost is US\$ 14.46 million, in activity involving 144 units of international experts providing in-country assistance, 142 units of overseas training for Ghanaian staff undertaken and 528 units of domestic training for Ghanaian staff undertaken for the period from 2002 to 2010.

8.13 Result of Budgetary Simulation for the Overall Polytechnic Sub-sector

Table A-8.13.1 Budgetary simulation of existing departments (Packaged Course + Short Course)

Overall PI	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2002 to 2009	2010 to 2012	2013 to 2020	Total	
(US\$ 1,000)																								
(A) Cash Outflow																								
(A-1) Investment Related																								
Building	5,168	5,562	5,532	5,693	6,125	6,591	3,321	3,093	3,218	3,348	3,484	3,626	3,774	3,929	4,091	4,261	4,438	4,623	4,816		41,084	10,049	33,557	84,690
Equipment	457	696	818	987	1,195	2,516	1,384	1,591	1,863	2,185	8,881	3,025	3,571	4,225	5,012	13,771	7,112	8,509	10,212		9,644	12,929	55,438	78,011
Training	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Sub-total	5,625	6,257	6,350	6,680	7,320	9,107	4,704	4,684	5,081	5,533	12,365	6,651	7,345	8,155	9,104	18,032	11,549	13,131	15,028		50,727	22,979	88,995	162,701
(A-2) Operation and Maintenance																								
Maint. (Building)	155	167	166	171	184	198	100	93	97	100	105	109	113	118	123	128	133	139	144		1,233	301	1,007	2,541
Maint. (Equipment)	66	80	96	116	140	1,833	197	228	266	309	361	421	493	577	677	797	939	1,109	1,313		2,756	936	6,327	10,019
Personnel Cost (Teacher)	3,268	3,697	4,043	4,438	4,872	5,470	6,034	6,600	7,189	7,804	8,446	9,116	9,814	10,543	11,304	11,821	12,365	12,938	13,543		38,422	23,440	91,444	153,306
Full-time	(2,377)	(2,663)	(2,922)	(3,217)	(3,542)	(3,950)	(4,295)	(4,641)	(5,006)	(5,390)	(5,793)	(6,218)	(6,665)	(7,134)	(7,629)	(8,028)	(8,449)	(8,894)	(9,364)		27,606	16,189	62,380	(106,175)
Part-time	(891)	(1,033)	(1,121)	(1,221)	(1,330)	(1,520)	(1,739)	(1,958)	(2,183)	(2,415)	(2,653)	(2,898)	(3,150)	(3,409)	(3,676)	(3,793)	(3,916)	(4,044)	(4,178)		10,816	7,251	29,064	(47,131)
Personnel Cost (Adm.)	1,161	1,297	1,424	1,569	1,728	1,927	2,098	2,273	2,462	2,665	2,883	3,118	3,370	3,641	3,932	4,162	4,405	4,662	4,935		13,477	8,010	32,226	53,713
Other Costs	3,225	3,467	3,661	3,890	4,112	4,412	4,620	4,816	5,018	5,225	5,439	5,658	5,884	6,116	6,355	6,471	6,589	6,709	6,831		32,193	15,682	50,613	98,488
Sub-total	7,875	8,708	9,391	10,174	11,036	13,839	13,048	14,010	15,031	16,104	17,233	18,422	19,674	20,996	22,392	23,378	24,431	25,558	26,766		88,081	48,369	181,617	318,067
Cash Outflow Total	13,500	14,965	15,741	16,854	18,356	22,946	17,752	18,694	20,112	21,638	29,598	25,073	27,020	29,150	31,496	41,410	35,981	38,689	41,794		138,808	71,348	270,612	480,768
(B) Cash Inflow																								
(B-1) Equity																								
(B-1-1) Investment																								
Building	5,168	5,562	5,532	5,693	6,125	6,591	3,321	3,093	3,218	3,348	3,484	3,626	3,774	3,929	4,091	4,261	4,438	4,623	4,816		41,084	10,049	33,557	84,690
Equipment	457	696	818	987	1,195	2,516	1,384	1,591	1,863	2,185	8,881	3,025	3,571	4,225	5,012	13,771	7,112	8,509	10,212		9,644	12,929	55,438	78,011
Training	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Sub-total																								
(B-1-2) O/M																								
Maint. (Building)																								
Maint. (Equipment)																								
Personnel Cost (Teacher)																								
Base	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268	3,268		26,147	9,805	26,147	62,098
Incremental																								
Personnel Cost (Adm.)																								
Base	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1,161		9,287	3,483	9,287	22,056
Incremental																								
Other Costs																								
Subtotal	10,055	10,686	10,779	11,109	11,749	13,536	9,133	9,113	9,510	9,962	16,794	11,080	11,774	12,584	13,533	22,461	15,979	17,561	19,457		86,161	36,266	124,428	246,855
(C) Balance1: (B1) Equity Total - (A) Cash Outflow																								
	-3,446	-4,279	-4,961	-5,745	-6,607	-9,410	-8,619	-9,581	-10,602	-11,675	-12,804	-13,993	-15,245	-16,567	-17,963	-18,949	-20,002	-21,128	-22,337					
(B-2) Student Fee																								
Packaged Course	1,382	1,681	2,033	2,467	2,995	3,635	4,256	4,964	5,788	6,750	7,872	9,181	10,707	12,486	14,561	16,981	19,804	23,095	26,933		23,413	20,411	133,749	177,573
Short Course	0	42	51	62	75	182	426	745	1,158	1,688	2,362	3,213	4,283	5,619	7,281	8,491	9,902	11,548	13,467		1,581	5,207	63,802	70,590
Subtotal	1,382	1,723	2,084	2,529	3,070	3,817	4,682	5,708	6,946	8,438	10,234	12,394	14,989	18,105	21,842	25,472	29,706	34,643	40,400		24,994	25,618	197,551	248,164
(B-3) Income Generation																								
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
(B-4) Tuition Payback																								
Subtotal																								
(B-5) Others (Undepreciated)																								
(Total of B-2, B-3, B-4 and B-5)	1,382	1,723	2,084	2,529	3,070	3,817	4,682	5,708	6,946	8,438	10,234	12,394	14,989	18,105	21,842	25,472	29,706	34,643	40,400					
Cash Inflow Total	11,436	12,409	12,863	13,638	14,819	17,353	13,815	14,821	16,456	18,401	27,028	23,474	26,764	30,689	35,375	47,933	45,684	52,203	62,391		111,155	61,885	384,370	557,410
(D) Balance2: (B) - (A)																								
Accumulated	-2,064	-2,556	-2,878	-3,216	-3,537	-5,593	-3,937	-3,873	-3,656	-3,237	-2,570	-1,599	-256	1,538	3,879	6,523	9,704	13,514	80,454					
(E) Subsidies																								
	2,064	2,556	2,878	3,216	3,537	5,593	3,937	3,873	3,656	3,237	2,570	1,599	256	0	0	0	0	0	0		27,653	9,463	1,854	38,971
(F) Balance3: (B) - (A) + (E)																								
Accumulated	0	0	0	0	0	0	0	0	0	0	0	0	0	1,538	3,879	6,523	9,704	13,514	80,454					
Total of Equity and Subsidies	12,118	13,243	13,657	14,325	15,286	19,129	13,070	12,986	13,166	13,200	19,364	12,679	12,030	12,584	13,533	22,461	15,979	17,561	19,457		113,814	45,729	126,283	285,826
(B) - (A) Plus Previous Year's Accum (Balance3)	-2,064	-2,556	-2,878	-3,216	-3,537	-5,593	-3,937	-3,873	-3,656	-3,237	-2,570	-1,599	-256	1,538	5,417	11,940	21,644	35,158	115,612					
Calc. of Subsidies	2,064	2,556	2,878	3,216	3,537	5,593	3,937	3,873	3,656	3,237	2,570	1,599	256	0	0	0	0	0	0					

Table A-8.13.2 Budgetary simulation of pilot program (Packaged Course + Short Course)

Overall PI																					2002 to	2010 to	2013 to	Total		
(US\$ 1,000)		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2009	2012	2020			
(A) Cash Outflow																										
(A-1) Investment Related																										
Building		0	0	0	0	0	2,177	2,440	2,727	7,399	8,260	9,201	7,604	8,358	9,175	10,149	11,954	14,082	16,591	19,548	129,664	7,344	24,860	97,460	129,664	
Equipment		0	0	0	0	0	3,586	3,586	3,586	12,310	10,298	10,298	5,598	5,598	27,087	6,285	6,966	7,721	8,560	9,490	120,970	10,759	32,906	77,305	120,970	
Training	100%	160	160	160	1,026	4,046	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	23,829	9,468	3,917	10,445	23,829	
Sub-total		160	160	160	1,026	4,046	7,069	7,332	7,619	21,014	19,864	20,805	14,507	15,261	37,568	17,739	20,225	23,109	26,456	30,344	274,463	27,571	61,683	185,209	274,463	
(A-2) Operation and Maintenance																										
Maint. (Building)		0	0	0	0	0	65	73	82	222	248	276	228	251	275	304	359	422	498	586	3,890	220	746	2,924	3,890	
Maint. (Equipment)		0	0	0	0	0	72	143	215	421	627	833	945	1,057	1,169	1,295	1,434	1,588	1,760	1,949	13,509	430	1,881	11,197	13,509	
Personnel Cost (Teacher)		0	0	0	0	0	292	618	982	1,954	3,035	4,232	5,291	6,453	7,726	9,069	10,435	12,007	13,817	15,902	91,814	1,892	9,222	80,700	91,814	
Full-time		(0)	(0)	(0)	(0)	(0)	(120)	(256)	(409)	(818)	(1,278)	(1,792)	(2,253)	(2,763)	(3,326)	(3,926)	(4,542)	(5,254)	(6,079)	(7,035)	(39,850)	785	3,888	35,177	(39,850)	
Part-time		(0)	(0)	(0)	(0)	(0)	(172)	(362)	(573)	(1,136)	(1,757)	(2,440)	(3,038)	(3,690)	(4,400)	(5,144)	(5,893)	(6,753)	(7,738)	(8,868)	(51,964)	1,107	5,334	45,523	(51,964)	
Personnel Cost (Admi.)		0	0	0	0	0	57	125	208	432	701	1,021	1,333	1,698	2,122	2,602	3,125	3,755	4,512	5,421	27,113	390	2,155	24,568	27,113	
Other Costs		0	0	0	0	0	292	621	992	1,983	3,094	4,334	5,443	6,669	8,021	9,459	10,933	12,637	14,607	16,886	95,971	1,905	9,411	84,655	95,971	
Sub-total		0	0	0	0	0	777	1,582	2,478	5,013	7,705	10,696	13,240	16,127	19,314	22,729	26,286	30,409	35,193	40,746	232,296	4,837	23,414	204,044	232,296	
Cash Outflow Total		160	160	160	1,026	4,046	7,846	8,914	10,098	26,026	27,569	31,501	27,747	31,389	56,882	40,468	46,511	53,518	61,649	71,089	506,759	32,409	85,097	389,254	506,759	
(B) Cash Inflow																										
(B-1) Equity																										
(B-1-1) Investment																										
Building		0	0	0	0	0	2,177	2,440	2,727	7,399	8,260	9,201	7,604	8,358	9,175	10,149	11,954	14,082	16,591	19,548	129,664	7,344	24,860	97,460	129,664	
Equipment		0	0	0	0	0	3,586	3,586	3,586	12,310	10,298	10,298	5,598	5,598	27,087	6,285	6,966	7,721	8,560	9,490	120,970	10,759	32,906	77,305	120,970	
Training		160	160	160	1,026	4,046	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	23,829	9,468	3,917	10,445	23,829	
Sub-total		160	160	160	1,026	4,046	7,069	7,332	7,619	21,014	19,864	20,805	14,507	15,261	37,568	17,739	20,225	23,109	26,456	30,344	274,463	27,571	61,683	185,209	274,463	
(B-1-2) O/M																										
Maint. (Building)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maint. (Equipment)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Personnel Cost (Teacher)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Incremental		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Personnel Cost (Adm.)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Incremental		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Costs		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		160	160	160	1,026	4,046	7,069	7,332	7,619	21,014	19,864	20,805	14,507	15,261	37,568	17,739	20,225	23,109	26,456	30,344	274,463	27,571	61,683	185,209	274,463	
(C) Balance1: (B1) Equity Total - (A) Cash Outflow																										
		0	0	0	0	0	-777	-1,582	-2,478	-5,013	-7,705	-10,696	-13,240	-16,127	-19,314	-22,729	-26,286	-30,409	-35,193	-40,746	0	0	0	0	0	
(B-2) Student Fee																										
Packaged Course		0	0	0	0	0	618	1,261	1,930	3,702	5,545	7,460	9,002	10,603	12,263	13,913	15,786	17,912	20,327	23,068	143,391	3,809	16,708	122,874	143,391	
Short Course		0	0	0	0	0	31	126	289	740	1,386	2,238	3,151	4,241	5,519	6,957	7,893	8,956	10,163	11,534	63,225	447	4,365	58,413	63,225	
Subtotal		0	0	0	0	0	649	1,387	2,219	4,443	6,932	9,698	12,153	14,844	17,782	20,870	23,679	26,868	30,490	34,602	206,616	4,256	21,073	181,287	206,616	
(B-3) Income Generation																										
Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(B-4) Tuition Payback																										
Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(B-5) Others (Undepreciated)																										
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111,923	0	0	111,923	111,923	
(Total of B-2, B-3, B-4 and B-5)		0	0	0	0	0	649	1,387	2,219	4,443	6,932	9,698	12,153	14,844	17,782	20,870	23,679	26,868	30,490	34,602	318,539	4,256	21,073	293,210	318,539	
Cash Inflow Total		160	160	160	1,026	4,046	7,718	8,719	9,839	25,457	26,796	30,503	26,660	30,105	55,350	38,609	43,904	49,977	56,946	176,869	593,002	31,827	82,756	478,420	593,002	
(D) Balance2: (B) - (A)																										
Accumulated		0	0	0	0	0	-128	-194	-259	-570	-774	-998	-1,087	-1,284	-1,532	-1,860	-2,607	-3,541	-4,704	105,780	0	0	0	0	0	
(E) Subsidies																										
		0	0	0	0	0	128	194	259	570	774	998	1,087	1,284	1,532	1,860	2,607	3,541	4,704	0	19,537	582	2,341	16,614	19,537	
(F) Balance3: (B) - (A) + (E)																										
Accumulated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105,780	0	0	0	0	0	
Total of Equity and Subsidies		160	160	160	1,026	4,046	7,197	7,526	7,878	21,583	20,838	21,803	15,594	16,545	39,100	19,599	22,832	26,650	31,160	30,344	294,000	28,153	64,024	201,823	294,000	
																					(Net)				188,220	
(B) - (A) Plus Previous Year's Accum (Balance3)																										
		0	0	0	0	0	-128	-194	-259	-570	-774	-998	-1,087	-1,284	-1,532	-1,860	-2,607	-3,541	-4,704	105,780	0	0	0	0	0	
Calc. of Subsidies																										
		0	0	0	0	0	128	194	259	570	774	998	1,087	1,284	1,532	1,860	2,607	3,541	4,704	0	0	0	0	0	0	

Table A-8.13.3 Budgetary simulation of distance-learning

Overall PI																					2002 to	2010 to	2013 to	Total	
(US\$ 1,000)																					2009	2012	2020		
(A) Cash Outflow																									
(A-1) Investment Related																									
Building	0	0	0	318	324	297	0	0	0	0	69	71	73	75	77	80	82	85	87	1,637	939	69	630	1,637	
Equipment	0	5,956	904	600	0	0	596	90	210	150	150	1,341	331	120	0	0	2,978	13,426	0	26,853	8,146	510	18,196	26,853	
Training	160	160	160	796	796	404	0	0	0	0	0	0	0	0	0	0	0	0	0	2,476	2,476	0	0	2,476	
Sub-total	160	6,116	1,064	1,714	1,120	700	596	90	210	150	219	1,412	404	195	77	80	3,060	13,511	87	30,966	11,560	579	18,826	30,966	
(A-2) Operation and Maintenance																									
Maint. (Building)	0	0	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	153	48	29	76	153	
Maint. (Equipment)	0	0	0	0	0	149	149	149	152	155	158	161	164	164	164	164	164	1,895	0	3,791	448	466	2,878	3,791	
Personnel Cost (Teacher)																				0	0	0	0	0	
Full-time																									
Part-time																									
Personnel Cost (Admi.)	0	0	11	44	75	105	138	163	226	293	376	565	718	896	1,101	1,342	1,625	1,900	2,213	11,793	537	895	10,362	11,793	
Other Costs	0	0	0	0	0	0	0	0	47	103	181	519	699	892	1,096	1,321	1,570	1,740	1,920	10,087	0	331	9,756	10,087	
Sub-total	0	0	11	54	85	263	297	322	434	561	725	1,254	1,591	1,962	2,371	2,836	3,369	5,545	4,143	25,824	1,032	1,720	23,072	25,824	
Cash Outflow Total	160	6,116	1,075	1,768	1,205	964	892	413	644	711	944	2,667	1,994	2,157	2,448	2,916	6,429	19,056	4,230	56,790	12,592	2,299	41,898	56,790	
(B) Cash Inflow																									
(B-1) Equity																									
(B-1-1) Investment																									
Building	0	0	0	318	324	297	0	0	0	0	69	71	73	75	77	80	82	85	87	1,637	939	69	630	1,637	
Equipment	0	5,956	904	600	0	0	596	90	210	150	150	1,341	331	120	0	0	2,978	13,426	0	26,853	8,146	510	18,196	26,853	
Training	160	160	160	796	796	404	0	0	0	0	0	0	0	0	0	0	0	0	0	2,476	2,476	0	0	2,476	
Sub-total	160	6,116	1,064	1,714	1,120	700	596	90	210	150	219	1,412	404	195	77	80	3,060	13,511	87	30,966	11,560	579	18,826	30,966	
(B-1-2) O/M																									
Maint. (Building)																									
Maint. (Equipment)																									
Personnel Cost (Teacher)																									
Base																									
Incremental																									
Personnel Cost (Adm.)																									
Base																									
Incremental																									
Other Costs																									
Subtotal	160	6,116	1,064	1,714	1,120	700	596	90	210	150	219	1,412	404	195	77	80	3,060	13,511	87	30,966	11,560	579	18,826	30,966	
(C) Balance1: (B1) Equity Total - (A) Cash Outflow																									
	0	0	-11	-54	-85	-263	-297	-322	-434	-561	-725	-1,254	-1,591	-1,962	-2,371	-2,836	-3,369	-5,545	-4,143						
(B-2) Student Fee																									
Existing Course	0	0	0	0	0	0	0	0	0	0	0	688	959	1,254	1,572	1,917	2,290	2,693	3,128	14,503	0	0	14,503	14,503	
Pilot Program Course	0	0	0	0	0	0	0	0	106	249	466	736	1,087	1,534	2,080	2,777	3,661	4,344	5,155	22,195	0	821	21,374	22,195	
Subtotal	0	0	0	0	0	0	0	0	106	249	466	1,424	2,047	2,788	3,653	4,694	5,951	7,037	8,283	36,699	0	821	35,877	36,699	
(B-3) Income Generation																									
Subtotal																				0	0	0	0	0	
(B-4) Tuition Payback																									
Subtotal																				0	0	0	0	0	
(B-5) Others (Undepreciated)																									
																				1,201	1,201	0	0	1,201	1,201
(Total of B-2, B-3, B-4 and B-5)	0	0	0	0	0	0	0	0	106	249	466	1,424	2,047	2,788	3,653	4,694	5,951	7,037	9,484	37,899	0	821	37,078	37,899	
Cash Inflow Total	160	6,116	1,064	1,714	1,120	700	596	90	316	399	685	2,836	2,451	2,983	3,730	4,774	9,011	20,548	9,571	68,865	11,560	1,400	55,905	68,865	
(D) Balance2: (B) - (A)																									
Accumulated	0	0	-11	-54	-85	-263	-297	-322	-329	-312	-258	170	456	826	1,282	1,858	2,583	1,492	5,341						
(E) Subsidies																									
	0	0	11	54	85	263	297	322	329	312	258	0	0	0	0	0	0	0	0	1,931	1,032	899	0	1,931	
(F) Balance3: (B) - (A) + (E)																									
Accumulated	0	0	0	0	0	0	0	0	0	0	0	170	456	826	1,282	1,858	2,583	1,492	5,341						
Total of Equity and Subsidies	160	6,116	1,075	1,768	1,205	964	892	413	539	462	477	1,412	404	195	77	80	3,060	13,511	87	32,896	12,592	1,478	18,826	32,896	
																				(Net)				18,890	
(B) - (A) Plus Previous Year's Accum (Balance3)																									
	0	0	-11	-54	-85	-263	-297	-322	-329	-312	-258	170	626	1,452	2,733	4,591	7,173	8,665	14,006						
Calc. of Subsidies																									
	0	0	11	54	85	263	297	322	329	312	258	0	0	0	0	0	0	0	0	0					

Table A-8.13.4 Budgetary simulation of whole (existing departments & pilot program & distance-learning)

Overall PI																					2002 to	2010 to	2013 to	Total	
(US\$ 1,000)																					2009	2012	2020		
(A) Cash Outflow																									
(A-1) Investment Related																									
Building																									
Existing	5,168	5,562	5,532	5,693	6,125	6,591	3,321	3,093	3,218	3,348	3,484	3,626	3,774	3,929	4,091	4,261	4,438	4,623	4,816	84,690	41,084	10,049	33,557	84,690	
Pilot Program	0	0	0	0	0	2,177	2,440	2,727	7,399	8,260	9,201	7,604	8,358	9,175	10,149	11,954	14,082	16,591	19,548	129,664	7,344	24,860	97,460	129,664	
Distance L.	0	0	0	318	324	297	0	0	0	69	71	73	75	77	80	82	85	87	87	1,637	939	69	630	1,637	
(Total)	(5,168)	(5,562)	(5,532)	(6,011)	(6,449)	(9,065)	(5,760)	(5,821)	(10,616)	(11,608)	(12,754)	(11,300)	(12,205)	(13,179)	(14,317)	(16,294)	(18,602)	(21,298)	(24,451)	(215,992)	(49,366)	(34,978)	(131,647)	(215,992)	
Equipment																									
Existing	457	696	818	987	1,195	2,516	1,384	1,591	1,863	2,185	8,881	3,025	3,571	4,225	5,012	13,771	7,112	8,509	10,212	78,011	9,644	12,929	55,438	78,011	
Pilot Program	0	0	0	0	0	3,586	3,586	3,586	12,310	10,298	10,298	5,598	5,598	27,087	6,285	6,966	7,721	8,560	9,490	120,970	10,759	32,906	77,305	120,970	
Distance L.	0	5,956	904	600	0	0	596	90	210	150	150	1,341	331	120	0	2,978	13,426	0	26,853	8,146	510	18,196	26,853		
(Total)	(457)	(6,652)	(1,722)	(1,587)	(1,195)	(6,102)	(5,566)	(5,268)	(14,383)	(12,634)	(19,329)	(9,964)	(9,500)	(31,433)	(11,297)	(20,737)	(17,811)	(30,495)	(19,702)	(225,833)	(28,549)	(46,345)	(150,939)	(225,833)	
Training																									
Existing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pilot Program	160	160	160	1,026	4,046	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306	23,829	9,468	3,917	10,445	23,829	
Distance L.	160	160	160	796	796	404	0	0	0	0	0	0	0	0	0	0	0	0	0	2,476	2,476	0	0	2,476	
(Total)	(320)	(320)	(320)	(1,822)	(4,842)	(1,709)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(1,306)	(26,305)	(11,943)	(3,917)	(10,445)	(26,305)	
Subtotal (Invest.)																									
Existing	5,625	6,257	6,350	6,680	7,320	9,107	4,704	4,684	5,081	5,533	12,365	6,651	7,345	8,155	9,104	18,032	11,549	13,131	15,028	162,701	50,727	22,979	88,995	162,701	
Pilot Program	160	160	160	1,026	4,046	7,069	7,332	7,619	21,014	19,864	20,805	14,507	15,261	37,568	17,739	20,225	23,109	26,456	30,344	274,463	27,571	61,683	185,209	274,463	
Distance L.	160	6,116	1,064	1,714	1,120	700	596	90	210	150	219	1,412	404	195	77	80	3,060	13,511	87	30,966	11,560	579	18,826	30,966	
(Total)	(5,945)	(12,533)	(7,574)	(9,419)	(12,485)	(16,676)	(12,632)	(12,394)	(26,305)	(25,547)	(33,388)	(22,570)	(23,010)	(45,918)	(26,920)	(38,337)	(37,719)	(53,098)	(45,459)	(468,130)	(89,859)	(85,240)	(293,031)	(468,130)	
(A-2) Operation and Maintenance																									
Maint. (Building)																									
Existing	155	167	166	171	184	198	100	93	97	100	105	109	113	118	123	128	133	139	144	2,541	1,233	301	1,007	2,541	
Pilot Program	0	0	0	0	0	65	73	82	222	248	276	228	251	275	304	359	422	498	586	3,890	220	746	2,924	3,890	
Distance L.	0	0	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	153	48	29	76	153	
(Total)	(155)	(167)	(166)	(180)	(193)	(273)	(182)	(184)	(328)	(358)	(390)	(346)	(374)	(403)	(437)	(496)	(565)	(646)	(740)	(6,583)	(1,501)	(1,076)	(4,007)	(6,583)	
Maint. (Equipment)																									
Existing	66	80	96	116	140	1,833	197	228	266	309	361	421	493	577	677	797	939	1,109	1,313	10,019	2,756	936	6,327	10,019	
Pilot Program	0	0	0	0	0	72	143	215	421	627	833	945	1,057	1,169	1,295	1,434	1,588	1,760	1,949	13,509	430	1,881	11,197	13,509	
Distance L.	0	0	0	0	0	149	149	149	152	155	158	161	164	164	164	164	164	1,895	0	3,791	448	466	2,878	3,791	
(Total)	(66)	(80)	(96)	(116)	(140)	(2,054)	(489)	(593)	(839)	(1,092)	(1,352)	(1,528)	(1,714)	(1,910)	(2,136)	(2,395)	(2,692)	(4,764)	(3,263)	(27,319)	(3,634)	(3,283)	(20,402)	(27,319)	
Personnel Cost (Teacher)																									
Full-time																									
Existing	2,377	2,663	2,922	3,217	3,542	3,950	4,295	4,641	5,006	5,390	5,793	6,218	6,665	7,134	7,629	8,028	8,449	8,894	9,364	106,175	27,606	16,189	62,380	106,175	
Pilot Program	0	0	0	0	0	120	256	409	818	1,278	1,792	2,253	2,763	3,326	3,926	4,542	5,254	6,079	7,035	39,850	785	3,888	35,177	39,850	
Distance L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(Total)	(2,377)	(2,663)	(2,922)	(3,217)	(3,542)	(4,070)	(4,551)	(5,050)	(5,824)	(6,668)	(7,585)	(8,470)	(9,427)	(10,460)	(11,554)	(12,569)	(13,703)	(14,974)	(16,399)	(146,025)	(28,391)	(20,077)	(97,557)	(146,025)	
Part-time																									
Existing	891	1,033	1,121	1,221	1,330	1,520	1,739	1,958	2,183	2,415	2,653	2,898	3,150	3,409	3,676	3,793	3,916	4,044	4,178	47,131	10,816	7,251	29,064	47,131	
Pilot Program	0	0	0	0	0	172	362	573	1,136	1,757	2,440	3,038	3,690	4,400	5,144	5,893	6,753	7,738	8,868	51,964	1,107	5,334	45,523	51,964	
Distance L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(Total)	(891)	(1,033)	(1,121)	(1,221)	(1,330)	(1,692)	(2,102)	(2,531)	(3,319)	(4,172)	(5,093)	(5,936)	(6,840)	(7,809)	(8,819)	(9,687)	(10,669)	(11,782)	(13,046)	(99,095)	(11,923)	(12,584)	(74,588)	(99,095)	
Full+Part																									
Existing	3,268	3,697	4,043	4,438	4,872	5,470	6,034	6,600	7,189	7,804	8,446	9,116	9,814	10,543	11,304	11,821	12,365	12,938	13,543	153,306	38,422	23,440	91,444	153,306	
Pilot Program	0	0	0	0	0	292	618	982	1,954	3,035	4,232	5,291	6,453	7,726	9,069	10,435	12,007	13,817	15,902	91,814	1,892	9,222	80,700	91,814	
Distance L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
(Total)	(3,268)	(3,697)	(4,043)	(4,438)	(4,872)	(5,762)	(6,652)	(7,581)	(9,144)	(10,840)	(12,678)	(14,406)	(16,267)	(18,269)	(20,374)	(22,256)	(24,372)	(26,756)	(29,445)	(245,120)	(40,314)	(32,661)	(172,145)	(245,120)	
Personnel Cost (Admi.)																									
Existing	1,161	1,297	1,424	1,569	1,728	1,927	2,098	2,273	2,462	2,665	2,883	3,118	3,370	3,641	3,932	4,162	4,405	4,662	4,935	53,713	13,477	8,010	32,226	53,713	
Pilot Program	0	0	0	0	0	57	125	208	432	701	1,021	1,333	1,698	2,122	2,602	3,125	3,755	4,512	5,421	27,113	390	2,155	24,568	27,113	
Distance L.	0	0	11	44	75	105	138	163	226	293	376	565	718	896	1,101	1,342	1,625	1,900	2,213	11,793	537	895	10,362	11,793	
(Total)	(1,161)	(1,297)	(1,435)	(1,613)	(1,804)	(2,089)	(2,361)	(2,644)	(3,120)	(3,659)	(4,280)	(5,016)	(5,786)	(6,660)	(7,635)	(8,630)	(9,785)	(11,074)	(12,570)	(92,619)	(14,404)	(11,059)	(67,156)	(92,619)	
Other Costs																									
Existing	3,225	3,467	3,661	3,880	4,112	4,412	4,620	4,816	5,018	5,225	5,439	5,658	5,884	6,116	6,355	6,471	6,589	6,709	6,831	98,488	32,193	15,682	50,613	98,488	
Pilot Program	0	0	0	0	0	292	621	992	1,983	3,094	4,334	5,443	6,669	8,021	9,459	10,933	12,637	14,607	16,886	95,971	1,905	9,411	84,655	95,971	
Distance L.	0	0	0	0	0	0	0	0	47	103	181	519	699	892	1,096	1,321	1,570	1,740	1,920	10,087	0	331	9,756	10,087	
(Total)	(3,225)	(3,467)	(3,661)	(3,880)	(4,112)	(4,704)	(5,241)	(5,808)	(7,047)	(8,422)	(9,954)	(11,620)	(13,252)	(15,030)	(16,910)	(18,724)	(20,795)	(23,056)	(25,638)	(204,546)	(34,097)	(25,424)	(145,025)	(204,546)	
Subtotal (O/M)																									
Existing	7,875	8,708	9,391	10,174	11,036	13,839	13,048	14,010	15,031	16,104	17,233	18,422	19,674	2											

(B) Cash Inflow																																									
(B-1) Equity																																									
Existing	10,055	10,686	10,779	11,109	11,749	13,536	9,133	9,113	9,510	9,962	16,794	11,080	11,774	12,584	13,533	22,461	15,979	17,561	19,457	246,855	86,161																				
Pilot Program	160	160	160	1,026	4,046	7,069	7,332	7,619	21,014	19,864	20,805	14,507	15,261	37,568	17,739	20,225	23,109	26,456	30,344	274,463	27,571																				
Distance L.	160	6,116	1,064	1,714	1,120	700	596	90	210	150	219	1,412	404	195	77	80	3,060	13,511	87	30,966	11,560																				
(Total)	(10,375)	(16,962)	(12,003)	(13,849)	(16,914)	(21,305)	(17,061)	(16,823)	(30,734)	(29,977)	(37,818)	(26,999)	(27,440)	(50,347)	(31,349)	(42,766)	(42,148)	(57,527)	(49,888)	(552,284)	(125,292)																				
(C) Balance1: (B1) Equity Total - (A) Cash Outflow																																									
Existing	-3,446	-4,279	-4,961	-5,745	-6,607	-9,410	-8,619	-9,581	-10,602	-11,675	-12,804	-13,993	-15,245	-16,567	-17,963	-18,949	-20,002	-21,128	-22,337																						
Pilot Program	0	0	0	0	0	-777	-1,582	-2,478	-5,013	-7,705	-10,696	-13,240	-16,127	-19,314	-22,729	-26,286	-30,409	-35,193	-40,746																						
Distance L.	0	0	-11	-54	-85	-263	-297	-322	-434	-561	-725	-1,254	-1,591	-1,962	-2,371	-2,836	-3,369	-5,545	-4,143																						
(Total)	(-3,446)	(-4,279)	(-4,973)	(-5,798)	(-6,692)	(-10,451)	(-10,497)	(-12,381)	(-16,049)	(-19,941)	(-24,226)	(-28,487)	(-32,963)	(-37,843)	(-43,063)	(-48,071)	(-53,780)	(-61,867)	(-67,226)																						
(B-2) Student Fee																																									
Existing	1,382	1,723	2,084	2,529	3,070	3,817	4,682	5,708	6,946	8,438	10,234	12,394	14,989	18,105	21,842	25,472	29,706	34,643	40,400	248,164	24,994																				
Pilot Program	0	0	0	0	0	649	1,387	2,219	4,443	6,932	9,698	12,153	14,844	17,782	20,870	23,679	26,868	30,490	34,602	206,616	4,256																				
Distance L.	0	0	0	0	0	0	0	0	106	249	466	1,424	2,047	2,788	3,653	4,694	5,951	7,037	8,283	36,699	0																				
(Total)	(1,382)	(1,723)	(2,084)	(2,529)	(3,070)	(4,466)	(6,069)	(7,927)	(11,495)	(15,618)	(20,399)	(25,971)	(31,880)	(38,675)	(46,364)	(53,845)	(62,525)	(72,170)	(83,286)	(491,478)	(29,250)																				
(B-3) Income Generation																																									
Existing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
Pilot Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
Distance L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
(Total)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)																				
(B-4) Tuition Payback																																									
Existing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
Pilot Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
Distance L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																				
(Total)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)																				
(B-5) Others (Undepreciated)																																									
Existing																					62,391																				
Pilot Program																					111,923																				
Distance L.																					1,201																				
(Total)																					(175,515)																				
(Total of B-2, B-3, B-4 and B-5)																																									
Existing	1,382	1,723	2,084	2,529	3,070	3,817	4,682	5,708	6,946	8,438	10,234	12,394	14,989	18,105	21,842	25,472	29,706	34,643	40,400	310,555	24,994																				
Pilot Program	0	0	0	0	0	649	1,387	2,219	4,443	6,932	9,698	12,153	14,844	17,782	20,870	23,679	26,868	30,490	34,602	318,539	4,256																				
Distance L.	0	0	0	0	0	0	0	0	106	249	466	1,424	2,047	2,788	3,653	4,694	5,951	7,037	9,484	37,899	0																				
(Total)	(1,382)	(1,723)	(2,084)	(2,529)	(3,070)	(4,466)	(6,069)	(7,927)	(11,495)	(15,618)	(20,399)	(25,971)	(31,880)	(38,675)	(46,364)	(53,845)	(62,525)	(72,170)	(83,286)	(666,993)	(29,250)																				
Cash Inflow Total																																									
Existing	11,436	12,409	12,863	13,638	14,819	17,353	13,815	14,821	16,456	18,401	27,028	23,474	26,764	30,689	35,375	47,933	45,684	52,203	122,248	557,410	111,155																				
Pilot Program	160	160	160	1,026	4,046	7,718	8,719	9,839	25,457	26,796	30,503	26,660	30,105	55,350	38,609	43,904	49,977	56,946	176,869	593,002	31,827																				
Distance L.	160	6,116	1,064	1,714	1,120	700	596	90	316	399	685	2,836	2,451	2,983	3,730	4,774	9,011	20,548	9,571	68,865	11,560																				
(Total)	(11,756)	(18,685)	(14,087)	(16,378)	(19,984)	(25,771)	(23,130)	(24,750)	(42,229)	(45,595)	(58,218)	(52,970)	(59,319)	(89,021)	(77,713)	(96,611)	(104,673)	(129,697)	(306,689)	(1,219,277)	(154,542)																				
(D) Balance2: (B) - (A)																																									
Existing	-2,064	-2,556	-2,878	-3,216	-3,537	-5,593	-3,937	-3,873	-3,656	-3,237	-2,570	-1,599	-256	-1,538	3,879	6,523	9,704	13,514	60,454																						
Pilot Program	0	0	0	0	0	-128	-194	-259	-570	-774	-998	-1,087	-1,284	-1,532	-1,860	-2,607	-3,541	-4,704	105,780																						
Distance L.	0	0	-11	-54	-85	-263	-297	-322	-329	-312	-258	170	456	826	1,282	1,858	2,583	1,492	5,341																						
(Total)	-2,064	-2,556	-2,889	-3,269	-3,622	-5,985	-4,428	-4,454	-4,554	-4,323	-3,827	-2,516	-1,084	832	3,301	5,774	8,745	10,303	191,575																						
Accumulated	-2,064	-4,620	-7,509	-10,778	-14,400	-20,385	-24,813	-29,267	-33,821	-38,144	-41,970	-44,486	-45,570	-44,738	-41,437	-35,663	-26,918	-16,615	174,960																						
(E) Subsidies																																									
Existing	2,064	2,556	2,878	3,216	3,537	5,593	3,937	3,873	3,656	3,237	2,570	1,599	256	0	0	0	0	0	0	38,971	27,653																				
Pilot Program	0	0	0	0	0	128	194	259	570	774	998	1,087	1,284	1,532	1,860	2,607	3,541	4,704	0	19,537	582																				
Distance L.	0	0	11	54	85	263	297	322	329	312	258	0	0	0	0	0	0	0	0	1,931	1,032																				
(Total)	2,064	2,556	2,889	3,269	3,622	5,985	4,428	4,454	4,554	4,323	3,827	2,686	1,540	1,532	1,860	2,607	3,541	4,704	0	60,438	29,267																				
(F) Balance3: (B) - (A) + (E)																																									
Accumulated	0	0	0	0	0	0	0	0	0	0	0	0	170	456	2,364	5,161	8,381	12,286	15,006	191,575																					
	0	0	0	0	0	0	0	0	0	0	0	0	170	626	2,990	8,151	16,531	28,817	43,824	235,398																					
Total of Equity and Subsidies																																									
	12,438	19,519	14,892	17,118	20,536	27,290	21,488	21,277	35,288	34,299	41,644	29,685	28,979	51,879	33,209	45,372	45,689	62,231	49,888	612,722	154,559																				
																					377,324	111,231																			
Unit education cost																																									
Existing (US\$/student/year)	586	606	627	658	702	822	592	587	599	614	803	653	678	707	741	994	881	967	1,066																						
Pilot Program (US\$/student/year)						12,737	6,632	4,623	5,883	3,961	3,217	2,254	2,086	3,158	1,919	1,983	2,051	2,123	2,201																						
Distance L. (US\$/student/year)									1,020	510	386	381	211	179	165	163	303	810	163																						
Total (US\$/student/year)	600	660	676	767	903	1,113	880	859	1,211	1,144	1,263	962	939	1,237	949	1,095	1,088	1,290	1,202																						
Actual government budget	12,438	19,519	14,892	17,118	20,536	27,290	21,488	21,277	35,288	34,299	41,644	29,515	28,523	49,515	28,048	36,992	33,403	47,225	33,828																						
Gov. budget per student (US\$/student/year)	969	1,164	678	760	892	1,104	855	830	1,350	1,202	1,330	868	738	1,135	571	641	519	663	431																						
(B) - (A) Plus Previous Year's Accum (Balance3)																																									
	-2,064	-2,556	-2,889	-3,269	-3,622	-5,985	-4,428	-4,454	-4,554	-4,323	-3,827	-2,516	-914	1,458	6,291	13,925	25,276	39,120	235,398																						
Calc. of Subsidies																																									
	2,064	2,556	2,889	3,269	3,622	5,985	4,428	4,454	4,554	4,323	3,827	2,516	914	0	0	0	0	0	0	0																					

8.14 Results of Budget Simulation for Three Pilot Polytechnics

The budgetary simulation of each pilot polytechnic is described in this Appendix, each of which consists of (1) accumulated financial simulation from 2002 to 2020 and (2) financial simulation divided by the following three phases:

- Phase I-III (up to 2010): Preparation and trial stage of eight pilot programs
- Phase IV (2010 to 2013): Introduction stage of distance-learning for pilot programs
- Phase V (2013 to 2020): Expansion stage of the CBT approach to all technical education

(1) Accra Polytechnic

Table A-8.14.1 shows the summary of accumulated financial cost for 2002 to 2020 in Accra Pilot Polytechnic with the following findings:

- The accumulated enrolment is 171,000 student-year, which is shared by 74%, 14% and 12% by existing departments, pilot program and distance-learning, respectively.
- The accumulated cash outflow is US\$ 161 million, which consists of personnel cost (35%), building (19%), equipment (24%) and others.
- The accumulated cash inflow is US\$ 161 million, which consists of student fee (49%) government support (36%) and others, which means that Accra Polytechnic can achieve 64% self-financing under these assumptions.
- The unit education costs of existing department, pilot program and distance-learning are estimated to be US\$ 737, US\$ 2,458 and US\$ 421, respectively. Because of the revenue from student fee, the government support portion in these unit education costs are US\$ 261, US\$ 926 and US\$ 93, respectively. The average government support portion in unit education cost is US\$ 335, which compares to US\$ 421 in 1998.

Table A-8.14.1 Summary of accumulated financial cost for 2002-2020 (Pilot Polytechnic: Accra)

	Existing		Pilot		DL		Total	
Students (1,000)	126	74%	24	14%	20	12%	171	100%
Finance (Mil. US\$)								
Cash outflow	93	100%	59	100%	8	100%	161	100%
Building	16	17%	15	25%	0	3%	31	19%
Equipment	17	18%	17	28%	5	54%	38	24%
Staff training	0	0%	3	5%	0	4%	3	2%
Personnel Cost	41	44%	13	23%	2	21%	56	35%
Others (*)	19	21%	11	19%	1	18%	32	20%
Cash inflow	93	100%	59	100%	8	100%	161	100%
Revenue	60	65%	37	62%	7	78%	104	64%
Student fee	49	52%	25	41%	5	64%	79	49%
Others (**)	12	12%	12	21%	1	14%	25	16%
Government support	33	35%	22	38%	2	22%	57	36%
Unit education cost (US\$/student/year)	737		2,458		421		943	
Government support (US\$/student/year)	261		926		93		335	

Note: (*) Others in cash outflow include transportation, utilities and so on. For DL, only, learning materials and schooling are included.

(**) Others in cash inflow is residual value of building.

Table A-8.14.2 shows the phased summary of the accumulated financial cost for 2002 to 2020 in Accra Polytechnic with the following findings:

- The accumulated enrolment is 43,000, 24,000 and 103,000 for Phase I-III, IV and V, respectively. (Note that the period of each phases are different.)
- The accumulated cash outflow is US\$ 43, 24 and 103 million for Phase I-III, IV and V, respectively.
- The accumulated cash inflow of student fee is US\$ 6, 8 and 65 million for Phase I-III, IV and V, respectively. The accumulated cash inflow of government support is US\$ 28, 17 and 12 million, respectively.
- The unit education costs are estimated to be US\$ 773, 1,040 and 990 for Phase I-III, IV and V, respectively. The government support portion in these unit education costs is US\$ 644 (83%), 703 (68%) and 119 (12%), respectively. As the increase of student fee, the government support portion in these unit education costs is decreased and Accra Polytechnic achieves 88% self-financing in Phase V.

Table A-8.14.2 Summary of accumulated financial cost for 2002-2020 (by Phase) (Pilot Polytechnic: Accra)

	Phase I-III (Upto 2010)				Phase IV (2010 to 2013)				Phase V (2013 to 2020)				Total			
	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total
Students (1,000)	42	1	0	43	21	3	0	24	63	20	19	103	126	24	20	171
Finance (Mil. US\$)																
Cash outflow	27	5	2	33	14	11	0	25	53	43	6	102	93	59	8	161
Building	8	1	0	9	2	3	0	5	6	10	0	17	16	15	0	31
Equipment	2	2	1	5	3	4	0	7	12	11	3	26	17	17	5	38
Staff training	0	1	0	2	0	0	0	0	0	1	0	1	0	3	0	3
Personnel Cost	10	0	0	11	6	2	0	8	24	11	2	37	41	13	2	56
Others (*)	6	0	0	7	3	1	0	5	10	10	1	21	19	11	1	32
Cash inflow	27	5	2	33	14	11	0	25	53	43	6	102	93	59	8	161
Revenue	5	1	0	6	5	3	0	8	50	33	6	90	60	37	7	104
Student fee	5	1	0	6	5	3	0	8	39	21	5	65	49	25	5	79
Others (**)	0	0	0	0	0	0	0	0	12	12	1	25	12	12	1	25
Government support	22	4	2	28	9	8	0	17	2	10	0	12	33	22	2	57
Unit education cost (US\$/student/year)	633	7,624		773	667	3,635	523	1,040	830	2,129	321	990	737	2,458	421	943
Government support (US\$/student/year)	516	6,597		644	425	2,640	340	703	37	501	-12	119	261	926	93	335

	Phase I-III (Upto 2010)				Phase IV (2010 to 2013)				Phase V (2013 to 2020)				Total			
	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total
Students (1,000)	99%	1%	0%	100%	85%	13%	3%	100%	81%	20%	19%	100%	74%	14%	12%	100%
Finance (Mil. US\$)																
Cash outflow	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Building	29%	22%	8%	27%	14%	31%	4%	21%	12%	24%	20%	100%	17%	17%	25%	3%
Equipment	9%	40%	68%	16%	19%	39%	43%	26%	23%	24%	51%	25%	18%	28%	54%	24%
Staff training	0%	25%	20%	5%	0%	4%	0%	2%	0%	3%	0%	0%	0%	5%	4%	2%
Personnel Cost	39%	7%	4%	32%	45%	14%	39%	31%	46%	26%	25%	36%	44%	23%	21%	35%
Others (*)	24%	6%	0%	20%	22%	12%	14%	18%	19%	22%	23%	21%	21%	19%	16%	20%
Cash inflow	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Revenue	18%	13%	0%	17%	36%	27%	35%	32%	96%	76%	104%	88%	65%	62%	78%	64%
Student fee	18%	13%	0%	17%	36%	27%	35%	32%	74%	48%	84%	63%	52%	41%	64%	49%
Others (**)	0%	0%	0%	0%	0%	0%	0%	0%	22%	28%	19%	25%	12%	21%	14%	16%
Government support	82%	87%	100%	83%	64%	73%	65%	68%	4%	24%	-4%	12%	35%	38%	22%	36%

Note: (*) Others in cash outflow include transportation, utilities and so on. For Dt. only, learning materials and schooling are included.
 (**) Others in cash inflow is residual value of building.

(2) Ho Polytechnic

Table A-8.14.3 shows the summary of accumulated financial cost for 2002 to 2020 in Ho Pilot Polytechnic with the following findings:

- The accumulated enrolment is about 117,000 student-year, which is shared by 67%, 20% and 14% by existing departments, pilot program and distance-learning, respectively.

- The accumulated cash outflow is US\$ 126 million, which consists of personnel cost (33%), building (21%), equipment (24%) and others.
- The accumulated cash inflow is US\$ 126 million, which consists of student fee (46%) government support (37%) and others, which means that the polytechnic sub-sector can achieve 63% self-financing under these assumptions.
- The unit education costs of existing department, pilot program and distance-learning are estimated to be US\$ 794, US\$ 2,502 and US\$ 426, respectively. Because of the revenue from student fee, the government support portion in these unit education costs are US\$ 303, US\$ 925 and US\$ 81, respectively. The average government support portion in unit education cost is US\$ 394, which compares to US\$ 421 in 1998.

Table A-8.14.3 Summary of accumulated financial cost for 2002-2020 (Pilot Polytechnic: Ho)

	Existing		Pilot		DL		Total	
Students (1,000)	78	67%	23	20%	18	14%	117	100%
Finance (Mil. US\$)								
Cash outflow	62	100%	57	100%	7	100%	126	100%
Building	12	19%	15	27%	0	3%	27	21%
Equipment	12	19%	15	26%	4	54%	31	24%
Staff training	0	0%	3	5%	0	4%	3	2%
Personnel Cost	27	43%	13	23%	1	21%	42	33%
Others (*)	12	19%	11	19%	1	17%	24	19%
Cash inflow	62	100%	57	100%	7	100%	126	100%
Revenue	39	62%	36	63%	5	81%	80	63%
Student fee	30	49%	23	41%	4	63%	58	46%
Others (**)	8	13%	13	22%	1	18%	22	18%
Government support	24	38%	21	37%	1	19%	46	37%
Unit education cost (US\$/student/year)	794		2,502		426		1,078	
Government support (US\$/student/year)	303		925		81		394	

Note: (*) Others in cash outflow include transportation, utilities and so on. For DL, only, learning materials and schooling are included.
 (**) Others in cash inflow is residual value of building.

Table A-8.14.4 shows the phased summary of the accumulated financial cost for 2002 to 2020 in Ho Pilot Polytechnic with the following findings:

- The accumulated enrolment is 27,000, 16,000 and 75,000 for Phase I-III, IV and V, respectively. (Note that the period of each phases are different.)
- The accumulated cash outflow is US\$ 24, 17 and 86 million for Phase I-III, IV and V, respectively.
- The accumulated cash inflow of student fee is US\$ 4, 5 and 49 million for Phase I-III, IV and V, respectively. The accumulated cash inflow of government support is US\$ 20, 11 and 15 million, respectively.
- The unit education costs are estimated to be US\$ 887, 1,075 and 1,146 for Phase I-III, IV and V, respectively. The government support portion in these unit education costs is US\$ 755 (85%), 725 (67%) and 197 (17%), respectively. As the increase of student fee, the government support portion in these unit education costs is decreased and Ho Polytechnic achieves 83% self-financing in Phase V.

**Table A-8.14.4 Summary of accumulated financial cost for 2002-2020 (by Phase)
(Pilot Polytechnic: Ho)**

	Phase I-III (Upto 2010)				Phase IV (2010 to 2013)				Phase V (2013 to 2020)				Total			
	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total
Students (1,000)	26	0	0	27	13	2	0	15	39	20	15	75	78	23	16	117
Finance (Mil. US\$)																
Cash outflow	18	4	2	24	9	7	0	17	35	46	5	86	62	57	7	126
Building	5	1	0	6	1	2	0	4	5	12	0	17	12	15	0	27
Equipment	2	2	1	4	2	2	0	4	8	11	3	22	12	15	4	31
Staff training	0	1	0	1	0	0	0	0	0	1	0	1	0	3	0	3
Personnel Cost	7	0	0	7	4	1	0	5	16	12	1	29	27	13	1	42
Others (*)	4	0	0	4	2	1	0	3	6	10	1	17	12	11	1	24
Cash inflow	18	4	2	24	9	7	0	17	35	46	5	86	62	57	7	126
Revenue	3	0	0	4	3	2	0	6	32	33	5	71	39	36	5	80
Student fee	3	0	0	4	3	2	0	6	24	21	4	49	30	23	4	58
Others (**)	0	0	0	0	0	0	0	0	8	13	1	22	8	13	1	22
Government support	15	4	2	20	6	5	0	11	3	12	0	15	24	21	1	46
Unit education cost (US\$/student/year)	683	9,477		887	726	3,150	561	1,075	890	2,275	323	1,146	794	2,502	426	1,078
Government support (US\$/student/year)	567	8,450		755	484	2,155	378	725	68	820	-27	197	303	925	81	394

(Share Percentage)

	Phase I-III (Upto 2010)				Phase IV (2010 to 2013)				Phase V (2013 to 2020)				Total			
	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total
Students (1,000)	98%	2%	0%	100%	82%	15%	3%	100%	53%	27%	21%	100%	67%	20%	14%	100%
Finance (Mil. US\$)																
Cash outflow	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Building	30%	24%	8%	27%	15%	32%	4%	22%	14%	28%	2%	20%	19%	27%	3%	21%
Equipment	10%	41%	68%	19%	21%	31%	43%	25%	24%	24%	51%	26%	19%	26%	54%	24%
Staff training	0%	25%	20%	6%	0%	6%	0%	3%	0%	3%	0%	1%	0%	5%	4%	2%
Personnel Cost	38%	6%	4%	30%	44%	17%	39%	32%	45%	26%	25%	34%	43%	23%	21%	33%
Others (*)	22%	5%	0%	18%	20%	14%	13%	18%	18%	21%	23%	20%	19%	19%	17%	19%
Cash inflow	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Revenue	17%	11%	0%	15%	33%	32%	33%	33%	92%	73%	108%	83%	62%	63%	81%	63%
Student fee	17%	11%	0%	15%	33%	32%	33%	33%	69%	45%	84%	57%	49%	41%	63%	46%
Others (**)	0%	0%	0%	0%	0%	0%	0%	0%	24%	28%	24%	26%	13%	22%	18%	18%
Government support	83%	89%	100%	85%	67%	68%	67%	67%	8%	27%	-8%	17%	38%	37%	19%	37%

Note: (*) Others in cash outflow include transportation, utilities and so on. For DL only, learning materials and schooling are included.
(**) Others in cash inflow is residual value of building.

(3) Tamale Polytechnic

Table A-8.14.5 shows the summary of accumulated financial cost for 2002 to 2020 in Tamale Pilot Polytechnic with the following findings:

- The accumulated enrolment is 62,000 student-year, which is shared by 53%, 30% and 17% by existing departments, pilot program and distance-learning, respectively.
- The accumulated cash outflow is US\$ 90 million, which consists of personnel cost (44%), building (18%), equipment (19%) and others.
- The accumulated cash inflow is US\$ 90 million, which consists of student fee (38%) government support (46%) and others, which means that the polytechnic sub-sector can achieve 54% self-financing under these assumptions.
- The unit education costs of existing department, pilot program and distance-learning are estimated to be US\$ 960, US\$ 2,879 and US\$ 471, respectively. Because of the revenue from student fee, the government support portion in these unit education costs are US\$ 497, US\$ 1,295 and US\$ 85, respectively. The average government support portion in unit education cost is US\$ 668, which compares to US\$ 421 in 1998.

Table A-8.14.5 Summary of accumulated financial cost for 2002-2020 (Pilot Polytechnic: Tamale)

	Existing		Pilot		DL		Total	
Students (1,000)	33	53%	18	30%	10	17%	62	100%
Finance (Mil. US\$)								
Cash outflow	32	100%	53	100%	5	100%	90	100%
Building	4	11%	12	23%	0	3%	16	18%
Equipment	4	12%	11	21%	2	45%	17	19%
Staff training	0	0%	2	4%	0	4%	2	3%
Personnel Cost	19	61%	18	35%	2	33%	39	44%
Others (*)	5	16%	9	16%	1	16%	15	16%
Cash inflow	32	100%	53	100%	5	100%	90	100%
Revenue	15	48%	29	55%	4	82%	48	54%
Student fee	13	40%	19	35%	3	57%	34	38%
Others (**)	3	8%	10	20%	1	25%	14	16%
Government support	16	52%	24	45%	1	18%	41	46%
Unit education cost (US\$/student/year)	960		2,879		471		1,454	
Government support (US\$/student/year)	487		1,295		85		668	

Note: (*) Others in cash outflow include transportation, utilities and so on. For DL only, learning materials and schooling are included.
(**) Others in cash inflow is residual value of building.

Table A-8.14.6 shows the phased summary of the accumulated financial cost for 2002 to 2020 in Tamale Pilot Polytechnic with the following findings:

- The accumulated enrolment is 27,000, 16,000 and 75,000 for Phase I-III, IV and V, respectively. (Note that the period of each phases are different.)
- The accumulated cash outflow is US\$ 24, 17 and 86 million for Phase I-III, IV and V, respectively.
- The accumulated cash inflow of student fee is US\$ 4, 5 and 49 million for Phase I-III, IV and V, respectively. The accumulated cash inflow of government support is US\$ 20, 11 and 15 million, respectively.
- The unit education costs are estimated to be US\$ 887, 1,075 and 1,146 for Phase I-III, IV and V, respectively. The government support portion in these unit education costs is US\$ 755 (85%), 725 (67%), and 197 (17%), respectively. As the increase of student fee, the government support portion in these unit education costs is decreased and Tamale Polytechnic achieves 83% self-financing in Phase V.

Table A-8.14.6 Summary of accumulated financial cost for 2002-2020 (by Phase) (Pilot Polytechnic: Tamale)

	Phase I-III (Upto 2010)				Phase IV (2010 to 2013)				Phase V (2013 to 2020)				Total			
	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total
Students (1,000)	11	0	0	11	5	2	0	8	17	16	10	42	33	18	10	62
Finance (Mil. US\$)																
Cash outflow	9	4	1	14	5	8	0	13	18	41	4	62	32	53	5	90
Building	2	1	0	3	0	2	0	3	1	9	0	11	4	12	0	16
Equipment	0	2	1	3	1	3	0	3	3	7	1	11	4	11	2	17
Staff training	0	1	0	1	0	0	0	0	0	1	0	1	0	2	0	2
Personnel Cost	5	0	0	6	3	2	0	5	11	16	1	29	19	18	2	39
Others (*)	2	0	0	2	1	1	0	2	3	8	1	11	5	9	1	15
Cash inflow	8	4	1	14	5	8	0	13	18	41	4	62	32	53	5	90
Revenue	1	0	0	2	1	2	0	3	13	27	4	43	15	29	4	48
Student fee	1	0	0	2	1	2	0	3	10	16	3	29	13	19	3	34
Others (**)	0	0	0	0	0	0	0	0	3	10	1	14	3	10	1	14
Government support	8	4	1	12	3	6	0	10	5	14	0	19	16	24	1	41
Unit education cost (US\$/student/year)	816	9,490		1,232	874	4,002	519	1,680	1,083	2,547	376	1,472	960	2,879	471	1,454
Government support (US\$/student/year)	698	8,463		1,060	632	3,007	338	1,242	319	870	-20	449	497	1,295	85	668

	Phase I-III (Upto 2010)				Phase IV (2010 to 2013)				Phase V (2013 to 2020)				Total			
	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total	Exstg.	Pilot	DL	Total
Students (1,000)	96%	4%	0%	100%	64%	26%	6%	100%	39%	38%	23%	100%	53%	30%	17%	100%
Finance (Mil. US\$)																
Cash outflow	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Building	20%	24%	8%	20%	9%	28%	3%	21%	8%	22%	1%	17%	11%	23%	3%	18%
Equipment	5%	41%	66%	20%	12%	33%	30%	25%	15%	17%	40%	18%	12%	21%	45%	19%
Staff training	0%	20%	19%	7%	0%	4%	0%	3%	0%	2%	0%	2%	0%	4%	4%	3%
Personnel Cost	56%	10%	7%	39%	62%	24%	53%	38%	63%	40%	39%	46%	61%	35%	33%	44%
Others (*)	18%	5%	0%	13%	17%	11%	14%	13%	14%	19%	20%	18%	16%	16%	16%	16%
Cash inflow	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Revenue	14%	11%	0%	12%	28%	25%	35%	26%	71%	66%	105%	70%	48%	55%	82%	54%
Student fee	14%	11%	0%	12%	28%	25%	35%	26%	56%	73%	47%	40%	35%	52%	38%	38%
Others (**)	0%	0%	0%	0%	0%	0%	0%	0%	14%	26%	33%	23%	8%	20%	25%	16%
Government support	86%	89%	100%	86%	72%	75%	65%	74%	29%	34%	-5%	30%	52%	45%	18%	46%

Note: (*) Others in cash outflow include transportation, utilities and so on. For DL only, learning materials and schooling are included.
(**) Others in cash inflow is residual value of building.

8.15 Economic Analysis

This Appendix includes supplemental information of economic analysis such as formula of economic internal rate of return (EIRR), definition of economic cost and benefit and estimation of economic benefit.

8.15.1 Formula of EIRR

The formula of EIRR is shown below:

$$\sum_{t=1}^n \frac{\text{Benefits}_t}{(1+R)^t} = \sum_{t=1}^n \frac{\text{Inv.cost}_t + \text{O/M cost}_t}{(1+R)^t}$$

where:

Benefits _t ;	Benefits in year t
Inv.cost _t ;	Investment cost in year t
O/Mcost _t ;	Operation and Maintenance costs in year t
n:	Calculation period
t:	Year t (from 1 to n)
R:	Value of EIRR

EIRR means the value, which will satisfy the above formula.

8.15.2 Estimation of economic cost

The economic costs of investment and operation/maintenance are estimated by multiplying financial costs by a conversion factor of 0.85. The background for this assumption is as follows:

The tax portion of VAT (12.5%) was excluded from financial costs, which is equivalent to 0.889 (=1/(1+0.125)) as a factor. The standard conversion factor of 0.958 was referred to, which has been estimated in the JICA Study called the Reserve Forest Management Project in Ghana. Then, the modified conversion factor is calculated as a product of both factors, 0.85 (0.889x0.958).

8.15.3 Definition of Economic Benefit

According to several experiences in developed and also developing countries, it can be said in general that national economic growth has been supported largely by human resource development in the countries. Human resource development is normally achieved through the education and training process. In general, education (technical education) contributes to national economic growth in the countries through development of the human resources, which in turn supports economic growth.

The effects of technical education appear in various aspects of society. Therefore, the effects of education are difficult to measure in monetary terms. In this economic analysis, the study of educational effects has focused on the return on investment in education, which will be represented by peoples' (technical workers') lifetime incomes.

This return on technical workers' income originates from the increase in their productivity. Generally speaking, technical workers' increased productivity results in the growth of per capita national income. The rate of return, as an indicator of the efficiency of educational spending, is obtained by comparing lifetime income against the educational cost.

The rate of return on education of polytechnics is obtained by comparing lifetime income and educational cost between polytechnic graduates and Technical Institutes (TI) / Senior Secondary School (SSS), considering that currently entries into polytechnics originate mainly from TIs and SSSs. The rate of return on education of polytechnics is the discount rate, which balances the present values of the following: Lifetime income difference between the two groups; i.e. (a), and incremental costs regarding polytechnics, i.e. (b).

- (a) Sum of the stream of difference of lifetime income between polytechnic graduates and TI / SSS graduates.
- (b) Sum of the stream of incremental costs regarding polytechnic.

8.15.4 Estimation of Economic Benefit

The process of estimation economic benefits is as follows:

(1) Process of estimation of economic benefits

First, the unit values of graduates' salary differences between polytechnics and TI / SSS are estimated. Also, the unit values of cost of opportunity loss (negative benefits) are estimated. Next, the annual number of graduates is estimated based on the estimated number enrolled. Then, by multiplying the above estimated unit values by the annual number of graduates, benefits (and negative benefits) are calculated.

(2) Estimation of unit graduates' salary difference

In order to estimate the average income level in the informal sector, the Study Team conducted interview survey to employees and owners working in the informal sector in downtown Accra in October 2000.

As for the formal sector, the salary data of graduates of polytechnic, TI and SSS were estimated by year of graduation, base on the local survey carried out by JICA Study Team in May 2000, which is shown in Table A-8.15.1, in comparison with the results from the informal sector survey.

Table A-8.15.1 Salary data by sector / years after graduation / institution

	Formal			Informal		
	1st year	5th year	After 10 years	1st year	5th year	After 10 years
Polytechnic	5,639,000	7,975,000	13,260,000	6,258,000	12,714,000	18,972,000
TI	3,633,000	6,019,000	7,449,000	3,168,000	6,240,000	8,060,000
SSS	2,473,000	3,395,000	5,496,000	3,168,000	6,240,000	8,060,000

Source: Local survey by JICA Study Team

Based on the above salary data, the differences of graduates' salaries between polytechnics and TIs and those between polytechnics and SSSs are estimated. Assuming that the share of entries into polytechnics from TIs and SSSs are one third (33%) and two thirds (67%) respectively, the weighted average differences of salaries has been estimated. By applying an exchange rate of Cedi 4,743 per US\$ as of May 2000, the weighted average differences of salaries on US\$ basis are obtained. Refer to Table A-8.15.2.

Table A-8.15.2 Estimated graduates' salary differences by sector / years after graduation

	Formal			Informal		
	1st year	5th year	After 10 years	1st year	5th year	After 10 years
PI -TI	668,667	652,000	1,937,000	1,030,000	2,158,000	3,637,333
PI -SSS	2,110,667	3,053,333	5,176,000	2,060,000	4,316,000	7,274,667
Weighted average	2,779,333	3,705,333	7,113,000	3,090,000	6,474,000	10,912,000
Weighted average (US\$ basis)	586	781	1,500	651	1,365	2,301

Source: Estimated by JICA Study Team

Based on the Local Survey to technical education institutions, the share of graduates by job placement (formal sector / informal sector) has been assumed for existing packaged course, then the share of other courses were assumed, as shown in Table A-8.15.3. Considering the characteristics of departments, the graduates of pilot program for Short course and Distance-learning are assumed to have a higher share in formal sector.

Table A-8.15.3 Assumption on share of graduates by job placement

		Formal	Informal	Total
Packaged	Existing	70%	30%	100%
	Pilot	70%	30%	100%
Short	Existing	70%	30%	100%
	Pilot	90%	10%	100%
Distance-learning	Existing	70%	30%	100%
	Pilot	90%	10%	100%

Source: Assumed by JICA Study Team

The salary difference between existing and pilot programs is estimated by the following way, assuming that the graduates from pilot programs have more chance to find jobs at higher salary, compared to those in existing courses:

- From the formal sector survey, the salary difference is estimated to be 1.39 times from calculation of the top 16 companies' average salary divided by all 56 companies' average salary.
- From the informal sector survey, the salary difference is estimated to be 1.92 times from calculation of the top 9 graduates' average salary divided by all 25 graduates' average salary.
- Assuming that 70% goes to the formal sector and 30% goes to the informal sector, the weighted average salary difference is calculated 1.54.

As a result, utilizing the weighted average of graduates' salary differences by job placement (refer to Table A-8.15.2) and the above share (refer to Table A-8.15.3), the unit salary differences of graduates by year of graduation and by course / department category are estimated, as shown in Table A-8.15.4.

Table A-8.15.4 Estimated unit graduates' salary differences by year of graduation and by course / department category

		(US\$/year)		
		1st year	5th year	After 10 years
Packaged	Existing	606	956	1,740
	Pilot	935	1,477	2,688
Short	Existing	606	956	1,740
	Pilot	915	1,297	2,440
Distance-learning	Existing	606	956	1,740
	Pilot	915	1,297	2,440

Source: Estimated by JICA Study Team

(3) Estimation of unit opportunity loss cost (negative benefit)

As previously mentioned, the current entries into polytechnics originate mainly from TIs and SSSs. If graduates of TIs / SSSs do not enter polytechnics, they can get salary for the period of time that they would attended a polytechnic. In other words, those who enter polytechnics from TIs / SSSs possibly lose an opportunity (opportunity loss) to get salary for the period of attendance at polytechnic, compared to those who get jobs directly after graduation from TIs / SSSs.

Therefore, such a cost of opportunity loss is treated as a negative benefit in the process of the estimation of economic benefits. The survey data of the salary of graduates of TIs / SSSs, as previously shown in Table A-8.15.1, are utilized. Assuming that the ratio of entries to polytechnics from TIs and SSSs are one third (33%) and two thirds (67%) respectively, the weighted average salaries of TI / SSS graduates have been estimated. By applying the exchange rate of Cedi 4,743 per US\$ as of May 2000, the weighted average salaries in US\$ have been obtained. Refer to Table A-8.15.5.

Table A-8.15.5 Salary data by sector / year of graduation/ institution

(Cedi /year)

	Formal		Informal	
	1st year	5th year	1st year	5th year
TI (Survey data)	1,211,000	2,006,333	1,056,000	2,080,000
SSS (Survey data)	1,648,667	2,263,333	2,112,000	4,160,000
Weighted average	2,859,667	4,269,667	3,168,000	6,240,000
Weighted average (US\$ basis)	603	900	668	1,316

Source: Local survey and estimated by JICA Study Team

The share of graduates by job placement (formal sector / informal sector) have been assumed by type of course (packaged / short / distance-learning) and by category of department (Existing / Pilot program) to be 30% and 70% in formal and informal sectors, respectively. As a result, costs of opportunity loss are estimated as shown in Table A-8.15.6. The values from 2nd year to 4th year are estimated by interpolation based on the estimated values of the base years of 1st year and 5th year.

Table A-8.15.6 Estimated Cost of Opportunity Loss by Year of Graduation

(US\$)

	1st year	2nd year	3rd year	4th year	5th year
Cost of opportunity loss	648	784	920	1,055	1,191

Source: Estimated by JICA Study Team

(4) Estimation of number of graduates

The number of graduates has been estimated based on the estimated numbers enrolled. The timing of graduation has been assumed as follows:

- Packaged course (Existing and Pilot program) : three years after entrance.
- Short course (Existing and Pilot program) : one year after entrance.
- Distance-learning (Existing and Pilot program) : four years after entrance.

Regarding the estimation of opportunity loss costs, the calculations are distributed for the period of previous three years, one year and none for each graduation year in packaged course, short course and distance-learning course, respectively. In the case of distance-learning courses, students do not need to attend a conventional school, so that, a zero year is assumed for calculation of opportunity loss cost.

(5) Estimation of economic benefits

By multiplying the above estimated unit values of graduates' salary differences between polytechnics and TIs / SSSs by the annual number of graduates, annual economic benefits are calculated.

The unit values of graduates' salary differences between polytechnics and TIs / SSSs are obtained for year 1, year 5 and after 10 years, so that, the values for intermediate years are estimated by interpolation and the values after year 11 are assumed to be the same as those after year 10. All graduates until year 2020 are included in the calculation. The calculation period is assumed to be 20 years after graduation for each year of graduates. Thus, the year after 20 years for those who graduate in 2020 is equivalent to year 2039.

Negative benefits are calculated annually by multiplying the above estimated unit values of the cost of opportunity loss by the estimated annual number of graduates.

Table A-8.16.2 Economic analysis: pilot polytechnic: Ho

Pilot Pl: Ho																																							
(US\$ 1,000)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	
(A) Costs																																							
(A-1) Investment Related																																							
Building	505	544	587	665	715	1,006	621	673	948	1,019	1,102	1,279	1,390	1,510	1,471	1,666	1,894	2,160	2,471																				
Equipment	56	689	190	180	143	763	690	665	823	854	1,647	1,344	1,303	3,401	1,194	2,239	1,871	3,172	2,078																				
Training	31	31	31	177	459	163	122	122	122	122	122	122	122	122	122	122	122	122	122																				
Sub-total	593	1,264	808	1,022	1,318	1,933	1,433	1,460	1,892	1,995	2,871	2,745	2,815	5,033	2,787	4,028	3,887	5,454	4,671																				
(A-2) Operation and Maintenance																																							
Maint. (Building)	15	16	18	20	21	30	20	21	29	32	34	39	42	46	45	51	58	66	75																				
Maint. (Equipment)	8	10	12	14	17	254	57	71	87	104	122	146	172	199	223	250	282	494	342																				
Personnal Cost (Teacher)	388	433	473	517	566	659	747	840	992	1,156	1,334	1,514	1,708	1,916	2,126	2,313	2,523	2,758	3,024																				
Full-time	(155)	(174)	(191)	(210)	(232)	(271)	(309)	(349)	(415)	(486)	(584)	(644)	(730)	(824)	(919)	(1,005)	(1,102)	(1,212)	(1,336)																				
Part-time	(233)	(259)	(281)	(307)	(335)	(388)	(438)	(491)	(577)	(670)	(770)	(870)	(977)	(1,092)	(1,207)	(1,308)	(1,420)	(1,546)	(1,688)																				
Personnal Cost (Admi.)	121	135	149	167	187	216	242	271	317	369	429	505	583	673	770	868	983	1,110	1,258																				
Other Costs	337	360	380	403	427	484	534	588	704	833	976	1,147	1,315	1,498	1,682	1,859	2,061	2,281	2,532																				
Sub-total	889	954	1,031	1,121	1,218	1,644	1,600	1,790	2,129	2,494	2,895	3,351	3,820	4,331	4,846	5,341	5,905	6,709	7,230																				
Costs Total	1,482	2,218	1,839	2,143	2,536	3,577	3,033	3,250	4,022	4,489	5,767	6,097	6,635	9,364	7,632	9,369	9,792	12,163	11,902																				
(Sensitivity)	1.00	1,462	2,218	1,839	2,143	2,536	3,577	3,033	3,250	4,022	4,489	5,767	6,097	6,635	9,364	7,632	9,369	9,792	12,163	11,902																			
(B) Benefits																																							
Existing: Packaged + Short																																							
Benefits	0	0	658	1,422	2,294	3,279	4,471	6,047	8,003	10,358	13,128	16,341	19,862	23,721	27,944	32,558	37,408	42,454	47,665	51,075	54,347	57,441	58,426	59,124	59,278	58,850	57,580	55,235	51,919	48,161	43,981	39,397	34,426	29,087	23,396	17,368	11,462	5,673	
Negative B.	-1,361	-2,343	-2,384	-2,428	-2,477	-2,600	-2,782	-2,920	-3,050	-3,175	-3,293	-3,405	-3,512	-3,612	-3,708	-3,634	-3,035	-2,339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net	-1,361	-2,343	-1,726	-1,006	-182	679	1,689	3,127	4,953	7,183	9,835	12,936	16,351	20,109	24,237	28,924	34,373	40,116	47,665	51,075	54,347	57,441	58,426	59,124	59,278	58,850	57,580	55,235	51,919	48,161	43,981	39,397	34,426	29,087	23,396	17,368	11,462	5,673	
Pilot: Packaged + Short																																							
Benefits	0	0	0	0	0	5	28	136	333	655	1,294	2,153	3,284	4,875	6,856	9,198	12,061	15,393	17,095	18,925	20,827	22,797	24,815	26,524	27,871	28,811	29,250	28,957	28,464	27,692	26,135	24,177	21,751	18,411	14,513	10,285	5,365		
Negative B.	0	0	0	0	0	-43	-102	-176	-333	-532	-774	-971	-1,206	-1,477	-1,704	-1,896	-1,794	-1,527	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net	0	0	0	0	0	-43	-96	-148	-197	-199	-119	322	947	1,807	3,170	4,960	7,404	10,533	15,393	17,095	18,925	20,827	22,797	24,815	26,524	27,871	28,811	29,250	28,957	28,464	27,692	26,135	24,177	21,751	18,411	14,513	10,285	5,365	
Distance L: Existing + Pilot																																							
Benefits	0	0	0	0	0	0	0	0	0	0	0	62	144	262	662	1,025	1,465	1,992	2,212	2,478	2,785	3,120	3,488	3,829	4,075	4,247	4,338	4,338	4,338	4,338	4,338	4,338	4,172	3,972	3,694	2,646	1,860	980	
Negative B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net	0	0	0	0	0	0	0	0	0	0	0	62	144	262	662	1,025	1,465	1,992	2,212	2,478	2,785	3,120	3,488	3,829	4,075	4,247	4,338	4,338	4,338	4,338	4,338	4,338	4,172	3,972	3,694	2,646	1,860	980	
Total																																							
Benefits	0	0	658	1,422	2,294	3,279	4,476	6,075	8,140	10,691	13,784	17,635	22,077	27,149	33,081	40,075	47,631	55,980	65,050	70,382	75,751	81,053	84,344	87,427	89,631	90,795	90,638	88,824	85,214	80,963	76,012	69,870	62,776	54,810	45,501	34,527	23,606	12,018	
Negative B.	-1,361	-2,343	-2,384	-2,428	-2,477	-2,643	-2,884	-3,096	-3,383	-3,707	-4,067	-4,377	-4,717	-5,090	-5,412	-5,529	-4,829	-3,866	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net	-1,361	-2,343	-1,726	-1,006	-182	636	1,593	2,979	4,756	6,984	9,716	13,258	17,360	22,060	27,669	34,546	42,801	52,114	65,050	70,382	75,751	81,053	84,344	87,427	89,631	90,795	90,638	88,824	85,214	80,963	76,012	69,870	62,776	54,810	45,501	34,527	23,606	12,018	
(Sensitivity)	1.00	-1,361	-2,343	-1,726	-1,006	-182	636	1,593	2,979	4,756	6,984	9,716	13,258	17,360	22,060	27,669	34,546	42,801	52,114	65,050	70,382	75,751	81,053	84,344	87,427	89,631	90,795	90,638	88,824	85,214	80,963	76,012	69,870	62,776	54,810	45,501	34,527	23,606	12,018
Undepreciated Value		18,948																																					
(C) Net Cash Flow for EIRR																																							
EIRR = 25.3%	-2,823	-4,562	-3,565	-3,149	-2,718	-2,941	-1,440	-271	734	2,495	3,950	7,162	10,725	12,695	20,037	25,177	33,009	39,951	72,096	70,382	75,751	81,053	84,344	87,427	89,631	90,795	90,638	88,824	85,214	80,963	76,012	69,870	62,776	54,810	45,501	34,527	23,606	12,018	
Until 2020	EIRR = 20.1%																																						
Until 2039	EIRR = 25.3%																																						

Table A-8.16.3 Economic analysis: pilot polytechnic: Tamale

Pilot Pl: Tamale																																									
(US\$ 1,000)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039			
(A) Costs																																									
(A-1) Investment Related																																									
Building	178	190	204	237	253	509	376	417	692	764	847	636	685	738	954	1,108	1,290	1,504	1,757																						
Equipment	14	377	81	68	40	553	549	527	798	807	1,034	407	368	1,811	655	1,055	1,030	1,775	1,121																						
Training	22	22	22	126	357	124	100	100	100	100	100	100	100	100	100	100	100	100	100	100																					
Sub-total	213	589	306	431	650	1,186	1,025	1,045	1,590	1,671	1,981	1,142	1,153	2,649	1,709	2,263	2,419	3,379	2,978																						
(A-2) Operation and Maintenance																																									
Maint. (Building)	5	6	6	7	8	15	12	13	21	23	26	20	21	23	29	34	39	46	53																						
Maint. (Equipment)	2	3	3	4	5	75	34	45	60	77	93	100	107	114	127	142	159	282	192																						
Personnal Cost (Teacher)	324	362	396	432	471	577	682	794	998	1,219	1,459	1,647	1,849	2,066	2,323	2,562	2,832	3,140	3,489																						
Full-time	(32)	(37)	(40)	(44)	(49)	(60)	(72)	(84)	(107)	(132)	(159)	(181)	(205)	(231)	(262)	(291)	(325)	(363)	(407)																						
Part-time	(292)	(326)	(355)	(388)	(423)	(517)	(610)	(710)	(891)	(1,087)	(1,300)	(1,466)	(1,644)	(1,835)	(2,061)	(2,270)	(2,508)	(2,777)	(3,082)																						
Personnal Cost (Admi.)	51	56	63	73	83	100	117	135	170	209	255	307	360	421	494	574	668	770	890																						
Other Costs	141	151	160	170	180	219	258	300	393	497	613	713	814	925	1,059	1,193	1,347	1,516	1,711																						
Sub-total	523	578	628	685	746	987	1,103	1,287	1,642	2,024	2,445	2,786	3,151	3,548	4,032	4,504	5,046	5,754	6,335																						
Costs Total	736	1,167	934	1,117	1,396	2,173	2,128	2,332	3,232	3,695	4,427	3,928	4,304	6,197	5,742	6,767	7,465	9,133	9,313																						
(Sensitivity)	1.00	736	1,167	934	1,117	1,396	2,173	2,128	2,332	3,232	3,695	4,427	3,928	4,304	6,197	5,742	6,767	7,465	9,133	9,313																					
(B) Benefits																																									
Existing: Packaged + Short																																									
Benefits	0	0	275	596	962	1,376	1,878	2,540	3,363	4,353	5,519	6,870	8,352	9,977	11,754	13,696	15,738	17,862	20,055	21,490	22,868	24,170	24,590	24,886	24,951	24,771	24,236	23,250	21,854	20,272	18,512	16,583	14,491	12,243	9,848	7,311	4,824	2,388	0		
Negative B.	-569	-982	-1,002	-1,022	-1,042	-1,094	-1,171	-1,229	-1,284	-1,336	-1,386	-1,433	-1,478	-1,521	-1,561	-1,529	-1,278	-984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net	-569	-982	-727	-426	-80	282	707	1,311	2,079	3,017	4,133	5,437	6,874	8,456	10,194	12,167	14,460	16,877	20,055	21,490	22,868	24,170	24,590	24,886	24,951	24,771	24,236	23,250	21,854	20,272	18,512	16,583	14,491	12,243	9,848	7,311	4,824	2,388	0		
Pilot: Packaged + Short																																									
Benefits	0	0	0	0	0	5	28	136	326	629	1,213	1,968	2,929	4,210	5,803	7,691	9,998	12,877	14,064	15,539	17,053	18,605	20,185	21,524	22,580	23,316	23,649	23,356	22,882	22,160	20,744	19,045	17,023	14,426	11,387	8,082	4,221	0			
Negative B.	0	0	0	0	0	-43	-102	-176	-315	-491	-704	-831	-979	-1,149	-1,329	-1,483	-1,408	-1,202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net	0	0	0	0	0	-43	-96	-148	-178	-165	-75	382	988	1,780	2,880	4,320	6,283	8,796	12,877	14,064	15,539	17,053	18,605	20,185	21,524	22,580	23,316	23,649	23,356	22,882	22,160	20,744	19,045	17,023	14,426	11,387	8,082	4,221	0		
Distance L.: Existing + Pilot																																									
Benefits	0	0	0	0	0	0	0	0	0	0	59	132	239	458	703	1,000	1,383	1,538	1,719	1,927	2,151	2,397	2,620	2,792	2,915	2,983	2,983	2,983	2,983	2,983	2,983	2,983	2,983	2,827	2,646	2,397	1,852	1,320	729		
Negative B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net	0	0	0	0	0	0	0	0	0	0	59	132	239	458	703	1,000	1,383	1,538	1,719	1,927	2,151	2,397	2,620	2,792	2,915	2,983	2,983	2,983	2,983	2,983	2,983	2,983	2,827	2,646	2,397	1,852	1,320	729	0		
Total																																									
Benefits	0	0	275	596	962	1,376	1,883	2,568	3,499	4,679	6,148	8,083	10,379	13,038	16,203	19,958	24,132	28,860	34,115	37,093	40,126	43,150	45,346	47,468	49,094	50,143	50,467	49,881	48,192	46,137	43,655	40,310	36,362	31,913	26,671	20,549	14,227	7,338	0		
Negative B.	-569	-982	-1,002	-1,022	-1,042	-1,137	-1,273	-1,405	-1,599	-1,827	-2,090	-2,264	-2,457	-2,669	-2,890	-3,013	-2,686	-2,186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Net	-569	-982	-727	-426	-80	239	610	1,163	1,901	2,852	4,058	5,819	7,921	10,369	13,313	16,945	21,446	26,674	34,115	37,093	40,126	43,150	45,346	47,468	49,094	50,143	50,467	49,881	48,192	46,137	43,655	40,310	36,362	31,913	26,671	20,549	14,227	7,338	0		
(Sensitivity)	1.00	-569	-982	-727	-426	-80	239	610	1,163	1,901	2,852	4,058	5,819	7,921	10,369	13,313	16,945	21,446	26,674	34,115	37,093	40,126	43,150	45,346	47,468	49,094	50,143	50,467	49,881	48,192	46,137	43,655	40,310	36,362	31,913	26,671	20,549	14,227	7,338		
Undepreciated Value																																									
(C) Net Cash Flow for EIRR																																									
EIRR = 23.5%	-1,306	-2,149	-1,661	-1,543	-1,477	-1,934	-1,518	-1,169	-1,332	-843	-369	1,891	3,617	4,172	7,571	10,178	13,981	17,541	36,844	37,093	40,126	43,150	45,346	47,468	49,094	50,143	50,467	49,881	48,192	46,137	43,655	40,310	36,362	31,913	26,671	20,549	14,227	7,338	0		
Until 2020	EIRR = 16.0%																																								
Until 2039	EIRR = 23.5%																																								

Table A-8.16.4 Economic analysis: pilot program of overall polytechnics

Overall PI	(US\$ 1,000)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
(A) Costs																																							
(A-1) Investment Related																																							
Building	4,393	4,727	4,702	5,109	5,481	7,705	4,896	4,948	9,024	9,867	10,841	9,605	10,374	11,202	12,170	13,850	15,811	18,103	20,784																				
Equipment	389	5,854	1,464	1,349	1,016	5,187	4,731	4,478	12,225	10,739	16,430	8,470	8,075	26,718	9,602	17,626	15,140	25,921	16,747																				
Training	272	272	272	1,548	4,115	1,453	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110	1,110																				
Sub-total	5,054	10,653	6,438	8,007	10,612	14,345	10,737	10,535	22,359	21,715	28,380	19,184	19,559	39,030	22,882	32,586	32,061	45,134	38,640																				
(A-2) Operation and Maintenance																																							
Maint. (Building)	132	142	141	153	164	232	155	157	279	304	332	294	317	342	371	422	480	549	629																				
Maint. (Equipment)	56	68	82	99	119	1,746	416	504	713	928	1,149	1,298	1,457	1,624	1,816	2,036	2,288	4,050	2,773																				
Personnal Cost (Teacher)	2,778	3,142	3,437	3,773	4,141	4,898	5,654	6,444	7,772	9,214	10,777	12,245	13,827	15,529	17,318	18,917	20,716	22,743	25,028																				
Full-time	(2,020)	(2,264)	(2,463)	(2,734)	(3,011)	(3,459)	(3,868)	(4,293)	(4,951)	(5,667)	(6,447)	(7,200)	(8,013)	(8,891)	(9,821)	(10,684)	(11,648)	(12,728)	(13,939)																				
Part-time	(758)	(878)	(953)	(1,038)	(1,131)	(1,438)	(1,786)	(2,152)	(2,821)	(3,546)	(4,329)	(5,045)	(5,814)	(6,638)	(7,496)	(8,234)	(9,069)	(10,015)	(11,089)																				
Personnal Cost (Admi.)	987	1,103	1,220	1,371	1,533	1,775	2,007	2,248	2,652	3,110	3,638	4,264	4,918	5,661	6,490	7,335	8,318	9,413	10,684																				
Other Costs	2,741	2,947	3,112	3,298	3,495	3,998	4,455	4,936	5,990	7,159	8,461	9,877	11,264	12,776	14,374	15,915	17,676	19,598	21,792																				
Sub-total	6,694	7,402	7,992	8,693	9,453	12,648	12,687	14,289	17,406	20,715	24,357	27,979	31,783	35,931	40,369	44,625	49,478	56,352	60,907																				
Costs Total	11,747	18,055	14,429	16,700	20,065	26,993	23,424	24,824	39,765	42,430	52,737	47,163	51,342	74,961	63,250	77,211	81,539	101,485	99,547																				
(Sensitivity)	1.00	11,747	18,055	14,429	16,700	20,065	26,993	23,424	24,824	39,765	42,430	52,737	47,163	51,342	74,961	63,250	77,211	81,539	101,485	99,547																			
(B) Benefits																																							
Existing: Packaged + Short																																							
Benefits	0	0	5,357	11,610	18,748	26,803	36,563	49,472	65,525	84,850	107,589	133,963	162,885	194,586	229,292	267,211	307,079	348,569	391,411	419,444	446,347	471,783	490,036	485,839	487,166	483,708	473,342	454,124	426,858	395,963	361,595	323,905	283,041	239,143	192,351	142,796	94,233	46,640	
Negative B.	-11,109	-19,143	-19,522	-19,884	-20,282	-21,312	-22,843	-24,003	-25,079	-26,102	-27,074	-27,996	-28,871	-29,700	-30,484	-29,874	-24,954	-19,227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net	-11,109	-19,143	-14,164	-8,274	-1,534	5,491	13,720	25,469	40,446	58,749	80,515	105,967	134,014	164,886	198,808	237,336	282,126	329,342	391,411	419,444	446,347	471,783	480,036	485,839	487,166	483,708	473,342	454,124	426,858	395,963	361,595	323,905	283,041	239,143	192,351	142,796	94,233	46,640	
Pilot: Packaged + Short																																							
Benefits	0	0	0	0	0	51	262	1,273	3,105	6,099	12,020	19,875	30,100	44,202	61,757	82,524	107,883	137,374	152,537	168,775	185,580	202,922	220,639	235,639	247,464	255,705	259,529	256,794	252,205	245,039	230,596	212,746	190,943	161,631	127,408	90,293	47,100		
Negative B.	0	0	0	0	0	-399	-947	-1,644	-3,097	-4,942	-7,180	-8,811	-10,740	-12,965	-14,960	-16,641	-15,753	-13,409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net	0	0	0	0	0	-399	-896	-1,382	-1,823	-1,837	-1,080	3,209	9,136	17,134	29,241	45,116	66,772	94,475	137,374	152,537	168,775	185,580	202,922	220,639	235,639	247,464	255,705	259,529	256,794	252,205	245,039	230,596	212,746	190,943	161,631	127,408	90,293	47,100	
Distance L.: Existing + Pilot																																							
Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	578	1,334	2,434	5,791	8,919	12,711	17,329	19,253	21,566	24,222	27,119	30,288	33,216	35,346	36,848	37,651	37,651	37,651	37,651	37,651	36,109	34,254	31,677	22,924	16,168	8,628
Negative B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net	0	0	0	0	0	0	0	0	0	0	0	0	0	578	1,334	2,434	5,791	8,919	12,711	17,329	19,253	21,566	24,222	27,119	30,288	33,216	35,346	36,848	37,651	37,651	37,651	37,651	37,651	36,109	34,254	31,677	22,924	16,168	8,628
Total																																							
Benefits	0	0	5,357	11,610	18,748	26,803	36,614	49,734	66,799	87,955	113,688	145,983	183,339	226,020	275,927	334,759	398,522	469,163	546,114	591,233	636,689	681,585	710,077	736,766	756,021	766,518	765,895	751,304	721,303	685,819	644,284	592,152	531,895	464,341	385,659	293,128	200,694	102,369	
Negative B.	-11,109	-19,143	-19,522	-19,884	-20,282	-21,712	-23,790	-25,647	-28,175	-31,043	-34,253	-36,807	-39,611	-42,665	-45,445	-46,516	-40,706	-32,636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net	-11,109	-19,143	-14,164	-8,274	-1,534	5,091	12,824	24,086	38,623	56,912	79,435	109,176	143,728	183,355	230,483	288,243	357,816	436,527	546,114	591,233	636,689	681,585	710,077	736,766	756,021	766,518	765,895	751,304	721,303	685,819	644,284	592,152	531,895	464,341	385,659	293,128	200,694	102,369	
(Sensitivity)	1.00	-11,109	-19,143	-14,164	-8,274	-1,534	5,091	12,824	24,086	38,623	56,912	79,435	109,176	143,728	183,355	230,483	288,243	357,816	436,527	546,114	591,233	636,689	681,585	710,077	736,766	756,021	766,518	765,895	751,304	721,303	685,819	644,284	592,152	531,895	464,341	385,659	293,128	200,694	102,369
Undepreciated Value																																							
149,188																																							
(C) Net Cash Flow for EIRR																																							
EIRR = 25.6%	-22,856	-37,199	-28,594	-24,974	-21,599	-21,901	-10,600	-737	-1,142	14,482	26,698	62,013	92,385	108,394	167,232	211,032	276,277	335,042	595,755	591,233	636,689	681,585	710,077	736,766	756,021	766,518	765,895	751,304	721,303	685,819	644,284	592,152	531,895	464,341	385,659	293,128	200,694	102,369	
Until 2020	EIRR = 20.3%																																						
Until 2039	EIRR = 25.6%																																						

APPENDIX

CHAPTER 9 URGENT ACTION PROGRAMS

9.1 Scope of Works for Experts

The followings are the proposed TOR for experts to follow up the JICA Study of Development of a Master Plan to Strengthen Technical Education

9.1.1 Institutional development expert

(1) Man-month input

Short-term expert: 2 months x 6 times.

(2) Objectives

To assist National Council for Tertiary Education (NCTE) to develop related organizations to introduce the Competency Based Training (CBT) in the Technical and Vocational Education and Training (TVET) sector, which include provisional organizations of Ghana National Training Authority (GHANTA), Industrial Training Advisory Boards (ITABs) and National Qualification Authority (NQA)

(3) Expected outcomes

Expected outcomes from consulting services of the institutional development expert are the followings:

- Cooperation agreement between NCTE and the industrial sector in terms of establishment of CBT related organizations
- Draft of Act to introduce the CBT in the TVET sector
- Draft of articles of association for provisional organizations of GHANTA, ITABs and NQA
- Preparation for establishment of provisional organizations of GHANTA, ITABs and NQA

(4) Activities

Activities that the expert provides NCTE with consulting services are as follows:

- Assist NCTE to disseminate the CBT approach among all relevant parties including industries, MOE, NCTE, polytechnics through a series of meetings, workshops and report
- Assist NCTE to strengthen linkage with industries by clarifying roles, responsibilities and benefit in both the industrial and TVET sectors

-
- Assist NCTE to identify member companies to establish ITABs in six industrial areas of pilot programs, i.e., hospitality and tourism, information technology and communications, business information technology, post harvest and food processing, wood processing technology and manufacturing technology
 - Assist NCTE to define roles, functions and responsibilities of all relevant organizations related to the CBT

(5) Conditions

The institutional development expert should be invited from countries with experiences of the CBT approach such as Singapore.

9.1.2 Financial development expert

(1) Man-month input

Short-term expert: 1 month x 6 times

(2) Objectives

To assist NCTE to develop financial schemes of relevant funds/organizations to support implementation of the CBT approach, which include skill development fund, student loan fund and the CBT resource development center

(3) Expected outcomes

- Cooperation agreement between NCTE and the industrial sector in terms of establishment of skill development fund
- Draft of Act to establish skill development fund
- Financial scheme of skill development fund
- Operation scheme of student loan fund
- Identification of other financial sources such as private money transfer from overseas Ghanaians
- Draft document to request a grant for construction of CBT resource development center

(4) Activities

To provide NCTE with consulting services in the following activities:

- Assist NCTE to identify member companies to participate in skill development fund
- Assist NCTE for financial data-base development to implement skill development fund and student loan fund
- Assist NCTE to identify other financial sources such as private money transfer from overseas Ghanaians

- Assist NCTE to develop scheme for a public-private cooperation of the CBT resource development center
- Assist NCTE to design functions and activities of the CBT resource development center

9.1.3 CBT resource development expert (Singaporean)

(1) Man-month input

Short-term expert: 2 months x 5

(2) Objectives

To assist NCTE to develop CBT related documents, such as competency standards, assessment guidelines, qualifications, textbook and workbook

(3) Expected outcomes

- Selection of 10 modules which could be commonly used for existing packaged courses in polytechnics
- CBT related documents for selected 10 modules such as competency standards, assessment guidelines, qualifications, textbook and workbook
- Capacity building of both the public and private sectors to plan, design and develop competency standards, assessment guidelines, qualifications
- Capacity building of Ghanaian managerial and teaching staff to plan, design and develop textbook and workbook

(4) Activities

To provide NCTE with consulting services in the following activities:

- Transfer of knowledge and know-how to develop CBT related documents
- Strengthen system to plan, design and develop CBT related documents
- Organize a joint team of industries and teachers to develop CBT related documents
- Develop CBT related documents for selected 10 modules to start the CBT approach for existing packaged courses in polytechnics

(5) Conditions

The CBT resource development expert should be invited from countries with experiences of the CBT approach such as Singapore.

9.1.4 Textbook/workbook production expert

(1) Man-month input

Short-term expert: 3 months x 3 times

(2) Objectives

To assist NCTE to develop capabilities to produce textbook and workbook by editing, printing and binding

(3) Expected outcomes

- Capacity building of Ghanaian staff to produce textbook and workbook
- Draft document to request a small-scale grant for establishment of the printing document production unit in NCTE
- Textbook and workbook for selected 10 modules above mentioned

(4) Activities

To provide NCTE with technical assistance in the following activities:

- Transfer of knowledge and know-how to produce documents
- Select equipment for the printing document production unit and make a cost estimation
- Assist NCTE to install equipment for the printing document production unit
- Produce textbook and workbook for 10 selected modules in cooperation with the CBT resource development expert

(See Appendix 9.2 for the printing document production unit.)

9.2 Printing Document Production Unit

9.2.1 Background

In the JICA Study called Development of a Master Plan to Strengthen Technical Education in the Republic of Ghana, the competency based training (CBT) approach was proposed and accepted to reform technical and vocational education and training (TVET) by Ministry of Education, Ghana. However, the current capabilities to develop teaching materials is very limited in Ghana, particularly in the fields of technical education, the printing document production unit was proposed to start developing textbooks and workbooks to introduce the CBT approach in a small scale.

9.2.2 Objectives of the printing document production unit

Objective of the printing document production unit is to develop capabilities to produce textbooks and workbooks for some selected modules by applying the CBT approach. Commonly and widely used modules for existing packaged courses in polytechnics will be selected so that these newly developed teaching materials can be also used to upgrade workers and life-long learners.

9.2.3 Activities

In order to achieve the objective, the activities of printing document production unit should include (1) human resource development by providing on-the-job training for planning, manuscript development, editing, printing, distribution, inventory control and financial management and (2) production and sales of textbooks and workbooks for some selected modules.

9.2.4 Organization

The Unit belongs to National Council for Tertiary Education (NCTE) with the following personnel:

- Producer (course material's developer): one person
- Technical staff for textbook/workbook: two person
- Teachers to develop manuscript: two person
- Administrative staff: two person

In addition, four short-term experts, as described in Appendix 9.1, will assist them to develop the printing document production scheme and to operate the Unit.

9.2.5 Proposed subjects for textbook and workbook production

The following commonly and widely used modules would be candidates to develop their textbooks and workbooks in this project: (These are selected from the indicative training packages shown in Appendix 8.4.)

- Communicate in the workplace
- Participate in a team
- Receive and process oral and written communication
- Apply Occupational Health and Safety procedures
- Perform computations (basic)
- Operate word processing packages
- Operate spreadsheet packages

-
- Manage files and folders
 - Maintain equipment & consumables
 - Deliver a service to customers
 - Apply quality procedures
 - Plan to undertake a routine task

9.2.6 Preliminary financial estimation

In order to examine a financial viability of the Unit, the following preliminary financial estimation for the Unit was made:

- (1) Items of revenue and cost
 - a. Revenue items: sales of textbooks and workbooks
 - b. Cost items: personnel cost, production cost of teaching materials, maintenance, utilities and contingency (Initial investment for equipment is assumed to be donated by donor agencies.)
- (2) Assumptions
 - a. Project period: 2002 to 2006
 - b. Textbooks and workbooks produced: 15 modules (one subject needs one textbook and one workbook)
 - c. Sales amount: Half of polytechnic students enrolled in existing packaged courses purchase textbooks and workbooks developed by the Unit.
 - d. Production cost of textbook and workbook: Each has 100 pages and its production cost is US\$ 1.5. In addition, 20% of production cost is needed for packaging and distribution.
 - e. Sales price of textbook and workbook: US\$ 3 each
 - f. Maintenance and utility cost: 20% of initial investment every year
 - g. Numbers of personnel and their cost: described in Table 2 below.
 - h. Contingency: 10% of the total cost
- (3) Cost estimation for initial investment

A preliminary cost estimation is shown in Table A-9.2.1.

Table A-9.2.1 Cost estimation for printing document production unit

No.	Items	Unit Price(¥)	Unit Price(US\$)	Q'ty	Total Cost(US\$)
1	D.T.P. system Special Personal computer system with software	1,375,000	12,500	4	50,000
2	High speed copy machine	2,200,000	20,000	2	40,000
3	Bookbinding equipment	110,000	1,000	2	2,000
4	Other supplementary equipment	110,000	1,000	1	1,000
	Total				93,000

(4) Preliminary financial estimation

A preliminary financial estimation is shown in Table A-9.2.2. Since the initial investment is excluded in the calculation, the project is financially feasible with its financial internal rate of return (FIRR) of 49%.

Table A-9.2.2 Preliminary financial estimation of printing document production unit

		2002	2003	2004	2005	2006	Total	Share(%)
Revenue								
Sales of textbooks and workbooks								
Student enrollment in Packaged courses	(student)	23,033	23,545	23,925	24,404	24,892		
Development schedule of textbooks and workbooks	(module)	0	0	5	10	15		
Sales amount of textbooks and workbooks	(book)	0	0	39,875	81,345	124,458		
Sales revenue of textbooks and workbooks	(US\$ 1,000)	0	0	120	244	373	737	248%
Cost								
Personnel cost								
No. of staff								
Producer(course material's developer)		1	1	1	1	1		
Technical staff for textbooks		2	2	2	2	2		
Teacher to develop manuscripts		0	2	2	2	2		
Administration		1	1	2	2	2		
Total		4	6	7	7	7		
Personnel cost (Including activity cost)								
	100%							
Producer(course material's developer)	(US\$1000)	4	4	4	5	5	22	7%
Technical staff for textbooks	(US\$1000)	8	8	9	9	10	45	15%
Tutors	(US\$1000)	0	8	9	9	10	37	12%
Administration	(US\$1000)	1	2	3	4	2	12	4%
Total	(US\$1000)	13	22	26	27	27	116	39%
Production cost of teaching materials								
Textbooks/workbooks	(US\$1000)	0	0	60	122	187	369	124%
Others (Packaging and distribution)	(US\$1000)	0	0	12	24	37	74	25%
Total	(US\$1000)	0	0	72	146	224	442	149%
Maintenance and utility cost								
	(US\$1000)	0	0	0	19	19	19	6%
Contingency (10%)	(US\$1000)	1	2	10	19	27	27	9%
Total cost	(US\$1000)	14	24	107	212	297	297	100%
Balance	(US\$1000)	-14	-24	13	32	76	76	26%
Accumulated balance	(US\$1000)	-14	-24	13	32	76		
FIRR								49%

9.3 CBT Resource Development Center

9.3.1 Background

In the JICA Study called Development of a Master Plan to Strengthen Technical Education in the Republic of Ghana, the Competency Based Training (CBT) approach was proposed and accepted to reform technical and vocational education and training (TVET) by Ministry of Education, Ghana.

CBT is one of the technical education systems and has been successfully introduced in Canada, Australia, Singapore and so on. Since in the CBT system industries define competency standards, assessment guidelines and qualifications, based on which training organizations design and develop training courses, mismatching between industries and training organizations can be minimized. Since training courses are modularized in the CBT system, any training organizations, industries and individuals can provide module-based training, if they register as authorized training organizations. Therefore, the CBT is the technical education system that makes a maximum use of scarce resources in the country such as teachers, facilities and infrastructure.

Since the CBT is very new in Ghana, however, the said Center is extremely demanded to support a challenge to reform the current TVET system with functions of institutional development, teacher development, teaching material development and distance-learning development.

9.3.2 Objectives of the Center

The goal of the Center is to introduce the CBT approach in the TVET sector including all training organizations under all relevant ministries and to provide equal learning opportunities to the entire nation by reasonable training cost.

The following three objectives in short, mid and long terms are identified to achieve the goal:

- a. Short term objective: Introduction of the CBT approach for proposed eight pilot programs at 8 polytechnics (Target year to start: 2007)
- b. Mid term objectives: Introduction of distance-learning in the areas of proposed 6 pilot industrial areas (Target year to start: 2010)
- c. Long term objective: Introduction of the CBT approach by all the public and private technical training providers under various ministries with training functions by means of packaged course, short courses and distance-learning (Target year to start: 2013)

9.3.3 Proposed pilot programs

The JICA Study identified the following six potential target areas:

- a. Hospitality and tourism
- b. Information technology and communications
- c. Business information technology
- d. Wood processing technology
- e. Post harvest and food processing
- f. Manufacturing technology

Priorities are given to these six industrial areas to develop CBT training courses by the Center.

9.3.4 Functions, activities and facilities

The Center has the three major functions, i.e., human resource development, institutional development and teaching materials development. In addition, in order to support these three major functions, the Center has a function of administration and management.

The function of human resource development has two major activities, training for managerial staff and teaching staff both in the public training organizations and the industrial sector. The training for managerial staff includes understanding of the CBT approach, financial management of training organization, personnel management, operational skills and knowledge of training organization, training course management and so on. The training for teaching staff includes understanding of the CBT approach, development skills of teaching materials, teaching skills of CBT courses, course operation and management of CBT courses and so on.

The activities of the institutional development function are development and operation of CBT related organizations, i.e., GHANTA, ITABs and NQA. This should be done in close collaboration with the industrial sector.

The activities of the teaching material development have two activities, development and production of audio-visual video and textbook & workbook. These teaching materials can be developed by the Center from the beginning and also be developed by editing materials already developed in other countries. IN the latter option, editing, correction and modification are still necessary to reflect local needs, conditions and circumstances.

The function of administration and management has two major activities besides general administrative and managerial services for the Center, that is, sales & promotion of textbook & workbook and operation of distance-learning. This function also includes strengthening cooperative relation with the industrial sector. These activities are extremely important for the Center to achieve its self-financing management.

Figure A-9.3.1 indicates facilities necessary to conduct various activities mentioned above.

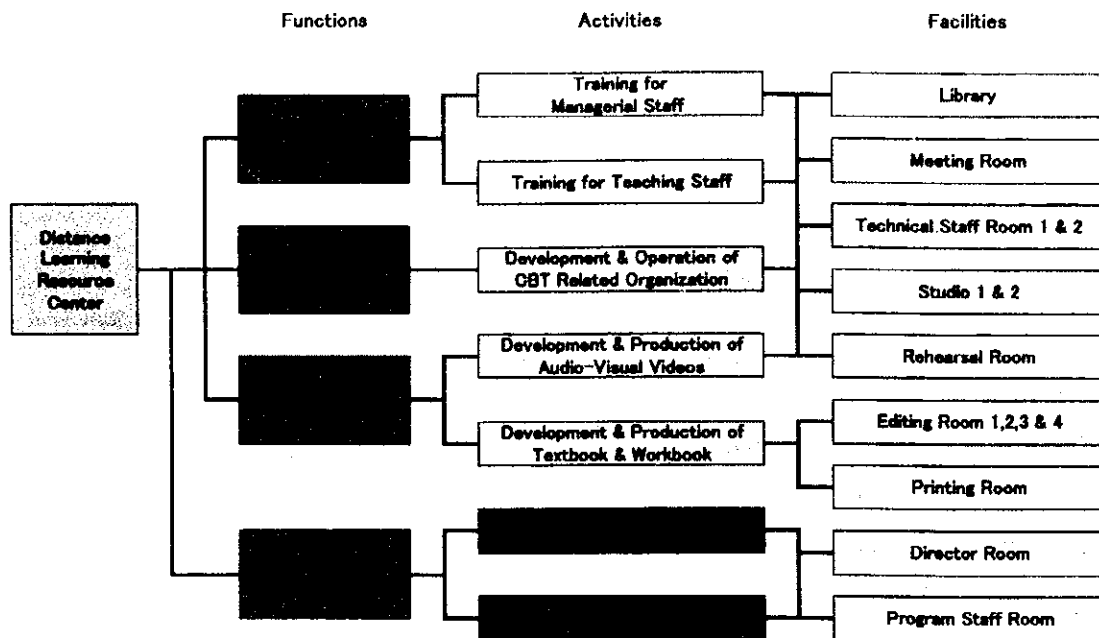


Figure A-9.3.1 Conceptual Diagram for the CBT Resource Development Center

9.3.5 Preliminary financial estimation

In order to examine a financial viability of the Center, the following preliminary financial estimation for the Center was made:

- (1) Items of revenue and cost
 - a. Revenue items: sales of textbooks and workbooks and tuition fee from distance-learning
 - b. Cost items: personnel cost, production cost of teaching materials, additional investment on equipment, maintenance and utility cost, schooling cost for distance learners and contingency (Initial investment for the Center and eight multi media class rooms and eight local learning centers at each polytechnic is assumed to be donated by donor agencies.)
- (2) Assumptions
 - a. Project period: 2004 to 2020
 - b. A student enrolled in packaged course, short course and distance-learning studies 12, 3 and 6 modules a year, each of which module needs one textbook (100 pages), one workbook (100 pages) and three videos (30 minutes).
 - c. Half of students enrolled in packaged and short courses of existing departments purchase textbooks and workbooks developed by the Center, whilst all other students purchase them. Students do not buy videos, since these are supplied to training organizations and learning centers by free of charge.
 - d. Production cost of textbook and workbook is US\$ 1.5. In addition, 20% of production cost is needed for packaging and distribution.

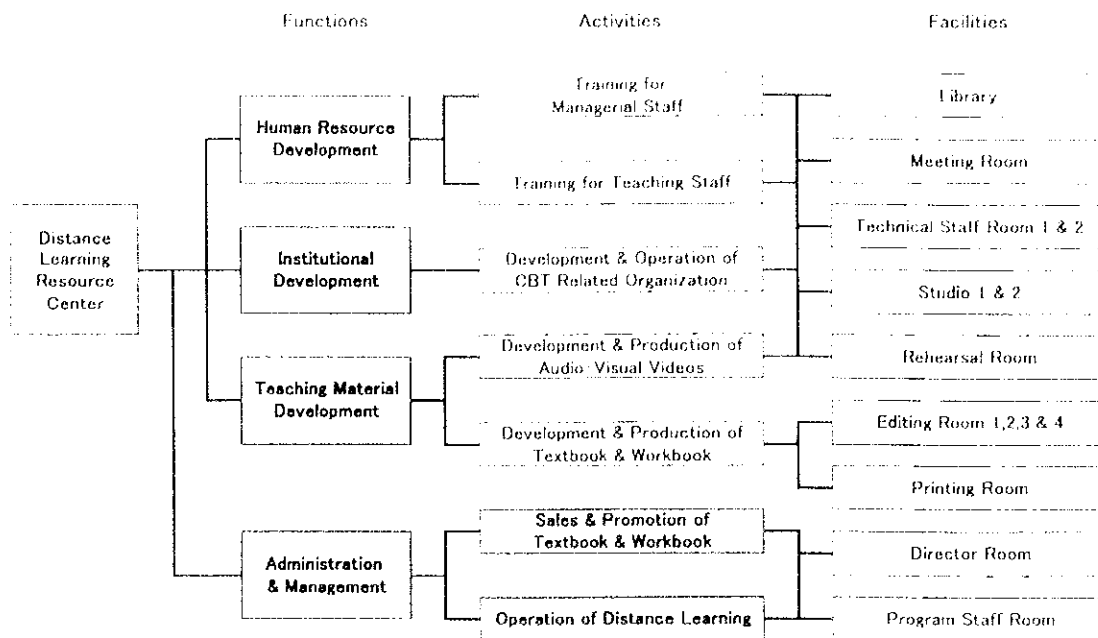


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 - c. Half of students enrolled in packaged and short courses of existing departments purchase textbooks and workbooks developed by the Center, whilst all other students purchase them. Students do not buy videos, since these are supplied to training organizations and learning centers by free of charge.
 - d. Production cost of textbook and workbook is US\$ 1.5. In addition, 20% of production cost is needed for packaging and distribution.

- e. Sales price of textbook and workbook is US\$ 3 each
- f. Annual tuition fee of distance-learning is US\$ 100, which increases by 6.7% per annum since 2002. This includes schooling cost.
- g. Participants in distance-learning have opportunities to attend 30 days schooling for two times a year. This cost is US\$ 74 a year, which includes lodging, transportation and academic use fee.
- h. Renewal costs of 10%, 20% and 50% of initial investment cost are needed after 5, 10 and 15 years, respectively.
- i. Maintenance and utility cost is 2% of accumulated investment cost up to the year.
- j. Numbers of personnel and their cost are described in Table A-9.3.1.
- k. Contingency is 10% of the total cost.

(3) Cost estimation for initial investment

Results of preliminary cost estimation for each cost items are as follows:

- a. Equipment cost for printing materials development: US\$ 1,580,000
- b. Equipment cost for audio-visual development: US\$ 4,273,000
- c. Multimedia classroom: US\$ 104,000
- d. Building: US\$ 354,000

The total initial investment cost to construct the Center, therefore, is US\$ 6,311,000.

In addition to the initial investment for the Center, multimedia classrooms and local learning centers at 8 polytechnics are needed and their initial investment costs of one facility are US\$ 104,000 and US\$ 75,000, respectively. The total investment cost of multimedia classrooms and local learning centers, therefore, is US\$ 1,432,000 ((104,000 + 75,999) x 8).

The grand total, therefore, is US\$ 7,743,000. The detailed estimation is shown in Appendix 8.8.

(4) Preliminary financial estimation

A preliminary financial estimation is shown in Figure A-9.3.2. Since the initial investment is excluded in the calculation, the project is financially feasible with its financial internal rate of return (FIRR) of 68%. However, since the project makes a loss up to 2010 and the accumulated loss is eliminated in 2013, Ministry of Education has to provide the Center with a matching fund for these losses in order to make a proper operation in the early stage of development. Another option to cope with these losses is to introduce a joint operation with the industrial sector or so-called the third sector approach.

The detailed calculation results are shown in Table A-9.3.1.

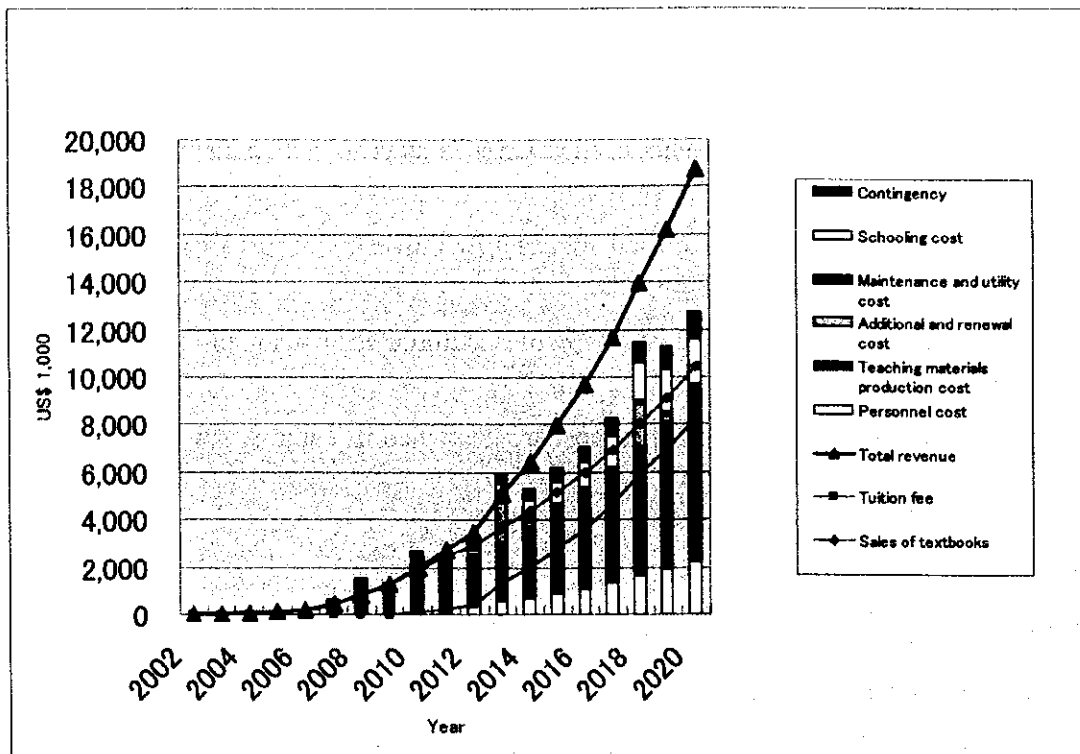


Figure A-9.3.2 Financial Estimation for the CBT Resource Development Center

JICA