October 2010

ICT in Education Strategy and Implementation Plan for Education in Papua

DEPARTEMEN PENDIDIKAN NASIONAL
REPUBLIK INDONESIA

THE WORLD BANK OFFICE JAKARTA
Indonesia Stock Exchange Building, Tower II/12-13th Fl.
Jl. Jend. Sudirman Kav. 52-53
Jakarta 12910
Tel: (6221) 5299-3000
Fax: (6221) 5299-3111

Printed in October 2010

Cover Photo by: Edmond Gaible

October 2010

ICT in Education Strategy and Implementation Plan for Education in Papua

Contents

Preface

On behalf of the Provincial Government of Papua, I am pleased to publish this report on *ICT in Education Strategy and Implementation Plan for Education in Papua* with the support of the Office of Education, Youth and Sports, and the World Bank. The production of this report was supported by the Dutch Education Support Program (DESP) which is generously funded by the Government of the Netherlands.

Improving the quality of education in Papua, to provide real opportunities for the future generations in this province, is a very high priority for us. We know that we are facing many challenges –particularly due to the isolation of so many of our schools and communities—but also that we need to apply more innovative solutions to overcome them.

Using information and communication technologies (ICT) in a strategic way, as outlined in this report, is a central element of our educational development strategy. We intend to provide "connectivity" particularly to our more isolated schools, based on a careful analysis of the most cost-effective and sustainable approach. We have started programs to develop new learning materials for teachers and pupils, using multimedia technologies for production and distribution. These learning materials, together with increasing availability of Internet access will enable our teachers to offer students new avenues for self-study and exploration. Finally, we are launching a new program of electronic data collection, management, analysis and dissemination, to monitor the performance of our school systems more effectively, beginning this year in K. Jayapura.

Our programs are ambitious, but for us they are of paramount importance, as investments in our future.

Contributing authors of this document Aries, Natasha Beschorner, Edmond Gaible and Jamaludin Hakim are grateful to the officials and staff of Pustekkom at the Ministry of National Education, Jakarta and are also grateful to James Modouw, the Head of Education, Youth and Sports of Papua Province, for his valuable support.

GOVERNOR OF PAPUA PROVINCE

BARNABAS SUEBU

Abbreviations

BERMUTU	–	Better Education through Reformed Management and Universal Teacher Upgrading
BPP	–	Balai Pengambungen Pendidikan
COTS	–	Commercial Off-the-Shelf
CRT	–	Cathode Ray Tube
DBMS	–	Database Management System
DeTIKNas	–	National ICT Council
DINAS	–	Provincial, District or Sub-district office with Sectoral Responsibilities
DIKPORA	–	Office of Education and Sport
FKIP	–	Fakultas Keguruan dan Ilmu Pendidikan
Gbps	–	Gigabits per second
GFMRP	–	Government Financial Management and Reporting Program
ICT	–	Information and Communications Technology
IPR	–	Intellectual Property Rights
IKIP	–	Institut Keguruan dan Ilmu Pendidikan
KKG	–	Kelompok Kerja Guru
LCD	–	Liquid Crystal Diode
LPMP	–	Lembaga Penjamin Mutu Pendidikan
Mbps	–	Megabits per second
MGMP	–	Musyawarah Guru Mata Pelajaran
MONE	–	Ministry of National Education
OECD	–	Organization for Economic Cooperation and Development
PAS	–	Paket Aplikasi Sekolah
PC	–	Personal Computer
PD	–	Professional Development
PMPTK	–	Direktorat Jenderal Peningkatan Mutu Pendidik dan Tenaga Kependidikan
PUSTEKOM	–	Pusat Teknologi dan Komunikasi
SD	–	Sekola Dasar
SEAMOLEC	–	South East Asia Ministers of Education Regional Open Learning Centre
SLA	–	Service-level Agreement
SMP	–	Junior Secondary School
SMA	–	Senior Secondary School
SSB	–	Single Side-Band (radio)
STKIP	–	Sekolah Tinggi Ilmu Keguruan dan Ilmu Pendidikan
TC	–	Total Cost of Ownership
TEI	–	Teacher Education Institution
TLI	–	Tertiary Learning Institution
TPD	–	Teacher Professional Development
UPI Bandung	–	Universitas Pendidikan Indonesia Bandung
USTJ	–	Universitas Sains & Teknologi Jayapura
UT	–	Universitas Terbuka (or Indonesian Open University)
VSAT	–	Very Small Aperture Terminal

Summary

A. Overview and Objectives

The five-year program outlined in this *ICT in Education Strategy and Implementation Plan* has four goals, to use information and communications technology—hardware, software, telecommunications or "connectivity" to:

- Facilitate better education and financial management at the school, district (*kabupaten*) and provincial level;
- Develop the capacity of technical staff, teachers, school leaders and education officers in ICT in education competencies;
- Enhance linkages between schools, districts and province, and the world around them;
- Develop students who are adaptable to change and empowered to change their environments, who are creative and innovative, and who are able to apply knowledge and solve problems with confidence in their community and beyond.

The program seeks to respond to a strong, and hitherto unmet demand, from stakeholders at all levels of the education system in Papua: administrators, teachers, as well as students, for access to information and skills.

The proposed *ICT in Education Strategy and Implementation Plan* acknowledges and builds on several existing and planned initiatives. The first is the proposed development of ICT Centers in Papuan schools, funded by block grants from the *Direktorat-Jenderal Peningkatan Mutu Pendidik dan Tenaga Kependidikan* (PMPTK). The ICT Centers are intended to provide teachers in Papua access to computers and the Internet. What is needed at this stage is a framework of support that will increase the value derived from these ICT Centers, and from ICT acquisitions that schools are making independently, and that will improve education in Papua as a whole. The second is the national education network, or *Jardiknas*, plus ongoing efforts to improve education/financial management at the national level, such as Padati-2, School ID [etc]. The third is a number of initiatives to develop digital

content/learning materials, and to make educational materials available electronically online and offline.

Overall, the *ICT in Education Strategy* strongly supports the three key objectives established in the Provincial Government's ***Strategic Plan for Education: 2007-2011*** **(RENSTRA),** as outlined below.

Equalizing and expansion of access to education. The proposed deployment of ICT will increase education equity by equalizing access for teachers and students to centrally developed resources and programs.

Improvement of the quality, relevance and competitive edge of education. Provision of ICT infrastructure will lead to improved teacher quality based on increased participation in teacher professional development (TPD). Dissemination of learning resources for students, as well as increased support for integration of those resources into Indonesian curricula, will also improve the quality of education significantly. Development of hands-on skills in the use of productivity software and communications tools, as well as development of information literacy, will increase overall competitiveness. ICT in support of MGMP teacher clusters is also a specific RENSTRA metric.

Improvement in governance, accountability and public image of education. Information-management initiatives supported by ICT (and prioritized by DIKPORA Papua in review of the *ICT in Education Strategy*) will positively impact management and accountability by improving the accuracy and frequency of school reporting, and by enabling "downstream" sharing of information to increase transparency within the education system. In addition, impact on real and perceived teacher professionalism stemming from effective use of ICT will improve public perception of teachers and education.
The *ICT in Education Strategy* is also aligned with the InPres no. 5/2007 *(Instruksi Presiden Republik Indonesia Nomer 5 tahun 2007 tentang Percepatan Pembangunan Provinsi Papua dan Provinsi Papua Barat),* prioritizing measures to accelerate Papuan development.

Challenges. There are many barriers to effective education in Papua. Major challenges surround management and accountability, the capacity and professionalism of teachers, and the availability of effective learning resources. For remote schools, these challenges are crippling. Schools near coastal population centres such as Jayapura are better able to function, but the knowledge and skills that they are building among Papuan youth are generally inadequate for the 21st-century workplace.

Increasing access to ICT in schools—resulting from government initiatives such as the PMPTK block grants and from the efforts of head teachers, non-governmental organizations (NGOs), and others—highlights additional challenges. Neither pre-service nor in-service teacher development in Papua addresses the use of ICT. In the absence of skilled teachers, poor maintenance and inadequate troubleshooting of computers and networks will limit the value derived from ICT. Capacity to develop, disseminate and effectively use digital learning resources is limited.

B. Proposed Activities

The *ICT in Education Strategy and Implementation Plan* envisages four integrated program components to build a foundation for well-managed schools and effective teaching and learning in the province: (a) phased deployment of ICT infrastructure (computer hardware, software, telecommunications) with appropriate operations and maintenance arrangements; (b) development of basic, standard computerized tools for education information management; (c) intensive capacity-building for teachers; and (d) development and dissemination of content: teaching and learning resources.

Improving ICT Infrastructure: Connectivity and Equipment. The primary objective is to provide schools in Papua with access to ICT that is appropriate to their needs and readiness. Schools' limited communication and lack of access to information are significant barriers to educational improvement in Papua on many fronts. Provision of ICT infrastructure has the potential to improve ongoing initiatives and

to enable new, higher-impact initiatives that are designed to leverage schools' increased capacities.

To accomplish this objective, the implementation plan calls for standardization of ICT installations for different types of schools and uses, support for improved procurement practices, and the procurement and installation of computers and networking hardware in schools throughout Papua.

- The 60 ICT Centers currently planned will be augmented to serve as hubs for professional development and to support student learning;
- Other secondary schools in Papua will receive smaller ICT installations to serve both teachers and students;
- Primary schools (SD)s, beginning with those that are most accessible, will receive basic "stations" enabling teachers to participate in reporting, access learning resources, and communicate with their peers and others.

Remote SDs, such as those in the highlands of Papua, have an increased need for communications and for access to information as a result of their isolation. However infrastructural barriers to implementation, such as lack of electricity or access to telecommunications, are compounded by limited teacher capacity and motivation and lack of oversight. The *ICT in Education Strategy* includes specific provision for these SDs in the form of a multiyear pilot test in one or more remote areas.

Improving Education System Monitoring and Financial Management. School management in Papua is inadequate, largely as a result of the significant challenges posed by the combination of geography and poverty. Effective oversight of schools in remote areas is impossible; many teachers in these schools feel isolated and unmotivated. Reporting levels are extremely low. Near coastal population centers, school management is more effective, but reporting requirements consume time and resources unnecessarily. There are other issues with quality and reliability of data. The objectives are to increase participation in education management processes, such as reporting; increase the availability and value of information about school administration and the education system, and to prepare schools to participate in other, centrally planned management initiatives.

The *Strategy* envisages development of simple, spreadsheet-based reporting tools for use by schools in conjunction with district education offices to complete current reporting requirements. These tools and decentralized processes will provide standardized information for a central database management system (Internet-based). Additional capacity will enable school heads and staff of the Provincial Office of Education, Youth and Sports (DIKPORA) to collect, share and interpret education information of importance to them.

Enhancing the Capacity of Education Staff. Teacher capacity in Papuan schools lags that of other provinces in Indonesia as well as international standards. This situation worsens significantly in remote schools. Efforts to support participation in skills upgrades and other programs to date have lacked scale sufficient to meet teachers' needs in the near term. Geography and its impact on cost, convenience and participation complicate efforts to increase the scale of professional development.

Capacity-building efforts will focus initially on development of the technical and management skills necessary to operate and maintain school-based ICT installations, and will be carried out in conjunction with Teacher Education Institutes (TEI). Additional professional development will address ICT leadership for schools heads, basic ICT skills and educational uses of computers for teachers. These efforts will help ensure that Papua's significant investment in technology returns results in terms of improved student learning, and will also establish a foundation of communication resources and skills that can in turn be leveraged to support additional degree-based and non-formal professional development.

Developing and Disseminating Teaching and Learning Resources. The lack of resources in schools throughout Papua negatively affects teaching and learning. In schools in remote areas, books, math manipulatives, illustrations of natural phenomena and most other types of learning resource are

absent. In many schools even in coastal centers, current textbooks, teachers guides and curricula are not available.

In order to provide teachers and students with access to effective, high-quality learning resources, the *ICT in Education Strategy* focuses on leveraging current national and provincial initiatives—notably DIKPORA Papua's support for a learning-resource development center housed within DIKPORA Papua's *Balai Pengembangan Pendidikan* (BPP). By building capacity of the learning-resource development center to evaluate and develop supporting materials the program will increase the quality and the effectiveness of these resources. By developing capacity for multicasting electronic content—uploading files to a satellite for later downloading by schools—the program will support access by schools with limited or expensive connectivity and will increase the dissemination of learning resources throughout Papuan schools.

Program Planning and Management. Given the scope and complexity of the programs proposed in the *ICT in Education Strategy,* the implementation plan envisages additional technical assistance for DIKPORA Papua in the areas of program planning and management, including intensive coordination of program activities at the school, district and regional levels. A further recommendation is for DIKPORA Papua to establish an advisory board, comprised of public- and private-sector stakeholders.

C. Implementation Framework

A five-year implementation period is proposed, as summarized in Table 1. For ICT infrastructure deployment the *ICT in Education Strategy* classifies schools into three "Tiers" based on their relative accessibility. A preliminary *Implementation Plan* has been prepared (Sections 7-12) for consideration.

D. Estimated Costs

Estimated costs for program management and for the four main components throughout all three phases of this five-year program are summarized in the tables that follow.

ICT Infrastructure: capital, operational costs and technical assistance.

Capital expenditure will be required to support the proposed 60 ICT Centers, beyond the PMPTK block grants estimated at US $10,000. Estimates are also provided for establishment of smaller ICT labs at

Component	Phase 1	Phase 2	Phase 3
ICT Infrastructure	• Augment 60 ICT Centers to create hubs for professional development • Install ICT stations in 30 urban SDs • Install ICT-Center labs in 5-8 Teacher Education Institutes (TEIs)	• Install ICT "minilabs" in 155 SMAs and SMKs • Install ICT labs in 130 SMPs • Install ICT stations in 170 urban SDs • Install ICT stations in 30 remote SDs	• ICT minilabs in 256 SMPs • ICT stations in 247 urban and near-urban SDs
Teacher Professional Development	• Develop six professional-development (PD) programs • Build capacity of TEIs	• Begin delivery of ICT Integration course to ICT Teachers at TEIs • Begin delivery of ICT Integration to select teachers at ICT Centers	• Continue delivery at ICT Centers of Basic ICT to teachers in schools with minilabs • Extend delivery of ICT Integration at ICT Centers to teachers in all schools with minilabs

Component	Phase 1	Phase 2	Phase 3
	• Develop ICT Teachers for 60 ICT Centers • Begin delivery of ICT Leadership at TEIs to secondary head teachers at schools receiving ICT Centers • Begin delivery of Basic ICT-SD version to one school head and one teacher from each SD receiving an ICT station	• Extend delivery at ICT Centers of Basic ICT to 5 teachers each in SMAs, SMKs and SMPs receiving minilabs • Continue delivery of Basic ICT-SD version to one school head and one teacher from each SD receiving an ICT station • Extend delivery at of ICT Leadership course to all secondary head teachers in schools receiving minilabs	• Continue delivery of Basic ICT-SD version to SD school heads and teachers • Continue delivery of Basic ICT-SD version to one school head and one teacher from each SD receiving an ICT station • Continue delivery at TEIs of ICT Leadership course to all secondary head teachers in schools receiving minilabs
Education and Financial Management	• Assess needs and capacities in remote SDs, other schools, district offices, and DIKPORA Papua • Develop easy-to-use ICT tools • Develop and integrate short information management module into ICT Leadership program • Integrate information-management module into Basic ICT-SD program • Train personnel in district and in DIKPORA Papua to receive and process electronic files	• Continue roll-out of information-management processes to head teachers, DINAS Kab. personnel, and DIKPORA Papua personnel • Monitor and evaluate • Revise processes, tools and information-management module based on M & E	• Continue roll-out of information-management processes to head teachers, DINAS Kab. personnel, and DIKPORA Papua personnel • Monitor and evaluate • Revise processes, tools and information-management module based on M & E
Learning Resources	• Provide initial TPD on learning-resource design to DIKPORA Papua staff • Procure and support learning-resource multicasting service (probably as part of procurement of connectivity) • Begin development of print-based teacher-support materials for existing learning resources	• Distribute existing learning resources to schools using ICT • Continue development and distribution of teacher-support materials enhancing the value of currently available resources • Begin development of Web-based supporting resources	• Continue distribution of existing learning resources • Continue development and distribution of print-based supporting resources • Continue development and support of Web-based supporting resources

the remaining SMAs and at all SMKs and SMPs, and for provision of minimal computational and communications capacities to all accessible SDs.[1]

Table I-1 shows per-phase deployment in secondary and primary schools:

Schools	Phase 1	Phase 2	Phase 3	Total schools
Schools per phase, Secondary				
Tier 1 (Coastal Centers)	20	123	58	201
Tiers 2 and 3 (Outside of coastal centers)	40	162	198	400
Subtotal	*60*	*285*	*256*	*601*
Schools per phase, Primary				
Tier 1 (Coastal Centers)	30	170	124	324
Tier 2 (Outside of coastal centers)	0	0	123	123
Tier 3 (Remote/ highlands)	0	30	0	30
Subtotal	*30*	*200*	*247*	*477*

Table I-2 shows anticipated capital costs of this deployment:

Lab costs	IDR	USD
Phase 1	15,800,700,000	1,699,000
Phase 2	42,384,750,000	4,557,500
Phase 3	43,734,180,000	4,702,600
Total lab costs	**IDR 101,919,630,000**	**10,959,100**

Operational costs when all schools have ICT installations will be significant. Maintenance costs are estimated at 10 percent of lab capital costs, in part based on high costs of transportation.

Table I-3 summarizes monthly connectivity costs by phase.

Connectivity costs	IDR	USD
Phase 1	4,052,700,000	435,774
Phase 2	8,848,980,000	951,503
Phase 3	20,273,760,000	2,179,974
Total connectivity costs	**IDR 33,175,440,000**	**3,567,251**

Technical Assistance, Infrastructure and Connectivity: although the primary capital expenses associated with the infrastructure component of this project are related to procurement and installation, the need for significant technical assistance is anticipated, particularly for operations and maintenance, as summarized in Table I-4.

Technical Assistance	IDR	USD
Phase 1	3,608,400,000	388,000
Phase 2	2,455,200,000	264,000
Phase 3	1,934,400,000	208,000
Total TA costs	**IDR 7,998,000,000**	**860,000**

Teacher Professional Development. Five TPD programs are envisaged to go hand-in hand with the ICT infrastructure rollout:

- Program 1: ICT and Support
- Program 2: Basic ICT
- Program 3: Basic ICT-SD level
- Program 4: ICT Integration
- Program 5: ICT Leadership

Using a cascade model in which ICT teachers are trained to provide instruction to other teachers, plans call the following numbers of teachers to participate in TPD, as summarized in Table I-5:

1 Unit costs of ICT labs and SD "stations" vary significantly based on school location and infrastructure. The unit costs provided here are for reference purposes only and are discussed in more detail in Section 8.

Work-shops / Courses	Partici-pants	Phase 1	Phase 2	Phase 3	Total partici-pants
ICT & Support	ICT Teachers	60	285	256	601
Basic ICT	Secondary Teachers	300	1,425	1,280	3,005
ICT Integration	Secondary Teachers	0	360	3,246	3,606
ICT Leadership	Secondary Head Teachers	60	285	256	601
Basic ICT (SD)	SD Heads & Teachers	60	400	954	1,414
Subtotal/ phase		*480*	*2,755*	*5,992*	*9,227*

In the model that supports Table I.5, five teachers from each secondary school will receive two rounds of TPD addressing the use of ICT in educational contexts. Costs are estimated in Table I-6

Operations costs, TPD	IDR	USD
Phase 1	4,181,850,000	449,661
Phase 2	21,775,050,000	2,341,403
Phase 3	24,282,682,500	2,611,041
Total operations costs	**50,239,582,500**	**5,402,106**
Technical Assistance, TPD		
Phase 1	6,984,300,000	751,000
Phase 2	4,208,250,000	452,500
Phase 3	1,106,700,000	119,000
Total technical assistance costs	12,299,250,000	1,322,500
Total costs, TPD	**62,538,832,500**	**6,724,606**

Education and Financial Management. Activities in education and financial management are envisaged to take place during Phase 1 of the proposed program, and consist primarily of comprehensive assessment of need and readiness, followed by analysis of "business processes" related to information flow, a professional-development module or modules to be integrated for school leadership, and training at DINAS at the district level and in DIKPORA Papua. Estimated costs for these activities are as follows, Table I-7:

Operations costs, information mgmnt	IDR	USD
Sub-total, Phase 1	2,591,375,900	278,643
Sub-total, Phase 2	518,279,700	55,729
Sub-total, Phase 3	258,967,800	27,864
Total costs, Operations	IDR 3,368,623,400	USD 362,236
Technical Assistance		
Sub-total, Phase 1	2,544,879,900	273,643
Sub-total, Phase 2	508,979,700	54,729
Sub-total, Phase 3	254,485,200	27,364
Total costs, Technical Assistance	IDR 3,308,344,800	USD 355,736
Total, information management	IDR 6,676,968,200	USD 717,972

Learning Resources. Primary costs associated with supporting the design, development and distribution of learning resources are comprised of technical assistance, multicasting software and licensing, and staff costs of BPP, and summarized in Table I-8. Current BPP staffing and projected staffing needs are not available, and are not included in this estimate.

Technical Assistance, learning resources	IDR	USD
Personnel	3,459,600,000	372,000
Travel	1,250,850,000	134,500
Subtotal, Technical Assistance	4,710,450,000	506,500
Multicasting costs, learning resources		
Licensing and service	2,997,390,000	322,300
Subtotal, multicasting	2,997,390,000	322,300
Total, Learning resources	**IDR 7,707,840,000**	**USD 1,151,100**

E. Total Estimated Costs

Based on the above, estimated costs for all program components are as summarized in Table I-9.

	Phase 1 (IDR)	Phase 2 (IDR)	Phase 3 (IDR)	Sub-totals (IDR)	Sub-totals (USD)
Capital Expenses					
ICT Infrastructure	15,800,700,000	42,384,750,000	43,734,180,000	101,919,630,000	10,959,100
Information Management (Hardware, software)	0	0	0	0	0
Learning Resources (Hardware, software)	18,600,000	0	0	18,600,000	2,000
Subtotal, Capital Expenses	***15,819,300,000***	***42,384,750,000***	***43,734,180,000***	***IDR 101,938,230,000***	***USD 10,961,100***
Operational Expenses					
Project Management	2,800,650,000	9,921,175,000	13,615,325,000	26,337,150,000	2,831,952
Information Management (licensing, add'l development)	46,500,000	13,950,000	9,300,000	69,750,000	7,500
Infrastructure (Maintenance)	1,580,070,000	4,238,475,000	4,373,418,000	10,191,963,000	1,095,910
Infrastructure (Connectivity)	4,052,700,000	8,848,980,000	20,273,760,000	33,175,440,000	3,567,252
Teacher Professional Development	4,853,550,000	25,372,750,000	40,808,602,500	71,035,202,500	7,638,194
Learning Resources (multicasting)	176,700,000	1,056,015,000	1,764,675,000	2,997,390,000	322,300
Subtotal, Operations	***13,510,470,000***	***49,451,345,000***	***80,845,080,500***	***IDR 143,800,895,500***	***USD 15,463,107***
Technical Assistance					
Project Management	5,980,800,000	2,492,400,000	3,357,300,000	11,830,500	1,272,097
Infrastructure	3,608,400,000	2,455,200,000	1,934,400,000	7,998,000,000	860,000
Teacher Professional Development	6,984,300,000	4,208,250,000	1,106,700,000	12,299,250,000	1,322,500
Information Management	2,544,875,250	763,462,575	508,975,050	3,817,312,875	410,464
Learning Resources	3,380,550,000	1,116,000,000	1,116,000,000	5,612,350,000	609,500
Subtotal, Technical Assistance	***22,498,925,250***	***11,035,312,575***	***8,023,375,050***	***IDR 41,557,612,875***	***USD 4,468,561***
Total cost				**IDR 287,302,738,375**	**USD 30,892,768**

Five-year funding for activities outlined in the *ICT in Education Strategy,* totalling IDR 266.4 billion (USD 28.6 million), compares favorably with five-year education financing proposed by DIKPORA Papua in the RENSTRA, of IDR 12.9 trillion (USD 1.4 billion). The amount of discretionary funding out of total funding for education in Papua is not identified in the RENSTRA,

However the amount of funds required by activities in the *ICT in Education Strategy,* approximately 2 percent of the RENSTRA total, falls well within accepted allocations of discretionary funds in education budgets. (Discretionary norms in education financing outside of OECD countries approximate 15-17 percent of total financing for education.)

F. Expected Benefits

Groups benefiting directly from the activities proposed in the *ICT in Education Strategy* extend from students to teachers to personnel responsible for education management, leadership and policy.

Benefits for secondary students. Educational benefits for secondary students will include increased motivation, possibly leading both to higher levels of participation and of completion, but should also encompass—primarily as a result of increased access to appropriate resources—improved exam performance. These projected outcomes align with RENSTRA objectives.

Additional potential benefits related to workplace readiness and job skills include development of real-world ICT skills, increased information literacy, and improved communication and collaboration behaviors. (Development of these skills is directly dependent on support for active-learning pedagogies in TPD programs.)

Benefits for primary students. Although primary students will themselves have very limited access to ICT given the scope of proposed activities, in Tier 1 and Tier 2 schools these students will benefit directly from teachers' access to learning resources and supporting materials, and from improved information and financial management within their school and in the education system as a whole.

Benefits for primary and secondary teachers. Secondary teachers will generally experience increased motivation and professionalism as outcomes of effective, learner-centered TPD, improved oversight and increased professional opportunities (resulting from access to distance-education programs). Increased access to information and to learning resources will in addition improve teachers' subject knowledge and their effectiveness in the classroom.

In addition, program activities will support increased participation in MGMPs, and will increase the effectiveness of those activities.

Benefits for education leadership and administration. Access to reasonably accurate and current information by DIKPORA Papua will comprise a significant benefit to education management, and should yield many indirect benefits. These will include more informed management of human resources, increased financial accountability and improved financial management, and improved tracking of student participation and performance.

Education leadership will be positioned to guide a wide range of activities and improvements directly affecting education outcomes. This include facilities upgrades, provision of learning resources, and distribution of curricular and test-preparation materials.

Enhanced communication with DINAS personnel at the district level will increase overall efficiency of a system that may be prone to duplication and gaps in responsibilities. Additional personnel directly engaged in local coordination and support will also present the opportunity to leadership to receive qualitative, field-level reporting about ongoing conditions and feedback about initiatives as they are in progress.

Overall, the provision of timely information and effective communication, in combination with other ongoing initiatives, will have the potential to reshape the Papuan education system into a more functional, adaptive and effective organization.

Part 1 Diagnostic and Strategy

Introduction and Strategic Framework

A. Barriers to Educational Improvement in Papua

Efforts to improve the quality of education in Indonesia face challenges in relation to educational resources, teachers' skills, management of administrative and financial information and many other factors that influence student learning. All of these challenges are present in Papua; they are intensified by the province's rugged terrain, widespread poverty and other factors.

Papua's mountainous geography, as well as its distance from Jakarta, bars the extension of needed infrastructure to many parts of the province. In the highlands, villages may be several days' walk from serviceable roads. Access to electrical power in these areas is limited, with local generation from micro-hydroelectric installations or diesel generators, for example, yielding only 1-2 watts per household. Given such constraints in "enabling" infrastructure, private sector rollout of telecommunications lags other parts of Indonesia and other developing countries significantly: most remote villages and many in the outer edge of coastal areas are not served by mobile telephony; in the most remote areas, telecommunications if possible at all may rely on satellite phones belonging to missionaries, or single side-band (SSB) radio. Internet access is also very limited and costly, via dial-up or satellite. The quality of communication—whether voice or data—is generally poor. Reliance on satellite "backbone" networks implies limited and high-cost transmission capacity or "bandwidth" available for communications.

Absent adequate roads, electricity and telecommunications, schools in the highlands and in remoter parts of southern lowland districts are cut off from the support and oversight of the Papuan education system. Without regular reporting, teachers are not accountable and head teachers fail to access even those resources that are available. Primary schools with several hundred students may be staffed by only one or two teachers on a given day. Without proper skills—such as teaching techniques for multi-grade classrooms—the good-faith efforts

of teachers who come to school are ineffective. In schools with only a few books, a globe, and a plastic replica of a human skeleton, students lack adequate learning materials for maths, reading, and other basic skills. The education available to students in many remote schools is both ineffective and irrelevant.

Even in less-remote schools, such as those a few hours' drive from coastal centers in Biak or Merauke, limited infrastructure and learning materials thwart efforts to improve instruction. Teachers who lack current textbooks also lack access to distance-education (TV or Internet-based) resources developed in Jakarta. Their efforts to participate in skills-upgrade programs require their absence from both schools and families. For students, science learning remains abstract, unsupported by laboratory materials, simulations or other aids to knowledge building. For head teachers, meeting even minimal reporting requirements involves preparation of lengthy paper records, and several hours travel to deliver them.

Provincial and national efforts to address critical problems in Papuan schools—teacher absenteeism, under-trained and under-qualified teachers, lack of learning resources, ineffective monitoring of school performance, and the lack of transparency in financial management—have fallen short and will continue to fall short in the absence of the means to reach schools beyond coastal population centers.

B. Using ICT to overcome these barriers

What does "using ICT" mean? "ICT" is broadly defined as the combination of hardware, software, and communications technologies (telephones, Internet, radio, TV) that are used to create, distribute, store and manage information. Using ICT to help improve educational outcomes in Papua would entail:

- Improving "connectivity" or communications networks between schools and government, and among schools—in particular reducing the extreme isolation of remote schools;
- Using these communications networks to deliver teaching and learning materials and to transmit information on school performance and financing;
- Using computerized information systems to monitor school performance and financing; and
- Using computer equipment and communications networks to develop ICT skills for teachers and students as required by the new national curriculum: ICT skills range from basic computer literacy and word processing to more advanced activities such as database management, for example.

The challenges confronting Papuan schools in terms of teacher capacity, access to learning resources, and management of education systems and financial information have been addressed successfully in other countries through the deployment of ICT as described above. National governments of Jordan[2] and Namibia[3] have supported country-wide programs using computers and the Internet to provide professional development to in-service teachers. In Chile, with geography that presents obstacles that are similar to those in Papua, the *Enlaces* project has enabled teachers and students in remote schools to access learning resources online since 1992.[4] Projects in both of these countries have used the Internet to support education management. More recently, island countries of the Caribbean such as Barbados, Antigua and Barbuda and St. Lucia have launched initiatives to link management of education and financial information at the school and education system levels.[5] ICT is increasingly being used to support delivery of education

2 Kozma, R.B., 2006, Contributions of Technology and Teacher Training to Education Reform: Evaluation of the World Links Arab Region Program in Jordan (Washington, DC: World Links; 2006).

3 Gaible, E. and Burns, M., 2006, Using Technology to Train Teachers: Appropriate Uses of ICTs for Teacher Professional Development (Washington, DC: infoDev; 2006).

4 Nunes, C. and Gaible, E., "Development of Multimedia Materials," in Technologies for Education: Potential, Prerequisites, Constraints and Prospects, Haddad, W. and Draxler, A., eds., (Paris: Unesco; 2002).

5 Gaible, E., ICT in Education in the Caribbean: A Critical Review (Washington, DC: infoDev, in press).

services across the Philippines archipelago,[6] while infrastructure-poor countries such as Namibia[7] and Uganda[8] have sustainably deployed computers and connected schools in rural and remote locations that lack grid-based electricity and telecommunications.

The critical success factors for effective use of ICT to support improvements of educational outcomes in all of these cases have included:

- Strong leadership and coordination of efforts at the national, sub-national and school levels;
- Availability and reliability of communications infrastructure and ICT equipment—effective operations and maintenance; and
- Strong emphasis on skills and capacity development, particularly for education administrators and teachers.

C. Current Use of ICT for Education in Papua

The national government, through the Ministry of National Education (MONE), and the provincial government of Papua, through DIKPORA Provinsi, the Department of Education, are aware of these challenges, and have already started to use ICT to support improved teaching and learning in schools, and to increase the effectiveness of other initiatives that address this goal. Some schools have also undertaken their own initiatives.

At the provincial level, DIKPORA Papua in collaboration with PMPTK is establishing 60 ICT Centers in Papuan secondary schools (SMAs). Three of these ICT Centers, comprising six laptops, a server computer and a satellite (VSAT) terminal, will be allocated to each of the province's 20 *districts*, and will be used primarily to support teachers in their efforts to learn about and use ICT as part of their activities school-based communities of practice, known as *Musyawarah Guru Mata Pelajaran* (MGMP). DIKPORA Papua has also established a learning-resource development centre, the *Balai Pengembangan Pendidikan* (BPP), that currently features a computer lab for use in training, equipment for high-speed copying of DVDs and a small videotaping facility.

At the national level, four initiatives address learning-resource needs in Papua directly:

Pusat Teknologi dan Kumunikasi (PUSTEKOM), among the government's premier agencies promoting innovation in ICT in education, develops and distributes learning resources to schools via two programs:

- TV-edukasi (TV-e) broadcasts animated units of instruction focused on the primary curriculum
- The e-dukasi.net Web site (www.e-dukasi.net) offers forums, recommended Web sites, learning activities and exam-preparation resources for Indonesian secondary students.

UPI Bandung has developed a series of multimedia learning modules delivered by DVD, and addressing secondary science, math and language arts curricula.

The Directorate for Vocational High School (Dikmenjur) has developed a separate Web site (www.dikmenjur.net) that addresses the needs of teachers and students at vocational high schools (SMKs).

Head teachers, families and communities in Papua are also acting independently to provide students and teachers with access to computers and the Internet. Many schools that are currently served by grid-based electricity have acquired a few computers; in some instances, these computers are augmented by dial-up or wireless connections to the Internet. With too few computers for student use, these installations are typically used by teachers to search for learning resources, and by head teachers to assist with recordkeeping, administration and reporting.

6 Belawati, T., "Philippines: ICT Use in Education," in *Meta-survey on the Use of Technologies in Education,* Farrel, G. and Wachholz, C., eds. (Bangkok: Unesco; 2002).

7 Gaible, E. and Burns, M. (Op. Cit).

8 Gaible, E. and Nadel, S., *The Uganda VSAT Rural Connectivity Project,* (Washington, DC: infoDev; in press).

In addition, the National ICT Council (DeTIKNas), in association with MONE has developed a program to provide free (i.e. subsidized) Internet access to all schools in Indonesia, and to make school textbooks available for download on the Internet.

While these programs are encouraging, there is a risk that they will fall short of expectations. Lack of coordination and planning, in combination with the limitations of specific programs and activities, increases the risk that significant expenditures on ICT and on other aspects of the education system will fail to generate expected impacts. Some Papuan schools already face problems arising from their computer installations: the power requirements of poorly planned computer labs exceed available electrical capacity; computers in need of maintenance go permanently out of service. High costs of operations—in terms of Internet connectivity, capacity building of staff and other factors—need to be addressed in a more systematic manner.

D. Telecommunications Infrastructure in Papua

At present, access to telecommunications in Papua is much more limited than in other provinces of Indonesia because of the high costs of service provision and relatively dispersed and low-income populations particularly in the highlands. Mobile telephony is the main access technology, with about 1.1 million subscribers; there are about 75,000 fixed-line subscribers, primarily in the major towns. More remote areas rely on satellite or radio. All communications traffic relies on satellite transmission from Papua to Jakarta. This constitutes a tremendous bottleneck. Telkom's transmission capacity for the entire province is 20 Mbps—compared, say, with a typical OECD residential connection of 8 Mbps. Expansion of voice or Internet traffic only further strains a system that is operating at capacity. As a result of these factors, data transfer speeds on the Internet are slow and of poor quality at all times, compared to international and even national norms, and in many instances make Web access impossible. Costs, even in coastal centers, are high; the cost of VSAT connectivity, the most expensive form of Internet access, ranges from US $500-900 per month.

At the provincial level, access to telephony and Internet is expected to improve within the next two years. A consortium of Indonesian telecommunications operators plans to build a new submarine cable network known as the East Palapa Ring due to start by December 2009 and completion up to Sorong, West Papua by May 2011. Although the Palapa Ring consortium has the intention to implement the further extension to Jayapura and Merauke this is still uncertain with respect to timing and financing. The E. Palapa Ring will replace satellite-based transmission (on which all telecommunications operators in Papua are currently dependent) with high-speed fiber-optic backbone. For the areas surrounding the five coastal "landing points" of the fibre-optic network—Biak, Jayapura, Merauke, Mimika and Sarmi—the completion of the full Palapa Ring East project has strong potential to render Internet access inexpensive, reliable and effective. Though the network is unlikely to reach highland areas in the medium-term, at least on commercial terms, it will reduce overall transmission costs for telecommunications operators and thus create incentives for further investment in more remote sites.

E. Framework for the strategy

The combination of ongoing provincial and national initiatives, schools' independent pursuit of ICT, and prospects for improved communications through the Palapa Ring present challenges and opportunities in relation to educational improvement in Papua. The proposed strategy is based on consultations at the national and provincial level, including field visits in Papua in March and June 2008.[9]

On that basis, the proposed components of the strategy are as follows:

9 To gain first-hand knowledge of relevant conditions, the fact-finding team visited schools in remote areas in the highland district of Jayawijaya, Yahukimo and Tolikara, and in the more isolated areas of the Biak and Merauke district. Lists of school visits and of interviews with government, private-sector and other key informants can be found in "Annex A: List of schools visited."

- Improving ICT infrastructure: connectivity, and equipment/materials
- Improving education system monitoring and financial management
- Enhancing the skills/capacity of education staff
- Developing and disseminating new teaching and learning resources

These components are to a large extent under the influence of the provincial government (as opposed to other areas such as curriculum and assessment, which are more closely linked to national policies and practices) and are areas in which ICT can have significant positive impacts.

This framework is used throughout this document as a structure for considering needs, current initiatives and gaps in those initiatives, proposed interventions, and implementation approaches over a five-year period.

The strategy also takes account of Papua's geography because geography directly affects the access to Internet connectivity and other accessibility factors. Different approaches will be required in *coastal population centers* (characterized as "Tier 1"), *other coastal areas and district capitals (kabupaten kota) ("*Tier 2"), and in *remote (mainly highlands) areas (kecamatan* or sub-district, *centers and villages)* ("Tier 3").

Challenges, Current Initiatives and Strategy – ICT Infrastructure

A. Overview

As noted above, "ICT infrastructure" refers to connectivity (telecommunications) and availability of computer hardware and relevant software. The quality of ICT infrastructure among Papuan schools varies greatly, frequently in relation to location.

The majority of Papua's population lives in or near the larger *coastal population centers* such as Jayapura, Biak, Merauke, Sarmi and Timika. Many schools in coastal centers have well-maintained facilities, are situated near good roads, receive consistent, well-regulated electrical power, and are within coverage areas both for mobile telephony and for Internet. In addition to being accessible by both air, land and water, by these areas can be reached by the Palapa Ring fibre-optic cable, which will greatly enhance the quality and lower the cost of communications. Currently the Palapa Ring consortium intends to start deployment by December 2009, reaching Sorong, West Papua by May 2011. Although the Palapa Ring consortium has the intention to implement the further extension to Jayapura and Merauke this is still uncertain with respect to timing and financing. Approximately 16 percent of primary schools and 49 percent of secondary schools are in these district.[10] Due to their urban catchments, these schools enrol disproportionately large segments of Papuan students.

Several hours by road from coastal centers, good conditions give way to variable ones: school facilities may be adequate or even good, but electricity, transportation and communications are problematic. Many schools in these *other coastal areas and district capitals* still lack telephone service and Internet connectivity. Approximately 6 percent of primary schools and 43 percent of secondary schools are in coastal district that will not be reached by the Palapa Ring.

10 School distribution may be affected by lack of data for newer remote district, including kabs. Yalimo, Puncak, and others. Distribution percentages are calculated from the "Datah Skolah Papua" spreadsheet (http:/npsn.jardiknas.org/cont/data_statistik/index.php?prop=603).

A large number of schools, approximately 78 percent of primary schools and 8 percent of secondary schools, however, are situated in the *highlands and other remote areas,* regions that are extremely infrastructure-poor. Such remote areas include the Baliem Valley and other parts of the highlands such as Paniai, as well as coastal areas such as Asmat. In remote areas, the quality of ICT and other infrastructure ranges from poor to very poor. School buildings at SMPs and SMAs, typically, may still be reasonably robust, however construction of school labs, new classrooms, and other needed enhancements was in all cases stopped at the time of visits by the fact-finding team. Electrical power is available only when locally generated by micro-hydroelectric or diesel generator. Communications for schools in remote areas typically requires use of SSB radio or acts of "physical communication"—walking or riding a motorbike to find a mobile telephone signal or to a DINAS at the *kecamaten* center. The Palapa Ring is unlikely to reach these areas in the medium-term due to prohibitive costs (and expected low return on investment), so they will continue to rely on satellite communications for the foreseeable future. *Kecamaten* in these areas may communicate with district government by single-sideband (SSB) radio, although use of SSB in many instances is infrequent and not reliable. The isolation of the schools and teachers who serve these communities degrades their administrative and educational effectiveness almost to zero.

In and near coastal centers, overall infrastructure does not appreciably impact the quality of education. In addition, these areas are reasonably ready to support computer installations and Internet connectivity of varying scales and bandwidth.

In remote areas, however, lack of overall infrastructure does influence students' experiences in schools. Lack of transportation and communication increases teacher absenteeism, because teachers must travel to receive their pay, file reports, participate in professional development and, in many cases, work in other jobs that supplement their salaries.

Although infrastructural limitations increase the costs of ICT deployment in remote areas, the value returned by such deployments will also be increased.

B. ICT Infrastructure in the Papuan Education System

As a result of efforts on the part of DIKPORA Papua, national agencies such as DIKMENJUR and schools themselves, computers and in some cases Internet access are present in many schools and district offices in Papua. Their impact has so far been difficult to determine.

District Education Offices (DINAS). The primary means of communications between DINAS is currently the *Jardiknas* network, which was established by DIKMENJUR to serve as an internal network (Intranet) and to facilitate dissemination of some learning resources resources. *Jardiknas* also serves select vocational schools (SMK). *Jardiknas* is also used to provide connectivity to nearby schools via Local Area Networks (LAN). *Jardiknas* theoretically provides each district centre with a 256kbps connection. The *Jardiknas* network, at this point, is one of the primary means of Internet connectivity in Papuan schools.

In addition, *Jardiknas,* in partnership with *Inherent*, a broadband Intranet for universities and other tertiary learning institutions, creates potential for content delivery, e-learning, and other services in *Jardiknas* schools. *Jardiknas* is available in all major districts in Papua, making Internet connectivity accessible and free-of-charge to schools.

However, *Jardiknas* was not designed to provide widespread Internet access, and its functionality as an internal network is also variable. At DINAS in Merauke and Biak, *Jardiknas* was poorly configured, providing very limited Internet connectivity to surrounding schools and other organizations.[11] At DINAS Wamena, *Jardiknas* is not currently configured to provide Internet access to local schools. Lack of capacity among technical staff makes sharing access impossible.

ICT in Schools. The main initiative in this regard is **ICT Center di Sekola, 2007.** In 2007 DIKPORA Papua

11 The fact-finding team assisted local staff in reconfiguring the LAN to improve Internet performance.

in collaboration with PMPTK provided block grants to establish eight to nine ICT Centers in schools. This is being scaled up through **ICT Center di Sekola, 2008.** DIKPORA Papua is currently collaborating with PMPTK in the administration of block grants to schools to create 60 ICT Centers in 20 district in Papua. The 2008 block grants provide funds for six laptop computers, one server computer, a VSAT terminal and an alternative power source. District offices of education (DINAS *kabupaten*) will be responsible for selecting three secondary schools and disbursing funds to them. As of July 2008, some DINAS (e.g., Biak Numfor) have selected schools to receive ICT Centers. In some other district (e.g., Supiori) personnel changes have delayed school selection. In addition, new district were created in June 2008, possibly complicating the allocation of ICT Centers and their assignment to schools.

Schools in Papua are acquiring computers and in some cases Internet connections—as a result of block grants by DIKPORA Papua and MONE under these programs, and independently, on the initiative of school leadership and community stakeholders. Implementation varies with schools' locations. Moreover, the planned ICT Centers represent an important potential resource for the improvement of the quality of education in Papua, but that the provincial education system lacks capacity on many levels to realize this potential.

- Schools in coastal population centers
  Several of the schools visited in coastal centers have acquired substantial ICT assets through government block grants and from other sources. Leading schools in this regard include SMK Sentani and SMK Yapis Biak, with labs funded by the Directorate of Vocational Education. SMP 5 Jayapura has experienced a rapid improvement in management and instructional quality as a result of new school leadership; improvements include acquisition of a school ICT lab via block grant. These schools, especially the SMKs linked to *Jardiknas* and managed by *Jardiknas* consultants, experience Internet connectivity of reasonable speed and quality.12 At other schools with ICT labs in these areas, such as SMA Muhammadiyah, Jayapura, bandwidth is so poor that the Internet is unusable.

  At all of these schools, the use and timetabling of ICT resources are primarily intended to support development of ICT skills by students. Schools with substantial ICT resources may also place one or two computers in school administrative offices. These computers are primarily intended to support administrative functions.

- **Schools outside coastal centers**
  The level of computer activity among schools that are several hours from coastal centers is moderate. Schools' efforts, however, are not systematic and result in installations that are not standardized and that have the potential to present challenges in terms of maintenance and in terms development of software resources to support learning and management.

  Many of the schools visited in these areas have acquired computers, ranging from one or two computers for administrative use (SD 1 Kurik) to a small number of computers (4-10) for student use (SMP 4 Kurik, SMK 1 Tanah Miring). When possible, these schools connect to the Internet using "fixed wireless" services (Telkom's *Speedy*). Quality of the Internet connection is not high, but may exceed that of some schools in coastal centers, with differences possibly related to network platforms and the provider quality.

  Use in most of these schools is limited to a few teachers. Students have more opportunities to use the computers in the course of receiving basic-skills instruction in ICT, however those opportunities are brief (one period per week

12 SMK Yapis Biak is notable also for its strong support of ICT education for girls. The lab manager is a woman, and possibly serves as a role model for girls in the school. In any event, of the three classes currently enrolled in the ICT curriculum at the school, girls in year 2 outnumber boys (10 to 9) and are equally represented in year 3 (24 out of 48).

at most); in almost all instances, several students use one computer; instruction is of uncertain quality, typically provided by self-trained teachers.

- **Schools in remote areas** ICT is far less prevalent among schools in remote areas. Schools in Wamena, however, demonstrate the potential and of the challenges in terms of establishing ICT Centers in schools in remote areas. SMA 1 Wamena has acquired 14 computers, plus a 20-meter tower to enable microwave data transmission. However, because *Jardiknas* at DINAS Jayawijaya is not yet configured to enable Internet access to schools and other organizations, SMA 1 does not have Internet access. SMP 1 Wamena has a computer lab with 20 computers, intended to support the ICT curriculum and basic-skills acquisition. However the supply of electrical power (or possibly the facilities' circuitry) does not support operation of all of these computers at once, so only 10 are used. SMK Yapis Wamena has 40 computers, with no Internet connection. SD Yapis Wamena, the top-ranked public SD in Wamena, does not have administrative or student computers.

  Outside Wamena and the Baliem Valley, schools have generally not acquired ICT. No schools visited in Kab. Yahukimo have acquired even administrative computers, although intermittent electrical power is available via micro-hydro-electric generation to SMP 1 Kurima. SMA 1 Bokondini has one laptop.

  An ICT Centre in Bokondini is located at the ABA Netaiken school for secondary-school graduates. The centre has approximately 15 computers, which it makes available twice weekly to 15 students from the SMA. ABA Netaiken is operated locally by staff of the EduVentures Foundation; these staff also operate Bokondini's micro-hydroelectric facility under a memorandum of understanding (MOU) with the district government.

C. Limitations of Current ICT-infrastructure Initiatives

Both the independent acquisition of computers by schools and the national and provincial initiatives suffer from limitations that will reduce their impact on the quality of education in Papua.

Standardization of Hardware, Software and Network Configurations. The absence of standard specifications for computer installations and of guidelines for hardware and software procurement increases program costs and reduces performance system-wide. By creating an "installed base" that is made up of many different computers, running different software, with different network configurations, schools increase challenges stemming from maintenance, training, development of compatible learning resources, and sustainable computer-lab operations.

Software installations also benefit from standardization. The proliferation of different versions of system software, in combination with changes made by local users, further complicates maintenance and support. In addition, critical software tools, such as virus-protection or backup software, may be neglected or improperly used.

Total Cost of Ownership Framework. Hardware procurement without consideration of the Total Cost of Ownership (TCO) increases overall program costs. Schools acquiring cathode-ray tube (CRT) monitors, for example, instead of liquid crystal display (LCD) monitors may reduce procurement costs, but these savings are rapidly exceeded by increased power consumption of these monitors. Similarly, schools may opt for diesel generators despite the fact that operating costs of generators dwarf those of solar panels.

Inadequate Planning for Alternative Electrical Supply. Schools with unreliable access to commercially provided electricity have limited ability to benefit from ICT. Schools with ICT labs typically use diesel generators as alterative power supplies, despite the general superiority of solar panels in terms of costs, service lifecycles,

environmental concerns and reliability. Planning and procurement processes, including product specifications and standardization, are inadequate to provide for alternative electrical supplies that are more environmentally sound and that lower overall costs.

The PMPTK / DIKPORA Papua ICT Centers will include funding for alternative power generation when necessary. Planning for adequate electrical power consumption and procurement of expandable systems may not be in place.

Internet Connectivity. Limited Internet connectivity bars students and teachers from communicating and from accessing learning resources and Web content. As mentioned previously, schools surrounding coastal population centers will have lower costs and higher bandwidth connections following the landing of the Palapa Ring fibre-optic cable. At schools outside these areas, poor quality and high costs will persist. There is high risk that students in these schools will fall further behind their peers in other regions in terms of access to learning resources, access to qualified teachers, ICT skills, and learning outcomes.

The *Jardiknas* network is primarily intended to serve as an intranet. In conjunction with configuration problems, use of *Jardiknas* by schools as a means to access the Internet degrades performance of the network to the point that *Jardiknas* is unusable in some locations.

D. Strategy for ICT Infrastructure

In light of the above, the objective of this component of the *ICT in Education Strategy* is to provide all secondary and some primary schools in Papua with access to appropriate ICT infrastructure (including functioning and well-maintained computers, relevant software and Internet access), depending on their location and priority needs, over a five-year period. Providing schools with computers and with Internet connectivity will support teacher professional development, dissemination of learning resources, management of education and financial information, and other activities throughout the Papuan education system.

Infrastructure activities will harness current provincial and national ICT initiatives, and will increase their impact on education in Papua through the adoption of more fully integrated and strategically designed approach. Supporting this deployment will require:

- Standardization of school hardware, software and networking configurations
- Establishing and enforcing guidelines for ICT procurement
- Developing and implementing maintenance and technical support policies

TCO-based financial projections and other improved management practices will also be introduced at the level of the provincial government. All activities will rely on public-private partnerships with local telecommunication companies and technology providers to the extent possible.

Three-tiered Approach for ICT Infrastructure in Schools. The strategy and implementation planning for ICT infrastructure takes into consideration the different "Tiers" of accessibility:

Tier 1 is comprised of schools located in or near coastal centers, where connectivity will be both fast and low-cost once the Palapa Ring landing points are operational— Sorong, West Papua by May 2011. The timing of the other landing points is, unfortunately, still uncertain since a number of Palapa Ring consortium members left the consortium and the additional financing requirements still have to be resolved.

Tier 2 is comprised of schools—including many of the ICT Centers currently planned by DIKPORA Papua—that are located near coastal centers but in areas where Internet costs are high and quality is poor.

Tier 3 comprises schools in remote areas. These schools are very difficult to access; Internet costs are high and quality is poor.

Smart allocation of costly satellite bandwidth is crucial. Schools outside Tier 1 will be offered low Internet capacity that will enable messaging, email, file transfer, and downloading of resources and information that have been multicast (see below).

ICT Centers outside of coastal centers may be allocated higher, and more expensive, bandwidth to support teacher training and improved access to resources.

As part of the *ICT in Education Strategy,* DIKPORA Papua will "multicast" learning resources and other information to lower-bandwidth schools. Multicasting involves upload of digital materials (e.g., learning resources) to satellite for delivery to "clients" (schools) overnight, when Internet usage levels are typically low. Multicasting enables low-bandwidth users to avoid "real-time" access to the World Wide Web while enabling them to download relatively large files. Schools can then store, or "cache," these files on server computers where they can be accessed on demand by teachers and students without connecting to the Internet.

ICT Centers in Schools. The 60 ICT Centers in SMAs, currently planned by DIKPORA Papua and funded by PMPTK, are critical elements in the strategic deployment of ICT in Papuan schools. The ICT Centers, with three in each district, will serve as:

- Hubs for the professional development of teachers
- Collaboration Centers for MGMPs[13]
- Support sites for ICT teachers and other teachers in their areas
- "Demonstration" sites for the integration of ICT into teaching and learning

To enable the ICT Centers to support this mission, their planned installations (six laptops, a server and a VSAT terminal) will be augmented with computer workstations and possibly other resources.

All ICT Centers will require broadband Internet connectivity. When possible, schools with ICT Centers will be connected to the Internet at low cost using fibre-optic cable and other commercially provided means; ICT Centers that are outside of fibre-optic and other commercial coverage will access the Internet by VSAT, which will entail significantly higher cost while providing moderate (256 Kbps) bandwidth.

ICT Centers in Teacher Education Institutions. While the 60 ICT Centers in schools will serve as hubs for professional development of most in-service teachers, higher-level training of technology specialists and others will take place at Teacher Education Institutions (TEIs). One TEI in Jayapura, such as UnCen FKIP or Universitas Sains & Teknologi Jayapura (USTJ), will serve as a central location for training of ICT teachers, secondary school heads, local coordinators and others. Additional TEIs will provide in-service training to head teachers and teachers from SDs. Other TEIs, such as the six "multicampus" teacher colleges being established by DIKPORA Papua, will include units in Basic ICT and ICT Integration in their curricula for pre-service teachers.

TEIs will receive computer and Internet installations to be used for professional development, as needed.

ICT Labs in Schools. SMAs, SMKs and SMPs that are not selected to be ICT Centers will, over the course of the five-year program, receive smaller-scale ICT "minilabs" suitable for use by teachers and students. These schools will be connected to the Palapa Ring fibre-optic network when possible, or will be connected by VSAT at low speeds and the lowest possible cost.

Low-speed VSATs will reduce operating costs while enabling schools to download and store learning resources, communicate via email and chat, and share files via email.

ICT "Stations" for SDs. SDs, including 30 SDs in a remote pilot area, will receive minimal "ICT stations" enabling them to communicate, manage information and access resources. These stations, in combination with other program components addressing information management, learning resources, professional development and other areas, will have the potential to greatly increase the school performance in many areas. These areas include reporting, teacher participation in skills-

13 MGMPs are communities of practice (COPs), in which secondary teachers of specific subjects (e.g., math, science, Indonesian language, etc.) meet to improve their knowledge of their subjects and their teaching techniques and materials.

upgrade programs, the effective use of learning resources such as TV-e, and teachers' participation in peer learning groups (KKGs).

Stations will consist of one laptop computer plus Internet connectivity and, when required, solar-based electricity generation and storage equipment.

When possible, SDs will be connected to the Palapa Ring fibre-optic network, or will be connected by VSAT at low speeds and the lowest possible cost.

Challenges, Current Initiatives and Strategy – Education and Financial Management

A. Current situation

Education and financial management in Papua are limited by many different factors. Among these, however, information management is critical. Without the ability to share information across Papua's distances, and across its mountains and marshes, no management effort will be successful.

By leveraging proposed ICT infrastructure and focusing on deployment of the simplest tools and processes, DIKPORA Papua can radically improve information flows, information retrieval, and analysis. These processes, in turn, will prepare teachers and schools in Papua to participate in the more sophisticated information-management initiatives that are currently planned or underway.

B. Challenges in Education and Financial Management

Papua's distances, forests and mountains complicate all processes that depend on the flow of information. Management of educational and financial information, however, is critical to the delivery of effective educational services—and to any effort to enhance the quality of those services.

The three main challenges to be addressed by the Strategy are:

- Consistent and reliable financial reporting and budget management
- Data-handling capacity
- Reporting and communications from remote schools

If not addressed, these factors limit transparency and accountability, as well as the overall functioning of the education system in the province. They also increase levels of risk associated with initiatives planned by DIKPORA Papua, other education organizations, and those proposed by this *ICT in Education Strategy*.

Burdensome Reporting. Monthly reporting by Papuan schools is far from complete; in schools that do report regularly, completing reports places burdens on school heads and other faculty that reduce their participation in management and teaching activities.

In and near coastal centers, the burden of administrative reporting increases teacher workloads, removes teachers from classrooms, and removes head teachers from schools. In Kab. Merauke, head teachers in the Kurik and Tanah Miring *kecamaten*, one to two hours from the town of Merauke, complete reports using paper and pencil. Others use school computer facilities, if available, to develop their own reporting forms and then travel to Merauke to use public computer facilities (*Warnet*) to complete or to print reports. In all cases, head teachers must travel to Merauke to deliver reports. In many schools, reporting activities require both the head teacher and a second teacher serving as an assistant.

Limited Participation in Reporting. School participation in monthly reporting varies greatly according to geography, but is inadequate in most instances. According to the Wamena office of education, approximately 30 percent of SDs in Kab. Jayawijaya complete their monthly reporting; this compares with 80 percent in Kab. Merauke. Although information is not available, in Kab. Yahukimo and other isolated areas reporting among SDs is likely lower than in Jayawijaya.

Reporting failures by remote schools link to a larger complex of problems related to schools' isolation and lack of communications. Among the most serious of these problems is teacher absenteeism, which results from the combination of schools' isolation, teachers' difficulties in receiving pay, and the general lack of leadership and oversight at the local level and other factors.

Inaccurate and Incomplete Data. As a result of the combination of burdensome reporting processes and limited participation, current data on schools in Papua is limited in terms of both accuracy and completeness. Gaps in basic information range from the numbers of schools in different district to student enrolment. More valuable information, such as the numbers of students held back in each school, is not tracked in any but the most accessible and developed district. Schools' inability to receive accurate data about administration and budgeting at the DINAS level contributes to their lack of financial resources and, by extension, to a host of problems ranging from teacher absenteeism to lack of student uniforms.

Since data management involves paper-based data entry and aggregation at both the school and DINAS levels, the probability of inaccurate data is increased. Poor-quality data creates challenges, in turn, for decision-makers and policy-makers.

Inadequate Management of Financial Information. Financial management and reporting processes in the primary and secondary school systems are extremely limited. According to head teachers and teachers in various schools, lack of reporting and transparency results in funds transfers that are—or that may be—significantly less than the amounts allocated. SD 1 Tangma, for example, reports receiving BOS payments of only Rp. 1,000 per Class 1 student, graduating up to Rp. 6,000 for Class 6 students.

Problems related to financial management result in stalled civil works, lack of learning resources in science labs and libraries and high levels of dissatisfaction among teachers, all stemming from limitations on the flow of resources to schools. Inadequate reporting without doubt contributes to failures of transparency and accountability, increasing the likelihood of corruption and undermining the commitment and participation of education staff from the district to the school levels.

Lack of Capacity to Process Electronic Reports. Even in coastal centers such as Merauke and Biak, where significant numbers of schools complete reports on computers and have email access,

district education offices lack the capacity to receive monthly reports electronically. Factors influencing this situation include limited technology skills among district staff, poor or non-existent Internet connectivity and lack of central guidelines and tools for electronic reporting and data management.

Limitations in terms of electronic communications and information management intensify other management challenges and will impede efforts to reform management processes.

Challenges in terms of the management of education and financial information negatively impact school functioning on many levels. These failures are reflected as limitations on the ability of DIKPORA Papua and other organizations to mobilize resources of all types on behalf of schools. In relation to the program outlined by this *ICT in Education Strategy,* the effective mobilization of significant resources for all program components will be jeopardized unless improvement information management can be extended to target schools

C. Current Information-Management Initiatives

Many complementary projects have been launched as part of "e-Pendidikan," the e-education "flagship" of the Government of Indonesia's cabinet-level National ICT Committee. (The seven flagships address issues range from e-government to infrastructure.) These national projects and other initiatives have potential bearing on management of schools in Papua in terms of ICT-based information managment and standardization of proceses such as database I.D.s for students, teachers and schools. Among the most developed and most significant initiatives are:

- *Jardiknas* "Unique I.D. Program"
- Padati2
- Government Financial Management and Reporting Program
- Strategic School Development Program

These programs and the many others that are currently underway have potential to improve education management in Indonesia as a whole. In Papua, however, their impact will be limited by lack of infrastructure, lack of capacity at the district and school levels, and by other factors contributing to the overall challenge of management.

Limiting Factors in Information Management. Although the potential for improvement of information management in Papuan schools is high, the potential less-than-optimal impact is also high, as a result of several critical limiting factors.

At the broadest, conceptual level, planned improvements to information management and school reporting are influenced by an "education culture" in Papua that at present does not value transparency or the exchange of information. Feeding into this situation, the capacity of school leadership and administration to meet reporting requirements is in doubt, both because the rewards of participation may be unclear and because general management capacity at the school level is limited.

However, the key barrier to the success of *any* information-management initiative in Papua is lack of infrastructure—in terms of both transportation and communication. Reporting levels in remote district are much lower than those in coastal district; the lack of accountability in schools is magnified the farther schools are from their district offices.

The national and provincial initiatives addressing information management also include specific elements of risk, including the risk that the proliferation of management-improvement initiatives will create complexity rather than resolve information flows.

D. Strategy for Information Management

In response to these challenges and to support measures that are planned or now underway, the education and financial management component will address the following objectives:

- **Increase participation** in education and financial management at the school and district levels

- **Increase the availability and value of information** about school administration for all stakeholders
- **Help Papuan schools prepare** for participation in planned provincial and national EMIS and FMIS activities

It is essential that initial steps to establish ICT-supported management of education and financial information rely on the simplest possible tools and processes. While the capacity of school leaders and district staff can be built through professional development, supporting resources must deliver immediate and meaningful benefits in terms of time savings and cost savings to users. As these simple solutions are deployed, as information-management practices are mastered, and as school leadership, district staff and communities begin to realize the advantages of increased transparency and accountability, more sophisticated national initiatives can be integrated into school practice.

Establishing Simple Information Management. Primary activities in relation to education and financial management at the school, district and provincial level will focus on implementing simple, effective reporting practices that can be computerized. To facilitate this process, the following tools and resources will be developed:

- Simple, easy-to-use ICT-based reporting tools for schools (such as standardized Excel spreadsheets)
- Simple, easy-to-use tools for aggregating and managing school reports and information electronically at DIKNAS district (such as Excel reporting tools)
- Professional-development resources and instructional units addressing information management and the use of the program's ICT tools at the school, district and provincial levels

These tools are intended to support existing information-management processes and information flows. By supporting such processes, these tools and resources will establish a foundation for system-wide reporting and information management. However, to generate value from this foundation, DIKPORA Papua must commit to and promote actions that reward transparency, that institute accountability, and that recognize the value of information management at all levels.

Establishing a Culture of Information Management. School heads and teachers must derive concrete value from participating in a "culture of information management." The value of participation can take the form of increased transparency, more efficient management of resources, and inclusion in the process of professionalization of school leadership. One component—a benefit of participation and a result of professionalization—of this process is the increasing availability of information about resource allocations and expenditures. And in general, administrative processes should no longer be seen as a "one-way street," but as mutually beneficial exchanges, shared activities that are part of the process of educational improvement. In this way, schools and school leaders will begin to develop the habits and skills that are critical to any significant management effort.

Incentives—particularly non-financial incentives—will be integrated into the information-management program to increase participation. Although increased accountability is needed, and is identified in this section as an overall goal, the primary reinforcement for increasing participation will be positive and based on real and perceived benefits. Outreach to and inclusion of directors of DIKNAS district and school heads during development and implementation is essential.

Using Information Systems. Development of information-management resources for the Papuan education system will address school-level reporting, information aggregation and management at the district level, and existing Database Management Systems (DBMS) and back-office services housed within DIKPORA Papua. Development may involve use of Commercial Off-the-Shelf (COTS) products, existing open-source tools and templates, or of newly created forms and templates in a spreadsheet application. Regardless of the cost and sophistication (or simplicity) of the platform, support for customization, training, revisions and updates is essential. During the process of

scoping and specification, comparative analysis will address the feasibility and the advisability of using products from international vendors, customizing open-source tools, or developing resources for use with productivity tools such as spreadsheets and databases.

While coordination with national and provincial EMIS and FMIS initiatives currently in development is desirable, simplicity of design, development and use are overriding priorities. It is anticipated that initial information-management tools will be developed in a standard office spreadsheet tool, such as Microsoft Excel or open-source equivalent, and will rely on templates, forms and other aids to users. Alternatives will be considered, but the primary requirements, simplicity and ease of use, will be served.

Building information-management capacity. In concert with the development of tools and processes, increasing capacity at the school, district and provincial is essential. For school heads, information management and use of ICT resources—including training on specific resources provided to schools—will be included in school-leadership courses. At the district level, equivalent professional development will be provided to directors of the office of education (DINAS *Pendidikan Kabupaten*) and to appropriate district staff.

Challenges, Current Initiatives and Strategy – Teacher Capacity and Professional Development

A. Overview

Infrastructure and information systems are necessary but not sufficient components of any strategy proposed to address ICT in education. Capacity-building activities are essential to enable administrators, teachers and students to use infrastructure resources effectively and efficiently, as demonstrated by worldwide experience.

Teacher capacity in many Papuan schools lags behind the rest of Indonesia and behind international standards[14]. ICT can be used cost-effectively to enhance teachers' mastery of their subjects, their pedagogical skills, their classroom-management abilities and many other aspects critical to their work with teachers. This component of the proposed *ICT in Education Strategy* primarily address the development of technical capacity, including teachers' skills in using computers and the Internet with students and to improve learning outcomes. In conjunction with the roll-out of ICT infrastructure, building technical capacity can help increase teachers' access to other forms of professional development, such as skills-upgrades programs addressing the S-1 degree, or participation in subject-based discussions with their peers.

B. Challenges in Teacher Capacity and Professional Development

The capacity of teachers, in particular, is tightly linked with other elements in the education system. The availability and quality of learning resources, the relevance and appropriateness of curricula and the effectiveness of education management are all reflected in teachers' interactions with students. Highly skilled teachers may offset limitations in these other elements. Similarly, teachers who are unmotivated or who lack capacity may greatly reduce the effectiveness of these elements.

14 The nature and scope of capacity-related challenges in Papua can be inferred from reports, from statements made to the fact-finding team, and from first-hand observations.

Teacher Qualifications. A majority of teachers at the SD and SMP levels, as well as many teachers at the SMA level, do not meet national standards for qualifications. Law number 14/2005 requires that all teachers hold the S-1 degree, equivalent to a bacherlor's degree. Kab. Merauke is a district with both new and established skills-upgrades initiatives and relatively high-performing management. However, 980 of approximately 2,000 teachers in that district fail to meet the S-1 standard. At highlands schools included in field research for this report, no teachers in attendance at SDs met the S-1 standard.

Teacher Absenteeism and Motivation. While reported student-teacher ratios vary from favorable levels to unacceptable levels, high rates of teacher absenteeism in remote areas create a crisis situation. At S.D. 1 Tangma, Kab. Yahukimo, the fact-finding team found one physical-education teacher and approximately 200 students; seven teachers were absent, with the dates of their last appearances documented by one of the town leaders. At S.D. 1 Seima, Kab. Yahukimo, two teachers were present, while seven other teachers were not. The head teachers of both schools were in Wamena at the time of the fact-finding visit, with the Tangma head teacher last observed at the school eight years previously.

Multigrade-classroom Management. No provision is made in pre-service or in-service professional development to build teachers' capacity to manage multigrade classrooms. However Papuan teachers, especially at the SD level, are confronted daily with the need to combine students of various levels or conduct several classes concurrently. Multigrade teaching techniques have been shown to be highly effective, but are not included in professional-development curricula in Papua.

Technology-related Capacity. Inadequate human capacity affects activities and quality-improvement initiatives in many other areas of the education system, including those related to ICT. Such influence operation of school ICT Centers, local network maintenance and access to national networks, and other activities. Inadequate capacity also affects areas such as education management and learning-resource development. At the district level, faulty network configurations of *Jardiknas* limit Internet access, and are directly attributable to low capacity among technical staff.

C. Current Professional-development Initiatives

Many national policies and projects have been launched to help fill the gap in ICT-focused professional development in Papua by:

- Motivating teachers to participate in professional development
- Providing curriculum and proven models for training
- Supporting the delivery of high-quality professional development

These initiatives are extensive and in many cases well founded. However their impact is diminished by small scope and scale, and by challenges in serving teachers in the hardest-to-reach schools. Key initiatives include:

- Law number 14/2005: S-1 requirement for all teachers
- Incentives for teachers in isolated schools
- Better Education through Reformed Management and Universal Teacher Upgrading (BERMUTU)
- ICT training provided by the LPMP, the regional office in each province responsible for enhancing teacher-quality through training
- Distance Learning Development Grants
- Working Group Grant Program for KKGs and MGMPs
- *Universitas Terbuka* (UT) S-1 program for Primary School Teacher Education.
- UT ICT course, *Komputer dan Media Pembelajaran*.
- UT GuruPintar Online (gurupintar.ut.ac.id)
- UPI Bandung ICT training for pre-service teachers
- SEAMOLEC HyLite Teacher Skills Upgrade program

In addition to these programs, the two main providers of pre-service teacher education are the *Universitas Cenderawasih* and its *Fakultas Keguruan dan Ilmu Pendidikan* (FKIP) and the *Sekolah Tinggi Ilmu Keguruan dan Ilmu Pendidikan* (STKIP). These organizations offer teacher-development programs in eight locations throughout Papua.

D. Limiting Factors in Teacher Professional Development

Limited access results in limited participation. The foremost limiter among TPD initiatives is access. Limited access to TPD, especially for teachers in remote areas, significantly limits participation. As a result, DIKPORA Papua faces a significant challenge in meeting national goals for teacher qualifications and in upgrading teachers' classroom skills.

DIKPORA Papua plans for the launch of teacher-college "multicampuses" to address shortfalls require ambitious levels of participation, as well as challenging logistical coordination to ensure that schools remain fully staffed and functional.

Distance-education-based programs such as SEAMOLEC HyLite and UT's teacher courses have the potential to be effective, but participation remains low. Only 50 teachers in Kab. Biak-Numfor are participating in the SEAMOLEC skills-upgrade program. Enrolment in the UT program is unclear,[15] however no teachers interviewed during field visits were aware of or participating in the program.

Quality of pre-service and in-service teacher education. The quality of both in-service and pre-service teacher education is variable, in part as a result of dynamism among the programs and institutions offering TPD. The STKP program in Kab. Biak-Numfor is new or has experienced recent change in leadership. Three hundred students are receiving in-service TPD of reasonable quality, however facilities are still under construction. Other institutions, possibly including the UnCen FKIP extension in Merauke, are scheduled to close operations within two years as funding terms for skills-upgrade activities are terminated.

Lack of focus on ICT. Current pre-service and in-service TPD programs available in Papua do not include significant focus on ICT.

E. Strategy for Teacher Professional Development

Professional development for Papuan teachers will have three overarching goals.

- Support motivated teachers to learn about, adopt and adapt technology resources to improve their teaching practice
- Motivate additional teachers to take advantage of the efficiencies and benefits of technology use for management and for teaching
- Provide access and support structures to secondary students enabling them to build sound skills in using technology and technology-accessed information to solve real-world problems

To achieve these goals, TPD will focus on the establishment of a human and technological network *within* Papuan schools and their faculties. This network is intended to serve as a foundation for proposed and future initiatives intended to build teachers' skills, engage students in more effective learning, and realize the potential that technology affords.

Building Technology Capacity. Building technology skills in schools and throughout the Papuan education system is critical to the effectiveness and sustainability of the proposed deployment of ICT. Such efforts face challenges, however, posed by Papuan geography and infrastructure.

Specific objectives for the development of technology skills include:

- Develop appropriately skilled ICT teachers sufficient to meet the needs of Papuan schools

15 Interviews with UT faculty suggest that several thousand teachers are participating. It is likely, however, that those teachers are distributed throughout Indonesia, with limited participation in Papua.

- Build ICT-leadership and information-management skills among school heads and other education leaders
- Develop a "vanguard team" of teachers in ICT Centers who will inspire, guide and support teachers in other schools as they experiment with technology in teaching and learning
- Provide access and incentives to participate in ICT-focused professional development to all teachers in Papuan schools
- "Mainstream" instruction in technology use and teaching with technology into curricula for pre-service teacher education

Accomplishing these objectives will significantly increase the likelihood that current and planned investment in ICT by the provincial and national governments will have positive impact on the use of ICT in schools, and on teaching and learning. No single measure—such as development of a cadre of ICT teachers—will ensure that investment in ICT returns value. The complementary paths proposed, in contrast, seek to concurrently develop school leadership, ICT support in schools, and teacher use of ICT. These provisions, in turn, support other program initiatives in learning-resource development and information management, and the initiatives of other programs such as BERMUTU and SEAMOLEC HyLite.

Professional Development Programs. The core value of TPD as outlined in this *ICT in Education Strategy* is leadership, which starts at the local level and extends throughout the education system. School heads, ICT teachers and other motivated teachers will be called on to share their knowledge and experience with other teachers. TEIs will be asked to help pre-service and in-service teachers, including school leaders and ICT teachers, gain a vision of technology's potential contribution to teaching and learning and to build the foundation of skills needed to start to realize that vision. District education staff will be tasked with building the overall technical capacity at the DINAS level, and with supporting and monitoring local activities.

Five TPD programs will go hand-in hand with the ICT infrastructure rollout:

- **Program 1: ICT and Support** Training for ICT teacher in how to use and provide basic maintenance for school computer installations, and how to support other teachers' learning and use of ICT
- **Program 2: Basic ICT** Training for secondary teachers in the use of ICT in educational contexts and to support educational activities
- **Program 3: Basic ICT-SD level** Training for primary school heads and teachers in the use of SD ICT stations for communication, reporting and access of learning resources
- **Program 4: ICT Integration** Training for ICT teachers and other secondary teachers in the use of computers and the Internet to support active learning by students
- **Program 5: ICT Leadership** Training for secondary school heads to help them gain basic ICT skills, understanding of the role and importance of ICT, and awareness of ways they can support program initiatives in their schools and surrounding communities

Centralized Training at Teacher Education Institutions. TEIs in Papua will be engaged as partners in the development of the skilled network of ICT leadership and support needed by the program. One high-capacity TEI in Jayapura, possibly USTJ or UnCen FKIP, will be asked to provide:

- ICT Leadership training to secondary school heads
- ICT and Support training to secondary ICT teachers

Other TEIs, among them the six multicampus teachers colleges established by DIKPORA Papua, will be asked to:

- Integrate Basic ICT and ICT Integration into the curricula of pre-service teachers
- Provide Basic ICT-SD training to school heads and teachers from local SDs receiving ICT stations

Services provided by TEIs must be closely coordinated with the ICT infrastructure roll-out to ensure that the training of head teachers, ICT teachers and other teachers from specific schools takes place as those schools are receiving ICT installations.

Local Training at ICT Centers and Other Schools. At the 60 ICT Centers and at secondary schools with ICT labs, in-service secondary and primary teachers will have access to both formal and non-formal professional development supporting their use of ICT.

Formal Professional Development at ICT Centers. Periodically, in sync with school holidays or at other appropriate times, ICT Centers will offer formal, certificate-based professional development for local teachers. These sessions will be led by ICT teachers with support as needed by consultants, local coordinators and other specialists. In these sessions, ICT Centers will be asked to provide:

- Basic ICT training to teachers from their schools and from other schools
- ICT Integration training to teachers from their schools and from other schools

Non-formal Professional Development at ICT Centers and Schools. Throughout the academic year, ICT teachers at ICT Centers and at schools with ICT minilabs will offer non-formal training and support to local teachers. The objective of this component of the capacity-building strategy is to help build small teams of motivated teachers committed to building their skills, leveraging available learning resources and getting the most possible benefit out of the ICT installations in their schools. As part of their responsibilities, ICT teachers will be asked to:

- Support teachers in their schools in the development of basic technology skills
- Help those teachers access and use available learning resources and other program-developed supports for teaching and learning
- Collaborate with school heads and other motivated teachers to develop a team of teachers committed to mastering technology skills and using these to support teaching and learning in their schools
- Support local LPMPs, KKGs and MGMPs as they explore and experiment with ICT

ICT Centers and secondary schools with minilabs will also be encouraged to support use of school computer facilities by primary-grade teachers as well.

Local Training at DINAS District. It is critical that DINAS staff receive appropriate, effective professional development supporting their roles in the system-wide introduction of ICT to support education in Papua. To meet this need, more thorough understanding of staff capacities, responsibilities and constraints is required. In addition, program implementation should be further elaborated before capacity building at the DINAS level can be planned in detail.

However, various DINAS staff should be enabled to support the ICT program components by using technology effectively in their jobs, and by providing technical support and logistical support to schools involved in ICT use and in local capacity building.

Motivating Participation in Professional Development. To be successful, capacity-building activities must be designed to take advantage of motivated teachers and students, engaged school leadership, and active district-level staff.

Additional investigation into existing teacher-development programs is needed. At the primary level, for example, the Decentralized Basic Education 2 Program, uses a local, cluster-based model of professional development for teachers in five Indonesia provinces working with limited ICT resources. DBE 2 might valuably be adapted for use in remote SDs. Integration with the BERMUTU Project's support for KKGs and MGMPs should also be explored. Other models not specifically related to computers and the Internet, such as strategies for teachers in multi-grade classrooms, should be assessed and, if appropriate, supported as a way of helping teachers meet challenges they face daily in schools.

Means of Motivating Participation and ICT Use in Schools. It is critical to build ways of stimulating participation in ICT-focused professional development and in the use of computers and the Internet in schools.

To motivate participation in professional development, capacity-building programs should take advantage of:

- Incentives for ICT teachers delivering training in their schools
- Incentives for teachers participating in local, non-formal training
- Integration of ICT-focused professional development into in-service skills-upgrade courses

Incentives can be provided through a combination of monetary payments, certificates and other recognition, privileges regarding Internet use or access to resources, and other means that leverage program components and partnerships. (Program partners in telecommunications might provide, for example, free mobile-phone air time to teachers participating in training.)

Participation in professional development, however, should be tightly linked to the use of ICT in schools. Additional incentives and motivating factors might involve:

- Contests, email surveys, and other opportunities to participate
- Rewards for schools or teacher working groups that are particularly active
- Staffed support for test preparation, curriculum and content issues, and other exam-related activities

Again, the specific incentives for increased participation should be determined by DIKPORA Papua and program partners.

Ensuring that the Right Teachers are Trained. While incentives may be critical to stimulating participation, such incentives must be carefully gauged to ensure that teachers who participate are authentically interested and very likely to contribute to the use of ICT in their schools. If per-diem expense allocations are too high, for example, teachers may choose or be chosen to participate in order to receive these payments.

Better practices include basing incentives on course completion and on meeting subsequent milestones, and calibrating per diem to meet but not exceed the costs that participants are likely to incur. When possible, central purchase of air fare, accommodations and other services is preferable.

Integration of ICT-focused Professional Development with Skills-upgrades Programs. In combination, ICT infrastructure, TPD and effective program management should be seen as a foundation supporting a range of education-related services that increase schools' effectiveness. In combination with the distance-education programs currently active in Papua, this foundation can help meet teachers' need for increased access to skills-upgrade courses. Programs such as the SEAMOLEC HyLite Teacher Skills Upgrade program, which currently enables 50 teachers in remote areas of Biak Numfor to study for the S-1 degree using ICT-enabled distance education, should be strengthened and expanded.

Setting Priorities and Managing Expectations. ICT-focused teacher professional development is not a zero-sum activity—one in which all teachers must attain a certain level of technical skill within a certain time frame. Rather, system-wide capacity building should set as its goal the enabling of intensive, creative and effective activity among teachers, students and teams throughout Papua. Not all teachers will participate, not all schools will manage ICT installations sustainably. But the benefits for schools, teachers and students, in terms of their engagement with education and learning, should be inspiring and impressive.

Challenges, Current Initiatives and Strategy – Teaching and Learning Resources

A. Overview

Learning resources are among the key factors determining the kinds of learning activities that are engaged in by teachers and students. The quality and availability of resources, then, has direct bearing on the quality and characteristics of education.

The approach outlined in this section seeks to leverage current learning-resource initiatives at the national level—especially those that seek to provide schools with electronic resources—and DIKPORA Papua's support for the Balai Pengembangan Pendidikan (BPP). Initial efforts will focus on improving distribution of resources currently available, with subsequent efforts starting to address the development of supporting materials and, if appropriate, new, locally focused resources.

B. Challenges Related to Learning Resources

In Papua, learning resources are not available in many schools; when they are available, they may not be accompanied by the supporting materials teachers need in order to use these resources effectively.

Lack of Textbooks and Teachers Guides. In both Kab. Merauke and Kab. Jayawijaya, textbooks and teachers guides were in short supply and/or out of date in SDs. In many schools, such as SMP 1 Kurima, Kab. Merauke, teachers continue to teach the old curriculum because they have neither guides nor textbooks for the 2004 revised curriculum.

Lack of Other Aids to Learning. In all schools visited, learning resources that can be used to

supplement textbooks and teachers guides are inadequate. Books, maths manipulatives, charts of the periodic table, diagrams of the human body and other resources serve several purposes in schools. In primary schools (SDs), such resources create visually and cognitively stimulating environments that connect students to both concepts and to enabling frameworks such as the alphabet or lists of homonyms. In secondary schools (SMAs, SMKs, SMPs) students might use lab materials, charts plotting local plants and animals, or other references to master both knowledge structures and specific facts. In Papua, such supplementary resources are absent from schools. Libraries in SDs and some remote secondary schools have fewer than 25 books for students; additional resources in these and other schools typically consist of one or more globes of the Earth and one or more plastic human skeletons.

To cope with the lack of resources in their schools, teachers are increasingly using (or asking school aides to use) the Internet in their schools or in Internet cafes (*warnet*).

C. Current Intiatives Addressing Learning Resources

At the national level, development of learning resources emphasizes use of the Internet and of computers and other technologies in schools. While the resources resulting from programs such as TV-e and e-dukasi.net are potentially of value to Papuan teachers and students, current infrastructure and other factors limit the impact of these activities. Relevant initiatives at the provincial level seek to address these limitations by facilitating dissemination of digital resources.

Current initiatives that have bearing on the situation in Papua include:

- TV-e
- E-edukasi.net
- Dikmenjur.net
- UPI Bandung multimedia DVDs

e-dukasi.net and dikmenjur.net both address the need for updated curricula, textbooks and exam-preparation materials in schools. These initiatives rely on electrical power and access to computers and the Internet. In Papua, however, such infrastructure is limited in schools and communities.
TV-e also relies on electrical power in schools, delivering short, instructional units using video animations to illustrate concepts and reinforce skills.

The sophisticated multimedia learning resources developed at UPI Bandung support several elements in the secondary curriculum. However to be used effectively these resources require computer skills on the part of students and teachers, and techniques for providing follow-up support on the part of teachers.

DIKPORA Papua has established the BPP to help schools overcome barriers to access and the effective use of electronic resources. Among BPP's current initiatives are:

- Dissemination of TV-e resources on DVD
- ICT training for teachers and other education staff

BPP also includes a small video-production facility.

D. Limiting Factors in Relation to Learning Resources.

The primary limiter, although by no means the only one, to the effectiveness of national and provincial development and dissemination of learning resources is the ability to access them—whether such resources are delivered in print or digital formats. At the national level, provision of online resources has the potential to meet schools' needs directly, however the percentage of schools in Papua able to access these resources is low. Other limiting factors center on teacher capacity and on the quality and relevance of existing learning resources.

Access to Internet-based resources. Online resources for students posted to e-dukasi.net, dikmenjur.net and other websites will be inaccessible to many teachers in Papua even following the landing of the Palapa Ring fibre-optic Internet backbone.

Although the Palapa Ring will likely increase teacher access in coastal population centers, access in most *district* will be largely unchanged.

Support for teacher use of TV-e. In the absence of teacher guides, professional development or other support for the use of TV-e in schools, increased access to TV-e resources may not be used effectively. The TV-e format involves short animated sequences that provide information or that demonstrate solutions to problems. Their use in the classroom and their integration into lessons and activities is very likely not clear to all teachers in Papua: At one school with access to TV-e, the head teacher said that when students had difficulty with a skill or problem, teachers would set up TV-e to run repeatedly.

TV-e also suffers from limited school access as a result of inadequate equipment and infrastructure, as well as scheduling issues resulting from different time zones and from lack of synchronization with curricula. BPP's efforts to distribute TV-e on DVD are an attempt to mitigate these problems.

Distribution capacity. Poor Internet access to resources hosted in Jakarta is compounded by the absence of effective alternatives for dissemination of these resources. As currently configured, the provincial BPP lacks both human and technical capacity to use methods such as multicasting of Web content to improve dissemination of online resources to schools with Internet connectivity.

Instructional design. Limited technical and human capacity in relation to the use of ICT for the design and development of learning resources will inhibit localization of existing resources and development of effective new resources. BPP has the potential to serve Papuan education as a point of distribution and of localization and development of learning resources. Immediate activities might include developing print-based supporting resources for distribution with TV-e DVDs. However as currently staffed and configured BPP does not have adequate instructional-design capacity to fulfil this potential.

Teacher capacity for localization of resources. Teachers' limited capacity for localization of curricula and resources minimizes the advantages of their localization of student assessments. For assessments in SDs and SMPs, teachers and district-level education officers adapt national examinations for local students. This aspect of decentralization opens an opportunity to increase the relevance and effectiveness of curricula and resources. Papuan teachers, however, lack knowledge and skills to make alterations to lessons and activities. (Many schools also lack current teachers' guides and student workbooks, increasing the potential value of adaptation and localization.)

E. Strategy for Learning Resources

The learning-resources component will focus primarily on developing capacity at the BPP to address learning-resource-related challenges and support current initiatives. Key objectives will be:

- Increase schools' access to digital learning resources
- Increase the positive impact of currently available digital resources on teaching and learning
- Increase capacity design, develop and support teaching and learning resources

To accomplish these objectives, activities will focus on staffing, capacity building and management within BPP, and on augmenting multimedia and other technologies available to BPP staff.

BPP Staffing and Capacity Building. Because the BPP mission involves a wide range of specific skills—ranging from technical skills to instructional design to planning and management—capacity building will primarily rely on a "learning by doing" approach: Substantial technical assistance will be provided to BPP staff in support of learning-resources activities, enabling staff to build expertise while accomplishing BPP objectives. Staffing will be augmented, possibly including a multimedia and Web developer, an instructional design specialist, and a technical coordinator as well as management and support staff. A strategic approach to BPP staffing will be further developed in collaboration with BPP leadership after review of current and projected staffing.

Technical Assistance. The learning-resources program component will rely heavily on technical assistance to directly improve the quality of learning resources available in schools and to help BPP develop critical skills and experience. Technical assistance might, for example, be provided to help staff build skills needed to evaluate learning resources, develop strategies to support teachers' use of specific resources, distribute such resources and supporting materials system-wide and, eventually, design and develop new resources specific to the needs of Papuan teachers and students.

Simplicity of Design. Key to the success of BPP support for learning resources will be maintaining a commitment to simplicity in terms of design and development. Supporting resources developed by BPP can be as simple as lesson plans that help teachers use TV-e units effectively or localizations of national curriculum units to make them more effective in Papuan schools.

Activities should be based on the real needs of teachers and students, as determined through consultative processes and, later, by ICT-enabled feedback and discussion.

Although Web-based environments are proposed and may be developed these should also be as simple as possible (in part to enable access from schools with low-bandwidth connectivity). Redundant methods—particularly using email and multicasting—should enable as many teachers as possible to access BPP Web sites.

Web-based Support for Teachers. In addition to learning resources, BPP will also support teachers and students through the development of Web sites facilitating teacher working groups (KKG and MGMP), collaborative projects, contests, and other strategies supporting the use of ICT for teaching and learning.

It will be critical to support Papuan versions of effective Web-based initiatives. For example, "collaboration exchanges" among communities of teachers provide effective support for tele-collaborative projects and other learning activities that increase the impact of ICT on teaching and learning. While international Web-based exchanges, such as IEARN, effectively connect teachers and students from many countries, Papuan teachers and students may face barriers to the use of these sites stemming from language skills, cultural difference, curricula, lack of confidence and capacity, and other factors. To help Papuan teachers overcome these barriers, BPP and the provincial government can cost-effectively launch and support local versions of collaboration exchanges and other Web sites.

Teachers and students from other provinces in Indonesia will be encouraged to participate in projects with Papuan teachers and students.

Proven Models. Development of Web environments for Papuan will draw on designs, practices and models of projects such as Chile's *Enlaces,* which have succeeded in conditions where ICT infrastructure is uneven, school infrastructure is poor, and human capacity is limited.

Multicasting. This component will include development of a "multicasting" capacity within BPP as noted in Section 3 above. Multicasting will be used to increase schools' access to learning resources developed by BPP and by the Ministry of National Education. Multicasting might also prove valuable to DIKPORA Papua as a means of providing software upgrades and support, improving information management, and increasing the level of coordination and the dissemination of information among schools.

Expected Outcomes

A. Introduction

This section outlines outcomes[16] that are intended to result from the measures described in the *ICT in Education Strategy*. The proposed *Implementation Plan* envisages substantial investments, plus budgetary commitments for operating costs. The expected benefits may used in the formulation of impact indicators that can be used to measure the performance of the program.

It is important to note that overall project costs increase substantially as deployment to remote areas increases. However, expected benefits—in terms of access to tools and learning resources, participation in collaborative activities and contests, teacher professional development, and reporting—increase exponentially when ICT infrastructure is provided to schools in remote areas.

16 "Outcomes" are considered here as changes in actions, behaviors and relations among individuals and groups that result directly from project activities (properly, "outputs"). "Impacts" would be considered as longer-term and larger-scale effects arising both directly and indirectly from project activities. Impacts may be positive or negative (e.g., lower rates of teacher retention, etc.).

B. Expected Outcomes

The outcomes described here are directly related to the activities proposed in the *ICT in Education Strategy*. However, given the integrated relationships of the various program components, it would generally be inaccurate to link individual outcomes to specific components. As an example, establishing ICT infrastructure supports increased use of learning resources, but such increased use also depends on effective dissemination of learning resources and on TPD to build teacher awareness. Rather than linking to program components, outcomes will be presented in relation to "agents" in the education system, such as teachers, students, DINAS personnel and others.

Outcomes for Secondary Students. As a result of program activities, secondary students will:

- Increase their enthusiasm for school and their motivation to learn

- Use learning resources and other materials to build conceptual understanding of curriculum topics
- Learn in more varied and more active ways
- Build basic ICT skills
- Build basic information-literacy skills
- Participate in collaborative learning with other students in their school and with students from other schools

Outcomes for Primary Students. As a result of proposed activities, primary students in Tier 1 and Tier 2 schools will:

- Increase the benefits they receive from access to resources such as TV-edukasi
- Participate in lessons that are based on current curricula

Primary students in Tier 3 pilot schools may also benefit from increased teacher attendance, resulting from increased reporting and oversight and from improved communications.

Outcomes for Secondary Teachers. As a result of proposed activities, secondary teachers using ICT will:

- Increase their use of current curricula and materials
- Use learning resources (e.g., edukasi.net) in the classroom more frequently and more effectively
- Increase the range of teaching techniques they use in class
- Conduct one or more collaborative projects
- Increase their knowledge of school subjects
- Communicate with peers in other schools
- Participate more frequently in MGMP activities
- Develop an increased sense of professionalism

Secondary teachers may also increase their participation in skills-upgrade programs and other forms of professional education using ICT tools provided by program activities.

Outcomes for Primary Teachers. As a result of proposed activities, primary teachers in Tier 1 and Tier 2 schools will:

- Increase their use of current curricula and materials
- Use learning resources such as TV-edukasi more frequently and more effectively
- Communicate with peers in other schools
- Participate more frequently in KKG activities

Teachers in Tier 3 pilot schools will also:

- Attend school more frequently

This outcome may extend to teachers in Tier 1 and Tier 2 schools as well, depending on current rates of absenteeism and on the impact of increased reporting and oversight.

Outcomes for DIKPORA Papua and DINAS Personnel. As a result of proposed activities, general staff in DIKPORA Papua and at DINAS district will:

- Increase their participation in ICT-focused professional development when it is offered
- Use ICT more frequently and more effectively in the course of their jobs
- Receive more accurate and more timely information about conditions and activities in schools

Specific personnel within DIKPORA Papua, such as BPP staff responsible for development of learning resources, will:

- Use computers, the Internet and other tools more regularly and effectively
- Build competencies in relation to evaluation, design and development of learning resources
- Build management competencies in relation to planning, budget planning and financial management, human resources and staffing, team-building, leadership, etc.

Outcomes for Decision-makers. Decision-makers within DIKPORA Papua and at MONE will be able to base decisions on more accurate and more timely information about schools. As important, however, decision-makers will be able to communicate more directly and more swiftly with schools. As direct and

indirect outcomes of these capacities, decision-makers and education leadership will be able to:

- Improve school administration and human-resource management
- Improve financial management and budget forecasting
- Allocate and manage expenditures on needed facilities upgrades
- Eliminate redundancies and gaps in management via communication with DINAS personnel within district
- Develop system-wide (and therefore equitable) distribution of learning resources, curricula and test-preparation materials
- Develop initiatives to benefit specific populations or local cultures

Education leadership will, as a more broad result of proposed activities, be better positioned to guide future development of education in Papua.

C. Program Impact

The director of DIKPORA Papua has set "pedagogical transformation" as an overarching goal for the deployment of ICT in education in Papua. Strong advocacy of this position within the provincial government is essential if the activities described here are to return value equal to the investment of money and time required for their success.

While no ICT initiative can in and of itself transform an education system, the comprehensive program described in this report is designed to support real change in teaching and learning over a term longer even than the proposed five-year implementation time-frame.

A foundation for change. Three components—the establishment of ICT infrastructure, provision of ICT-focused teacher professional development, and intensive local coordination—are designed to work together to create a foundation of access, capacity and support. This "ICT foundation" will enable dynamic responses to challenges to the education system overall, challenges in specific schools and to the needs of individual teachers and students. This foundation will enable students and teachers to act independently at the local level, and will improve management and decision-making at the provincial level.

The ICT-related foundation is also intended to support and increase the effectiveness of a wide range of programs and activities leading to change. Within the strategy, these activities include:

- Management of financial and education information
- Access to and effective use of digital learning resources
- Participation in training in ICT integration

These "change oriented" components exemplify the transformative activities that can take place once the foundation of infrastructure, capacity and support is established.

Impact on management and decision-making. Improved management is central to the strategies and activities proposed in the Provincial Government's RENSTRA. At present, however, reporting and communication are crippled by schools' isolation and lack of communication, and by limited capacity within DINAS District. Activities proposed by the *ICT in Education Strategy* will:

- Enable informed, accurate, "real-time" decision making at the provincial and central levels
- Support decreased absenteeism, more efficient and transparent access to funding in schools and improved conditions for students
- Lay the groundwork for contemporary one-to-one and one-to-many management practices

Based on DIKPORA Papua's express commitment to education transformation, ICT-enabled management will lead to improvements in quality and relevance of education for students.

Impact on competiveness. ICT infrastructure, TPD and support for learning resources will improve the academic competitiveness of Papua in relation to Indonesia as a whole and to international-

class schools, and will increase the economic competitiveness of Papuan school leavers. The activities proposed in the *ICT in Education Strategy* will, if undertaken by DIKPORA Papua and other stakeholders, establish infrastructure and capacity that will compare very favorably with those of other provinces in Indonesia in terms of access to ICT, development of necessary capacities and resources, and focus on change in teaching, learning and school practice. In addition, implementation of relevant ICT programs will ensure that students completing secondary education in Papua are well-qualified to enter the world of work and to support the use of ICT in business.

Impact on enrolment and achievement. Increased motivation among students, one of the most frequently and strongly indicated outcomes of the introduction of ICT in education, will lead to increased participation in junior- and senior-secondary education. Current participation rates of approximately 50 percent for junior-secondary education and 30 percent for senior secondary are targeted for increase to 58 percent and 33 percent, respectively, by 2011. With students using ICT meaningfully to communicate, exchange information and knowledge and complete collaborative activities with other students, targeted increases are achievable and may be surpassed. As important, and as mentioned, establishment of ICT infrastructure and better-practice use of ICT in schools lays the groundwork for long-term increases in enrolment and completion.

Impact on teaching, learning and the quality of education. Of greatest importance, the strong focus on change in classroom activities enabled by student-centered deployment of ICT and supporting inputs (e.g., TPD, learning resources) has the potential to transform student learning from a factory-like series of memorization activities to a process of engaged examination of information and active generation of knowledge and real-world skills.

At present, teachers rely on repetition, drill and memorization because these techniques are familiar (based on their own experiences in school) and feasible given widespread lack of pedagogical capacity, subject knowledge and supporting resources. Activities proposed in the *ICT in Education Strategy* address all of these factors, specifically targeting teacher use of current resources to improve students' conceptual understanding and context-related skills. As ICT Integration courses are launched and completed, teachers will also build competencies and motivation to support active learning, collaborative learning and other student-centered pedagogies.

Impact on schools in remote areas. Given that secondary schools in remote areas face challenges and limitations that are far more severe than those faced by schools in coastal centers and their surrounding areas, the potential impact of ICT-supported activities in Papua's more remote districts is profound. More motivated teachers working under improved management and oversight can, as a first step, improve educational quality. Increased access to TPD, learning resources and opportunities for email collaboration can, in addition, transform students' relationships to school, teachers and learning. Minimal impacts among primary schools include increased support for KKGs and teachers in general, accompanied by initial steps to increase in-school access to information and communication.

Remote schools in Papua present a challenge that is nearly unique worldwide in its scope and scale. It is difficult to imagine a solution to this challenge that *does not* involve improved communication and increased access to information.

Overall impact. In relation to the annual education budget of Papua, activities described in the *ICT in Education Strategy* entail reasonable costs, while potential benefits—because these activities target current gaps, challenges and obstacles—are great. Functionality across the primary and secondary systems depends on an integrated approach extending from the provincial government to the school level. In combination with the commitment to education-focused activities and support, the three-part foundation of ICT infrastructure, teacher development and intensive local support linking to central management represents a well-founded and cost-effective means of addressing current problems while building the support structure for

Part 2 Pre liminary Implementation Plan

Implementation Plan

future solutions.

A. Overview

This section outlines the planning considerations, activities and projected costs of implementing the components of the proposed *ICT in Education Strategy,* namely:

- Improving ICT infrastructure: connectivity, and equipment/materials.
- Improving education system monitoring and financial management
- Building the skills/capacity of education staff
- Developing new teaching and learning resources
- In addition, the *Implementation Plan* discusses anticipated project management requirements.

The proposed *Implementation Plan* covers a five-year period and will entail capacity-building as well as deployment of computer equipment and learning materials, and provision of Internet and/or email access to schools and educational administrative offices. The activities described in detail in the following sections will be undertaken in three phases to take account of existing/planned activities, availability of skills and availability/quality of supporting infrastructure. Table 1 summarizes the proposed phased implementation: Phases 1 and 2 are 18 months each; Phase 2 covers a 24-month period.

Timeline. The three pages that follow present program activities in five major strands:

- ICT infrastructure
- Teacher Professional Development
- Management of financial and education information
- Learning resources
- Program management

The activities listed in these strands help to identify key tasks and milestones. Ongoing activities addressing management, coordination or other regular actions are not listed.

Activity	Who	Planning	Phase 1	Phase 2	Phase 3
Project management					
Complete assessment of DIKPORA Papua capacity	Planning team				
Finalize planning and hire mgment personnel as needed	DIKPORA Papua				
Develop action plans for program components	DIKPORA Papua				
Contract and launch independent M&E	DIKPORA Papua				
Develop TORs and contract consultants	DIKPORA Papua				
Develop TCO-based financial plan	DIKPORA Papua				
Begin participatory planning with DINAS Kab.	DIKPORA Papua				
Hire and train 7 regional coordinators	DIKPORA Papua				
Hire and train 24 secondary coordinators	DIKPORA Papua				
Hire and train 10 primary coordinators	DIKPORA Papua				
Hire and train 21 secondary coordinators	DIKPORA Papua				
Hire and train 1 regional coordinator	DIKPORA Papua				
ICT infrastructure					
Technical specifications, procurement docs etc	Planning team				
Prepare site-specific roll-out data	DIKPORA Papua				
Procure school hardware& maintenance under SLA	DIKPORA Papua				
Procure connectivity & multicasting under SLA	DIKPORA Papua				
Prepare Phase 1 school sites for installations (civil works)	Vendor				
Install 60 ICT Centers	Vendor				
Install 30 Tier 1 SD ICT Stations	Vendor				
Prepare Phase 2 school sites for installations					
Install 285 ICT Minilabs in SMAs, SMKs, SMPs	Vendor				
Install 170 Tier 1 SD ICT Stations	Vendor				
Install 30 Tier 3 Pilot SD ICT Stations	Vendor				
Prepare Phase 3 school sites for installations					
Install 256 ICT Minilabs in SMPs	Vendor				
Install 247 Tier 1 and Tier 2 SD ICT Stations	Vendor				
Teacher Professional Development					
Complete assessment of TEIs	Planning team				
Develop five TPD courses	DIKPORA Papua				
Integrate courses into pre-service teacher education	DIKPORA Papua				
Train 60 ICT teachers from ICT-Center schools	TEI				
Train 60 school heads from ICT-Center schools	TEI				
Train 60 teachers & heads from SDs	TEI				
Train 300 teachers in ICT Centers	ICT teachers				
Train 60 ICT teachers in ICT integration	TEI				
Train 285 school heads from minilab schools	TEI				
Train 285 ICT teachers from minilab schools	TEI				
Train 1,425 teachers from minilabs in basic ICT	ICT teachers				
Train 300 teachers from ICT Centers in ICT integration	ICT teachers				
Train 400 teachers & head teachers from SDs	TEI				

Activity	Who	Planning	Phase 1	Phase 2	Phase 3
Train 541 ICT teachers in ICT integration	TEI				
Train 256 school heads from minilab schools	TEI				
Train 256 ICT teachers from minilab schools	TEI				
Train 1,280 teachers from minilabs in basic ICT	ICT teachers				
Train 2,705 teachers from minilabs in ICT integration	ICT teachers				
Train 954 teachers & head teachers from SDs	TEIs				
Information management					
Analyze current information flows and processes	DIKPORA Papua				
Develop specification for information-management tools	DIKPORA Papua				
Contract developer and manage development	DIKPORA Papua				
Develop information-management tools & documentation	Vendor				
Develop training resources for school heads & DINAS personnel	DIKPORA Papua				
Integrate training resources into ICT Leadership and Basic ICT-SD	DIKPORA Papua				
Train DINAS personnel in 20 - 25 district	DIKPORA Papua				
Train DIKPORA Papua personnel as necessary	DIKPORA Papua				
Assess and revise tools, processes & training as necessary	DIKPORA Papua				
Learning resources					
Evaluate currently available Indonesian resources	BPP				
Develop learning-resource action plan	BPP				
Complete BPP staffing for learning resources	BPP				
Develop lesson plans, etc., for available Indonesian resources	BPP				
Disseminate resources and supporting materials	BPP				
Evaluate int'l resources for adoption and adaptation					
Develop collaboration-support resources (Web, etc.)	BPP				
Provide support to teachers & students for collaborative projects	BPP				
Develop support for int'l resources	BPP				
Disseminate int'l resources and support	BPP				
Develop Web contests and other motivational support	BPP				
Provide support for contests, homework helpdesk, etc	BPP				

Implementation Plan for ICT Infrastructure

A. Overview, Objectives and Expected Outcomes.

The **objective** of the five-year, three-phase roll-out of ICT infrastructure is to provide schools in Papua with an appropriate level of access to ICT, based on their specific needs and readiness.

At the school level, this entails: provision of school-based ICT infrastructure (computer equipment, Internet and/or email access) to support school management, teaching and learning.

At the administrative level, this entails: adoption and enforcement of standards for hardware, software and networking installations, as well as standardization of ICT procurement policies and practices. In addition, systematic maintenance and support policies will be developed and implemented, and adequately resourced.

Expected **outputs** are:

- Increased access to ICT for students, teachers and head teachers
- Increased impact of *ICT Centre di Sekolah* (ICT Centers) funded by PMPTK block grants
- Improved maintenance and support for ICT in schools, and
- Enhanced public-private cooperation in ICT implementation

The main expected **outcome** is the establishment of a sustainable platform for administering education at the provincial and district level, for dissemination of teaching and learning materials, and for developing new skills.

B. Activities to be supported

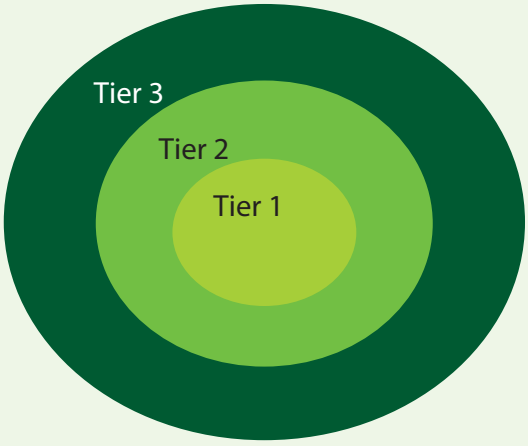
The following activities have been identified as being essential to the improvement of the quality of education and of school performance:

- Electronic submission–via email with attachment—of financial and performance reporting
- Online access to financial and performance data of the school, its district (*kabupaten*) and

sub-district (*kecamatan*) *ct*
- Online access to professional development programs, learning resources and Internet

C. Deployment Plan for ICT Infrastructure

As noted in Section 2 of the *ICT in Education Strategy,* implementation planning is based on classification of all schools—SMAs, SMKs, SMPs and SDs—into three "tiers" based on their relative accessibility. Cost estimates are based on schools' accessibility, bandwidth requirements and potential access to low-cost broadband Internet. Figure IX-1 shows the relation of Tier 1, Tier 2 and Tier 3 schools:



Tier 1 Schools. ICT Centers, ICT Minilabs, SD Stations

Location: In or very near coastal centers reached by the Palapa Ring

Internet access: Good connectivity (385 kbps – 20 Mbps), reasonably priced (RP 200,000/month; reliable electrical power

Tier 2 Schools. ICT Centers, ICT Minilabs, SD Stations

Location: Outside coastal centers but accessible by land or commercial air

Internet access, ICT Centers: Moderate connectivity (256 Kbps), but high priced (Rp 5-8 million/month; reliable electrical power

Internet access, all others: Limited connectivity (5-64 Kbps), at a moderate price (Rp. 1-1.5 million/month); possibly limited or no electrical power

Tier 3 Schools. ICT Minilabs, SDs

Location: Remote, access requires travel on difficult roads, by missionary plane or by foot

Internet access: Limited connectivity (5-64 Kbps), at a moderate price (Rp. 1-1.5 million/month); limited or no electrical power

This implementation plan emphasizes reinforcing the nationally funded establishment of 60 ICT Centers, enabling those that will serve as Centers for ICT access for teachers and for teachers' participation in formal professional-development activities.

The additional hardware (plus capacity building and other support) will enable the ICT Centers to be used by students as well as by teachers at appropriate times.

Schools will receive block grants for ICT Centers based on selection by the 20 DIKNAS District, with each district allotted three Centers. ICT Centers will receive funding for six laptops, one server, a VSAT (satellite) terminal and enhancement of electrical power. The deployment will be phased as shown in Table IX-1:

The "phase 4" deployment to remote SDs is shown as a point of reference for future planning.

Estimates of total cost for capital expenses, connectivity and technical assistance appear at the end of this section. Estimated costs per lab are based on :

Cost of ICT Installations. Costs for the proposed ICT installations are based on discussion with operators of Indonesian Internet cafes and other larger-scale purchasers of computer, networking and solar-power hardware.

Procurement of hardware to support use of ICT in schools will require tendering processes in conformance with government and donor regulations. The result of these processes should be favorable in relation to the estimates provided here.

Costs of installations used in budget estimates are presented here. Derivation of those costs appears in Annex C.

Table IX-1

Secondary Schools	Phase 1 number	Phase 2 number	Phase 3 number	Phase 4 number
Tier 1 (Coastal Centers)				
ICT Centers in SMAs	20	0	0	0
ICT Minilabs in SMAs and SMKs	0	73	0	0
ICT Minilabs in SMPs	0	50	58	0
Schools per phase (excluding SDs)	20	123	58	0
Tier 2 and Tier 3 (Outside of coastal centers)				
ICT Centers in SMAs	40	0	0	0
ICT Minilabs in SMAs and SMKs	0	82	0	0
ICT Minilabs in SMPs	0	80	198	0
Schools per phase (excluding SDs)	40	162	198	0
Teacher Education Institutions				
Multicampus (high speed/low-cost)	3	0	0	0
Multicampus (high-speed/high-cost)	5	0	0	0
Schools per phase	5	0	0	0
Primary Schools	**Phase 1 number**	**Phase 2 number**	**Phase 3 number**	**Phase 4 number**
Tier 1 (Coastal Centers)				
Tier 1 "package" for urban SDs	30	170	124	0
Schools per phase	30	170	124	0
Tier 2 (Near coastal/urban centers)				
Tier 2 "package" for peri-urban SDs with electricity	0	0	123	0
Schools per phase	0	0	123	0
Tier 3 (Remote / highlands)				
Tier 3 "package" for remote SDs	0	30	0	0
Tier 3 "package" Phase 2	0	0	0	0
Tier 3 "package" Phase 3	0	0	0	1,529
Schools per phase	0	30	0	1,529

- **ICT Center for TEI USD 28,000 / IDR 260,400,000**
  Lab of 20 PCs, plus VSAT and solar power
- **ICT Center for Tier 1 school USD 20,000 / IDR 186,000**
  Lab of 20 PCs, plus DSL networking, less PMPTK block grant
- **ICT Center for Tier 2 school USD 28,000 / IDR 260,400,000**
  Lab of 20 PCs, plus high-speed VSAT and solar power, less PMPTK block grant
- **ICT Minilab for Tier 1 school USD 10,500 / IDR 97,650,000**
  Lab of 10 PCs, plus DSL networking
- **ICT Minilab for Tier 2 or Tier 3 school USD 17,500 / IDR** 162,750,000
  Lab of 10 PCs, plus low-speed VSAT and solar power
- **SD Station, Tier 1 school USD 1,300 / IDR 12,090,000**
  One laptop plus DSL hardware
- **Station, Tier 2 USD 3,800 / IDR 35,340,000**
  One laptop, low-speed VSAT

- **SD Station, Tier 3 USD 7,000 / IDR 65,100,000**[17]
  One laptop, low-speed VSAT and solar power

Note that solar power is anticipated for all secondary-school installations outside of Tier 1, based on the requirements for significant and regular supplies of electricity. School-by-school assessment of needs and existing infrastructure must be undertaken as part of planning for any anticipated infrastructure roll-out.

Civil Works. Budget planning does not currently reflect the costs of civil works to improve school facilities prior to installation of ICT. Such activities might encompass electrical wiring, weather-proofing and ventilation, security measures and other items. Again, planning for these measures should be done on a school-by-school basis. DIKPORA Papua has collected at least a portion of the necessary information.

Connectivity Costs. Internet connectivity represents over 25 percent of operating costs over the course of the five-year program outlined in the *ICT in Education Strategy,* reaching over IDR 10 billion (USD 1 million) per year when schools are connected as planned.

Monthly connectivity costs per school used in budget estimates are presented here:

- **High-speed / low-cost (fibre-optic-based) USD 32 / IDR 300,000**
  Tier 1 school (TEI, ICT Center, Minilab, SD)
- **High-speed / high-cost USD 500 / IDR 4,650,000**
  TEI or ICT Centers outside of Tier 1 area
- **Low-speed / moderate-cost USD 100 / 930,000**
  ICT Minilab or SD Station

Connectivity prices reflect the assumption that DIKPORA Papua would purchase connectivity under a service-level agreement (SLA), and are based on responses from telecommunications providers (Telkom, IndoTel). The estimate for low-speed/low-cost connectivity (USD 100 / month) is available "at retail" in provinces other than Papua.

Maintenance and Support. First-line maintenance and support will be provided by local ICT teachers who have been appropriately trained, with assistance from local coordinators. Help-desk services (available via email and telephone) and additional maintenance and support will provided under one or more SLAs to appropriate vendors (either original equipment vendors or other service providers). Services will include:

- Remote support to the local staff
- Sending replacement units
- Dispatching an ICT specialist for troubleshooting
- Repair of faulty equipment

In part to reflect high travel and transportation costs in Papua, as well as the absence of local maintenance-service providers in most remote areas, maintenance costs are estimated at 10 percent of capital costs.

Initial research in Papua suggests that under such an agreement local vendors will be able to increase their capacity to meet the needs of schools in Papua. Several vendors in Papua currently provide remote support, which is critical in light of significant travel and transportation costs.

D. Financial Summary

This section summarizes both capital expenses and operating expenses for the infrastructure component of the Papua ICT in Education project. Estimates of capital expenses do not include possible cost reductions resulting from aggregate purchasing. The planned hardware deployment, including VSAT terminals, will have the potential to generate significant operating expenses for connectivity.

17 Costs of SD Stations are projected to diminish across phases 1 through 3, with phase 1 costs at USD 7,000, phase 2 costs at USD 6,500, and phase 3 costs at USD 6,000.

Table IX-2: Capital expenses for ICT infrastructure

Description	Cost/school (USD)	Cost/school (IDR)	Ph 1	Ph 1 subtotal	Ph 2	Ph 2 subtotal	Ph 3	Ph 3 subtotal
Tier 1								
ICT Centers in SMAs	$20,000	186,000,000	20	3,720,000,000	0	0	0	0
ICT Minilabs in SMAs and SMKs	$10,500	97,650,000	0	0	73	7,128,450,000	0	0
ICT Minilabs in SMPs	$10,500	97,650,000	0	0	50	4,882,500,000	58	5,663,700,000
SD ICT Stations (urban)	$1,300	12,090,000	30	362,700,000	170	2,055,300,000	124	1,499,160,000
Tier 1 subtotal schools			**50**	**4,082,700,000**	**293**	**14,066,250,000**	**182**	**7,162,860,000**
Tier 2								
ICT Centers in SMAs	$28,000	260,400,000	40	10,416,000,000	0	0	0	0
ICT Minilabs in SMAs and SMKs	$17,500	162,750,000	0	0	82	13,345,500,000	0	0
ICT Minilabs in SMPs	$17,500	162,750,000	0	0	80	13,020,000,000	198	32,224,500,000
SD ICT Stations (near-urban)	$3,800	35,340,000	0	0	0	0	123	4,346,820,000
Tier 2 subtotal schools			**40**	**10,416,000,000**	**162**	**26,365,000,000**	**321**	**36,671,320,000**
Tier 3 (remote)								
SD ICT Stations, phase 1	$7,000	65,100,000	0	0	30	1,953,000,000	0	0
SD ICT Stations, phase 2	$6,500	60,450,000	0	0	0	0	0	0
SD ICT Stations, phase 3	$6,000	55,800,000	0	0	0	0	0	0
Tier 3 subtotal schools			**0**	**0**	**30**	**1,963,000,000**	**0**	**0**
ICT Centers in TEIs	$28,000	260,400,000	5	1,302,000,000	0	0	0	0
Installation costs per phase				15,800,700,000		42,384,750,000		43,734,180,000
Maintenance factor (.1)				1,580,070,000		4,238,475,000		4,373,418,000
Subtotals per phase				17,380,770,000		46,623,225,000		48,107,598,000
Subtotals (USD)				USD 1,868,900		USD 5,013,250		USD 5,172,860
Total Capital Costs, ICT				**USD 10,959,100**				**IDR 43,367,403,000**

Table IX-3: Operational costs (Connectivity) of ICT Infrastructure

Schools	Description	Internet connection	Cost/ month (USD)	Cost/ month (IDR)	Ph 1	Ph 1/month	Ph 2	Ph 2/month	Ph 3	Ph 3 /month	
Tier 1	ICT Centers in SMAs	High speed / low cost	32	300,000	20	6,000,000	0	6,000,000	0	6,000,000	
	ICT Minilabs in SMAs and SMKs	High speed / low cost	32	300,000	0	0	73	21,900,000	0	21,900,000	
	ICT Minilabs in SMPs	High speed / low cost	32	300,000	0	0	50	15,000,000	58	32,400,000	
	Tier 1 "package" for urban SDs	High speed / low cost	32	300,000	30	9,000,000	170	60,000,000	124	97,200,000	
Tier 2	ICT Centers in SMAs	High speed / high cost	500	4,650,000	40	186,000,000	0	186,000,000	0	186,000,000	
	ICT Minilabs in SMAs and SMKs	Low speed / low cost	100	930,000	0	0	82	76,260,000	0	76,260,000	
	ICT Minilabs in SMPs	Low speed / low cost	100	930,000	0	0	80	74,400,000	198	258,540,000	
	Tier 2 "package" for peri-urban SDs	Low speed / low cost	100	930,000	0	0	0	0	123	114,390,000	
Tier 3	Tier 3 "Stations" for remote SDs	Low-speed / low cost	100	930,000	0	0	30	27,900,000	0	27,900,000	
TEIs	Multicampuses (Tier 2 & 3)	High speed / high cost	500	4,650,000	5	23,250,000	0	23,250,000	0	23,250,000	
	Multicampuses (Tier 1)	High speed / low cost	32	300,000	3	900,000	0	900,000	0	900,000	
	Per-month subtotals			*Tier 2 Schools. ICT Centers, ICT Minilabs, SD Stations Location: Outside coastal centers but accessible by land or commercial air*		*IDR 225,150,000*		*IDR 491,610,000*		*IDR 844,740,000*	**Total connectivity**
	Phase subtotals (IDR)				**Ph 1**	**IDR 4,052,700,000**	**Ph 2**	**IDR 8,848,980,000**	**Ph 3**	**IDR 20,273,760,000**	**IDR 33,175,440,000**
	Phase subtotals (USD)					**USD 435,774**		**USD 951,503**		**USD 2,179.974**	**USD 3,567,252**

E. Technical Assistance for ICT Infrastructure Deployment

In addition to equipment, substantial technical assistance will be required during project planning, procurement and installation, and as challenges emerge during the course of implementation. Estimate of technical assistance costs is based in part on the assumption that the highest need will occur during Phase 1, with less need during Phase 2 and Phase 3, as shown in Table IX-4. In addition, emphasis will shift to the extent possible to use of national consultants.

Activity	Item	Unit	Cost/unit	No.	Cost IDR	Cost USD
Phase 1	Int'l consultant, Technology	Month	167,400,000	6	1,004,400,000	108,000
	National consultants, Technology	Month	27,900,000	12	334,800,000	36,000
	Discretionary, int'l	Month	167,400,000	4	669,600,000	72,000
	Discretionary, nat'l	Month	27,900,000	6	167,400,000	18,000
	International travel	Phase subtotal	93,000,000	10	930,000,000	100,000
	Domestic travel	Phase subtotal	27,900,000	18	502,200,000	54,000
Subtotals, Phase 1					*IDR 3,608,400,000*	*USD 388,000*
Phase 2	Int'l consultant, Technology	Month	167,400,000	4	669,600,000	72,000
	National consultants, Technology	Month	27,900,000	10	279,000,000	30,000
	Discretionary, int'l	Month	167,400,000	2	334,800,000	36,000
	Discretionary, nat'l	Month	27,900,000	6	167,400,000	18,000
	International travel	Phase subtotal	93,000,000	6	558,000,000	40,000
	Domestic travel	Phase subtotal	27,900,000	16	446,400,000	48,000
Sub-total, Phase 2					*IDR 2,455,200,000*	*USD 264,000*
Phase 3	Int'l consultant, Technology	Month	167,400,000	2	334,800,000	36,000
	National consultants, Technology	Month	27,900,000	10	279,000,000	30,000
	Discretionary, int'l	Month	167400000	2	334,800,000	36,000
	Discretionary, nat'l	Month	27,900,000	6	167,400,000	18,000
	International travel	Phase subtotal	93,000,000	4	372,000,000	40,000
	Domestic travel	Phase subtotal	27,900,000	16	446,400,000	48,000
Sub-total, Phase 3					*IDR 1,934,400,000*	*USD 208,000*
				Total	**IDR 7,998,000,000**	**USD 860,000**
	Phase 1	**Phase 2**	**Phase 3**			
Subtotal, Int'l cons.	*2,604,000,000*	*1,562,400,000*	*1,041,600,000*		*IDR 5,208,000,000*	*USD 560,000*
Subtotal, Nat'l cons.	*1,004,400,000*	*446,720,000*	*892,800,000*		*IDR 2,790,000,000*	*USD 300,000*

Implementation Plan for Professional Development

A. Overview, Objectives and Expected Outcomes

The objectives of the proposed program in teacher professional development (TPD) are to:

- Develop appropriately skilled ICT teachers sufficient to meet the needs of Papuan schools
- Help to build an "information culture" and information-management skills among school heads and other education leaders
- Provide access and motivation to participate in ICT-focused professional development to all teachers in Papuan schools

The capacity-building program is expected to result in the:

- Development of a shared base of ICT skills and ICT-integration skills among teachers in SMA, SMK, SMP and some SD
- Development of one or more collections of effective learning resources with appropriate distribution mechanisms; and
- Effective use of ICT resources (learning materials, Internet, as well as equipment) by teachers and students in schools

B. Capacity-Building Programs

Professional Development of Teachers. Five major areas of need have been identified in terms of professional development. Each of these areas, currently, will be addressed through development of an instructional unit (40 to 120 hours of instruction). In several instances, these instructional units will be adapted for use in formal programs, such as those delivered at Teacher Education Institutions (TEIs), and in non-formal programs such as those delivered locally in secondary schools with ICT labs.

For each unit, the *Implementation Plan* assumes a certain number of participants in order to establish

goals and estimate costs. Participation rates and target audiences may of course be revised after consultations.

ICT and Support for ICT teachers. Proposed participants are: one ICT teacher per secondary school, including those that serve as ICT Centers and those that receive ICT labs.

Basic ICT skills for teachers. Proposed participants are: teachers from secondary schools (SMA, SMK, SMP and others). The current goal number assumes that the average faculty in secondary schools is 15 teachers, and that five teachers (or 33 percent) from each school will participate.

Basic ICT (SD version) for teachers and school leaders of SDs in remote areas. This program will be provided to one head teacher and one other teacher at all SDs, whether remote (Tier 3) or near coastal centers (Tier 1 and Tier 2).

ICT Integration for pre-service teachers, in-service teachers in skills-upgrade courses and ICT teachers. ICT integration[18] will be offered to ICT teachers and to pre-service teachers at TEIs, and at ICT Centers to teachers in schools with ICT minilabs.

ICT Leadership for school heads. This will be offered to all head teachers of secondary schools; installation of "Tier 3 stations" at SDs may be contingent on school heads participation in professional development.

Additional participants, for example from schools that have already acquired ICT facilities—can be added. Cost estimates will rise accordingly.

Regarding timing, TPD must be closely linked to the roll-out of ICT hardware and communications capacity. In addition, sequencing of capacity-building initiatives must provide time for participants to practice and consolidate skills that they have gained in training.

TPD will therefore also be implemented in three phases, and will involve provision of professional development in each program to the following number of participants:

Dissemination of ICT Integration. Although the integration of ICT into teaching and learning is a critical goal, on a system-wide level ICT integration is a goal appropriate to an advanced program. Formal participation in ICT integration will be supported by TEIs meeting the needs of pre-service teachers and in-service teachers.

TEIs will also host in-service ICT integration units for ICT teachers, approximately one year after those teachers have completed their initial ICT and Support course. ICT teachers will support dissemination of ICT-integration practices in their schools as teachers' readiness and demand warrants.

Planning for additional professional development supporting ICT integration, and possible introduction of new technologies (such as blogs or podcasts) can take place during Phase 3 if progress warrants.

BPP Staff. BPP staff will require a wide range of competencies, and in many instances different staff will require different competencies. Capacity building for BPP staff should address:

- ICT integration
- Instructional design
- Multimedia development and ICT resource management

If staffing allows, a specific professional-development module will be developed for BPP staff. Alternatively, individual BPP staff may be enrolled in appropriate training courses provided by Papuan TEIs and by universities and other organizations outside of Papua.

In addition, technical assistance to the BPP staff will be specifically designed to build capacity as well as to accomplish objectives in relation to the

18 "ICT integration" refers to a broadly defined set of pedagogical practices, in which ICT is used to support learning in many different school subjects, through use of computers, the Internet and other resources. ICT integration typically involves the use of computers by students, rather than by teachers demonstrating concepts or developing materials. While educational software may play a role in integrated use of ICT in schools, integration typically revolves around the use of many kinds of software, including productivity tools, and use of the Internet for communication, research and publishing

development and delivery of learning resources. For more information, refer to Section 4.5, "Learning Resources."

Capacity building for BPP staff may add costs to this program component or to the Learning Resources program component.

DINAS Staff. The programs proposed above do not address capacity building requirements for staff in DINAS District. Separate requirements, needs assessment and program design must be completed before such programs can be planned.

Capacity building for DINAS staff will add cost to this program component.

Pre-service and Skills-upgrade Students. The current plan does not fully factor in the costs and outputs of pre-service teacher education programs and in-service skills-upgrade programs now underway in Papua, though training programs outlined in this section are intended for use by such programs. Additional analysis of enrolment levels, curricula and the potential for cooperative integration of ICT programs into TEI-delivered courses is required.

Successful development of ICT teachers and new ICT-literate teachers by TEIs may reduce the costs of the capacity-building component.

Follow-up Support. Teachers participating in professional development will require follow-up support in the form of coaching and refreshers, at a minimum. For teachers in secondary schools, ICT teachers will be trained and available to provide support of this kind. Providing similar support to teachers in SDs may result in additional costs.

C. Course Delivery Approach and Institutions

"**Cascade" Model.** The key to cost-effective provision of professional development as proposed here is implementation of a modified "cascade" model: Teachers at hub schools (ICT Centers) receive intensive training at central locations or Teacher Education Institutions (TEIs) and then are deployed as trainers in their schools, district and subdisctrict; other teachers in the hub schools and surrounding areas are then trained locally, reducing staff, travel and other costs (per diem and accommodations).

By relying on three levels—TEIs, ICT Centers and schools themselves—to serve as sites for teacher training, all teachers in Papua can have access to professional development without undue cost.

The cascade approach generates a multiplier effect, and supports the MGMP / KKG framework in which teachers share expertise and experiences locally.

Depending on the phase and on scheduling of professional development (during school holidays or during the term), ICT teachers and other teachers who serve as part-time instructors for other schools should have their teaching duties in their own schools reduced.

TEIs will be relied on to develop ICT teachers—who will require the most comprehensive and the most technical level of instruction—and school heads. TEIs will also provide technology-focused instruction to pre-service teachers and to in-service teachers participating in skills-upgrade courses.

ICT Centers will be leveraged as hubs for professional development, with ICT teachers, skilled faculty (trained at TEIs), and other education professionals providing training to teachers from schools throughout their district.

ICT teachers in secondary schools with ICT labs will provide training and support primarily to teachers in their own schools and, as appropriate, to teachers at local SDs.

D. Financial Summary

Tables on the pages that follow present cost estimates for: operational costs of capacity building, as well as and costs of technical assistance and course development. **The following assumptions are used throughout this section to estimate costs:**

- **Incentives for participation**
  Teachers and other staff will require incentives for participation in professional development. Incentive levels are set at USD 75 per course.
- **Per diem reimbursement**
  Per diem reimbursement for accommodations, meals and incidental expenses is estimated at USD 124 per week. This rate is, however, lower than per-diem rates quoted by most respondents in Papua. In the estimates that follow, additional costs that can be paid directly by the program have been added (e.g., on-site lunches, local transportation), bringing the per diem estimate to USD 301 per week.
- **Travel**
  Reimbursement for round-trip travel within a district is set at USD 55. Reimbursement for round-trip travel requiring air travel to a central location such as Jayapura or Merauke is budgeted at USD 250.
- **Learning resources**
  The cost (including printing, storage and shipping) of resources used in professional-development programs is estimated at $25 per participant
- **Instruction and facilities, TEIs**
  Programs that are delivered at TEIs are budgeted at $500 per week of instruction for cost of the instructor and use of the facility.
- **Instruction and facilities, ICT Centers and secondary schools**
  Programs delivered at ICT Centers and at local secondary schools with ICT labs are budgeted at $150 per week of instruction for cost of the instructor and use of the facility.

Table X-1: Costs of ICT and Support course delivery

Item	Unit	Cost/unit (USD)	Cost/ unit (IDR)	No. Units	Phase 1 number	Phase 1 subtotal (IDR)	Phase 2 number	Phase 2 subtotal (IDR)	Phase 3 number	Phase 3 subtotal (IDR)s
ICT & Support										
Per diem	Week	$301	2,800,000	3	60	504,000,000	285	2,394,000,000	256	2,150,400,000
Travel	Round trip (Air to TEI)	$250	2,325,000	1	60	139,500,000	285	662,625,000	256	595,200,000
instructor / facility	Week (TEI)	$500	4,650,000	3	8	111,600,000	10	139,500,000	8	111,600,000
Materials	Learning resources (print/ digital)	$25	232,500	1	60	13,950,000	285	66,262,500	256	59,520,000
Subtotal, ICT & Support					Phase 1	769,050,000	Phase 2	3,262,387,500	Phase 3	2,916,720,000
Subtotal USD					Phase 1	82,694	Phase 2	350,794	Phase 3	313,626
								Total, ICT & Support (IDR)		6,948,157,500
								Total, ICT & Support (USD)		747,114

Table X-2: Costs of Basic ICT course delivery

Item	Unit	Cost per unit	Cost per unit (IDR)	No. Units	Phase 1 number	Phase 1 subtotal	Phase 2 number	Phase 2 subtotal	Phase 3 number	Phase 3 subtotal
Basic ICT										
Incentive	Course	$75	697,500	1	300	209,250,000	1,425	993,937,500	1,280	892,800,000
instructor / facility	Week	$150	930,000	3	60	167,400,000	120	334,800,000	180	167,400,000
Materials	Learning resources (print/ digital)	$25	232,500	1	300	69,750,000	1425	331,312,500	1,280	297,600,000
Travel	Round trip (within District)	$55	511,500	1	0	0	1425	728,887,500	1,280	654,720,000
Per diem	Week	$301	2,800,000	3	300	2,520,000,000	1425	11,970,000,000	1,280	10,752,000,000
Subtotal, Basic ICT (in-service)					Phase 1	2,966,400,000	Phase 2	14,358,937,500	Phase 3	12,764,520,000
Subtotal, USD					Phase 1	318,968	Phase 2	1,543,972	Phase 3	1,372,529
								Total, Basic ICT (IDR)		30,089,857,500
								Total, Basic ICT (USD)		1,576,529

Table X-3: Costs of ICT Integration delivery

Item	Unit	Cost per unit	Cost per unit (IDR)	Units per participant	Ph 1 no.	Ph 1 subtotal	Ph 2 no.	Ph 2 subtotal	Ph 3 no.	Ph 3 subtotal
ICT Integration										
Incentive	Course	$75	697,500	1	0	0	360	251,100,000	3,246	2,264,085,000
Per diem	Week	$301	2,800,000	1	0	0	360	1,008,000,000	3,246	9,088,800,000
Travel to ICT Center (Teachers)	Round trip within Kab	$55	511,500	1	0	0	0	0	2,705	1,383,607,500
Travel to TEI (ICT Teachers)	Round trip (Air to TEI)	$250	2,325,000	1	0	0	60	139,500,000	541	1,257,825,000
instructor / facility ICT Center	Total, ICT Teacher	$150	1,395,000	3	0	0	60	251,100,000	180	753,300,000
instructor / facility TEI	Week (TEI)	$500	4,650,000	3	0	0	3	41,850,000	10	139,500,000
Materials	Learning resources (print/digital)	$25	232,500	1	0	0	360	83,700,000	3,246	754,695,000
Subtotal, ICT Integration					Phase 1	0	Phase 2	1,775,250,000	Phase 3	15,641,812,500
Subtotal, USD					Phase 1	0	Phase 2	190,887	Phase 3	1,681,915
								Total, ICT Integration (IDR)		17,417,062,500
								Total, ICT Integration (USD)		1,872,802

Table X-4: Costs of ICT Leadership course delivery

Item	Unit	Cost per unit	Cost per unit (IDR)	Units per participant	Phase 1 number	Phase 1 subtotal	Phase 2 number	Phase 2 subtotal	Phase 3 number	Phase 3 subtotal
ICT Leadership										
Incentive	**Course**	$75	697,500	1	60	41,850,000	285	198,787,500	256	178,560,000
instructor / facility	**Week (TEI)**	$500	4,650,000	3	3	41,850,000	10	139,500,000	12	167,400,000
Materials	**Learning resources (print/ digital)**	$25	232,500	1	60	13,950,000	285	66,262,500	256	59,520,000
Travel	**Round trip (Air to TEI)**	$250	2,325,000	1	60	139,500,000	285	662,625,000	256	595,200,000
Per diem	**Week**	$301	2,800,000	3	60	504,000,000	285	2,394,000,000	256	2,150,400,000
Subtotal, In-service secondary teachers					Phase 1	741,150,000	Phase 2	3,461,175,000	Phase 3	3,151,080,000
Subtotal, USD					Phase 1	79,694	Phase 2	372,169	Phase 3	338,826
								Total, ICT Leadership (IDR)		2,305,005,000
								Total, ICT Leadership (USD)		107,600

Table X-5: Costs of Basic ICT-SD delivery

Item	Unit	Cost per unit	Cost per unit (IDR)	Units per participant	Phase 1 number	Phase 1 subtotal	Phase 2 number	Phase 2 subtotal	Phase 3 number	Phase 3 subtotal
Basic ICT (SD)										
Incentive	Course	$75	697,500	1	60	41,850,000	400	279,000,000	954	665,415,000
instructor / facility	Week (TEI)	$500	4,650,000	1	3	13,950,000	20	93,000,000	120	558,000,000
Materials	Learning resources (print/digital)	$25	232,500	1	60	13,950,000	400	93,000,000	954	221,805,000
Travel	Round trip (to TEI)	$250	2,325,000	1	60	139,500,000	400	930,000,000	954	2,218,050,000
Per diem	Week	$301	2,800,000	1	60	168,000,000	400	1,120,000,000	954	2,671,200,000
Subtotal, In-service secondary teachers					Phase 1	377,250,000	Phase 2	2,515,000,000	Phase 3	6,334,470,000
Subtotal, USD					Phase 1	40,565	Phase 2	270,430	Phase 3	681,126
								Total, Basic ICT [SD] (IDR)		5,267,520,000
								Total, Basic ICT [SD] (USD)		992,120

Table X-6: Costs of capacity building for TPD course development and delivery

Program	Item	Units	Unit cost (USD)	Ph 1 Units	Ph 1 Consultants	Ph 1 cost	Ph 2 Units	Ph 2 Consultants	Ph 2 cost	Ph 3 Units	Ph 3 Consultants	Ph 3 cost	Cost (IDR)
ICT & Support													
Personnel	Nat'l consultants	Month	3,000	12	5	180,000	6	3	54,000	0	0	0	2,176,200,000
	Int'l consultant	Month	18,000	3	1	54,000	1	1	18,000	1	1	18,000	837,000,000
	Nat'l travel	Trip	2,000	2	5	20,000	18	1	36,000	0	0	0	520,800,000
	Int'l travel	Trip	7,500	6	1	45,000	1	1	7,500	1	1	7,500	558,000,000
Subtotals						299,000			115,500			25,500	4,092,000,000
											Total	440,000	4,092,000,000
Basic ICT													
Personnel	Nat'l consultants	Month	3,000	12	1	36,000	1	1	3,000	1	1	3,000	390,600,000
	Int'l consultant	Month	18,000	1	1	18,000	0	0	0	0	0	0	167,400,000
	Nat'l travel	Trip	2,000	6	1	12,000	1	1	2,000	1	1	2,000	148,800,000
	Int'l travel	Trip	7,500	1	1	7,500	0	0	0	0	0	0	69,750,000
Subtotals						73,500			5,000			5,000	776,550,000
											Total	83,500	776,550,000
ICT Integration													
Personnel	Nat'l consultants	Month	3,000	6	2	36,000	12	5	180,000	3	1	9,000	2,092,500,000
	Int'l consultant	Month	18,000	4	1	72,000	3	1	54,000	1	1	18,000	1,339,200,000
	Nat'l travel	Trip	2,000	4	5	40,000	6	3	36,000	1	1	36,000	1,041,600,000
	Int'l travel	Trip	7,500	3	1	22,500	1	1	7,500	0	0	0	279,000,000
Subtotals						170,500			277,500			63,000	4,752,300,000
											Total	511,000	4,752,300,000

Program	Item	Units	Unit cost (USD)	Ph 1 Units	Ph 1 Consultants	Ph 1 cost	Ph 2 Units	Ph 2 Consultants	Ph 2 cost	Ph 3 Units	Ph 3 Consultants	Ph 3 cost	Cost (IDR)
Basic ICT (SD)													
Personnel	Nat'l consultants	Month	3,000	6	1	18,000	0	0	0	0	0	0	167,400,000
	Int'l consultant	Month	18,000	1	1	18,000	0	0	0	0	0	0	167,400,000
	Nat'l travel	Trip	2,000	3	1	6,000	0	0	0	0	0	0	55,800,000
	Int'l travel	Trip	7,500	3	1	22,500	0	0	0	0	0	0	209,250,000
Subtotals						64,500			0			0	599,850,000
											Total	64,500	599,850,000
ICT Leadership													
Personnel	Nat'l consultants	Month	3,000	3	3	27,000	3	3	27,000	0	0	0	502,200,000
	Int'l consultant	Month	18,000	3	1	54,000	1	1	18,000	1	1	18,000	837,000,000
	Nat'l travel	Trip	2,000	4	5	40,000	1	1	2,000	0	0	0	390,600,000
	Int'l travel	Trip	7,500	3	1	22,500	1	1	7,500	1	1	7,500	348,750,000
Subtotals						143,500			54,500			25,500	2,078,550,000
											Total	223,500	2,078,550,000
Totals												**USD 1,322,500**	**IDR 12,299,250,000**

Total Costs. The Table X-7 outlines operational costs and technical assistance costs for teacher professional development.

Operations costs	IDR	USD
Phase 1	4,853,550,000	521,914
Phase 2	25,372,750,000	2,728,253
Phase 3	40,808,602,500	4,388,022
Total lab costs	71,035,202,500	7,638,194
Technical Assistance		
Phase 1	6,984,300,000	751,000
Phase 2	4,208,250,000	452,500
Phase 3	1,106,700,000	119,000
Total technical assistance costs	12,299,250,000	1,322,500
Total costs, TPD	**IDR 83,334,452,500**	**USD 8,960,694**

Implementation Plan for Education and Financial Management

A. Overview, Objectives and Expected Outcomes

The objectives of the education and financial management component are to: increase participation in education and financial management at the school and district levels; increase the availability and value of information about school administration for all stakeholders; and to help Papuan schools prepare for participation in future education management information systems (EMIS) and financial MIS programs.

The proposed outputs are:

- Simple, easy-to-use ICT-based reporting tools for schools
- Simple, easy-to-use tools for aggregating and managing school reports and information electronically at DINAS *district*
- Professional development resources and instructional units addressing information management and the use of the program's ICT tools at the school, district and provincial levels

The development process for reporting tools and database will encompass establishing requirements and specifications, issuing Requests for Proposals (RFPs), procurement, customization, testing and other activities. In the first instance, simple. Excel-based reporting will likely meet the current needs of the Papuan education system; if more complex tools are necessary, custom software or database development should be avoided in favor of commercially developed and tested products.

Prospective outcomes include:

- Provision of professional development addressing information management to all school heads, DINAS *district* directors, and appropriate district-level staff
- Provision of ICT resources enabling electronic reporting at all schools
- Provision of ICT resources enabling collection, aggregation and management of education and financial information at all DINAS *district*

The expected impact of these measures on management in the education system of Papua depends on many factors. Levels of participation in

reporting and the quality of information reported will very likely improve. However the degree of improvement will depend on factors such as: effective project management and implementation; convergence of provincial information-management requirements and practical school-level information-management tools, and; outreach to school heads, a commitment to sharing information, and other building blocks of a "culture of information management." Of these and other factors, the last is most important.

B. Development and Implementation

All development of management systems for financial and education information will take place in Phase 1. The development timeline will require roughly one year (11 months currently projected). Every effort should be made to coordinate integration of information-management instruction into professional development for school heads and appropriate *district* staff. It is recommended that information-management tools and resources be kept as simple and as easy-to-use as possible. While emphasis on simplicity should not be seen as a short-cut, simple designs will support cost-effective and timely development. Development and implementation of financial and education information-management tools and resources will involve the following broad activities and sub-activities:

- **Scoping and design (2 months)**
  - Establish a minimum set of educational and financial data to meet needs and interests of stakeholders in the education system
  - Review current school-level EMIS programs in Indonesia
  - Develop specification for the simplest possible reporting tools for school and DINAS district
  - Design business processes[19] for information management based on school, district, and provincial input
- **Procurement (2 months)**
  - Issue Request For Proposals[20]
  - Issue a contract for development and support after competitive selection
- **Development and testing (4 months)**
  - Develop information-management tools for school and DINAS *district* use (working with vendor)
  - Test and revise tools and reporting processes in schools and DINAS *district* (working with vendor)
  - Integrate into provincial-level DBMS and existing back-office processes
  - Complete integration and testing of school-, district- and provincial-level tools
- **Integration into capacity-building and other programs (3 months)**
  - Develop and test professional-development materials for school leadership programs, and for DINAS *district* staff
  - Orient and build capacity of staff of TEIs with regard to program objectives, resources and course materials
  - Orient and train appropriate staff of DIKPORA Papua with regard to project status and processes
- **Launch and roll-out (1 month)**
  - Roll-out of information-management processes and tools will follow capacity building and infrastructure roll-outs in the ICT Centers and Tier 3 schools. Additional roll-out activities include:
  - Outreach and enlistment of school heads and district staff in appropriate schools (to be repeated in Phases 1, 2 and 3)
- **Management and oversight (ongoing)** by an appropriate department within DIKPORA Papua.[21]

19 "Business processes" refers to activities—in this case school reporting and information management—that are analyzed and understood in terms of how key tasks get done (as opposed to what these tasks produce) and from the points of view of all stakeholders in the activities.

20 Procurement and customization, with vendor support, is generally preferable to development of new software tools. Possible processes, to be finalized after completion of a specification and requirement, include: Contracting an existing international vendor of education-management tools for customization and support, and; contracting a local software developer for custom tool development and support; contracting customization and integration of open-source and freeware solutions. In any case, both international and local vendors should be invited to participate.

21 DIKPORA Papua may incur additional costs related to activities such as: participation by school and district staff in scoping and design activities; tendering and procurement; additional management and administrative costs.

C. Costs, information management

The Table XI-1 outlines operations and technical assistance costs for the program's information-management component.

Operations costs		
Sub-total, Phase 1	IDR 46,500,000	USD 5,000
Sub-total, Phase 2	IDR 13,950,000	USD 1,500
Sub-total, Phase 3	IDR 9,300,000	USD 1,000
Subtotal, Operations	**IDR 69,750,000**	**USD 7,500**
Technical Assistance		
Sub-total, Phase 1	IDR 2,544,875,250	USD 273,643
Sub-total, Phase 2	IDR 763,462,575	USD 82,093
Sub-total, Phase 3	IDR 508,975,050	USD 54,729
Subtotal, T.A.	IDR 3,817,312,875	USD 410,465
Total, Information management		
Sub-total, Phase 1	IDR 2,591,375,250	USD 278,643
Sub-total, Phase 2	IDR 777,412,575	USD 83,593
Sub-total, Phase 3	IDR 518,275,050	USD 55,729
Total costs, information mgment	**IDR 3,887,062,875**	**USD 417,965**

Implementation Plan for Learning Resources Development

A. Overview, Objectives and Expected Outcomes

The final program component in the Papua ICT in Education Project Centers on increasing support provided by DIKPORA Papua for the distribution and effective use of learning resources for use by teachers and students. The chief point of focus for inputs in this project component is the Balai Pengembangan Pendidikan (BPP), housed within DIKPORA Papua. This agency at present includes small facilities for ICT training, multimedia development, and video production. Plans call for establishment of a "Learning Resources Development Center" within BPP.

Three MONE initiatives currently make digital learning resources available to Papuan schools: TV-edukasi, edukasi.net and dikmenjur.net. The effectiveness of these initiatives is limited by barriers to access in schools and by lack of supporting materials, along with other factors.

Objectives for this project component are to

- Increase schools' access to digital resources for students and teachers
- Increase the positive impact of currently available digital resources on teaching and learning
- Increase capacity within DIKPORA Papua to design, develop and support teaching and learning resources

This component benefits significantly from activities in the development of ICT infrastructure and capacity building.

Outputs of activities undertaken to meet the above objectives include:

- Action plan for learning-resource development, distribution and support
- Provision of Internet-based multicasting service or hardware for BPP
- Series of classroom-ready teacher-support materials for TV-e, edukasi.net and dikmenjur.

net resources
- One or more Web-based collaboration environment for teachers
- Development of a "multicasting" capacity within BPP.

Learning resources—when they are accessible, relevant and effective—are important factors in terms of the kinds of teaching and learning activities that take place in schools, and in terms of the effectiveness of those activities. Potential outcomes of increased access to learning resources and improved support for their use in classrooms include:

- Increased and more effective use of available resources
- Wider variation in classroom teaching and learning activities
- Improved student learning outcomes in relation to national assessments

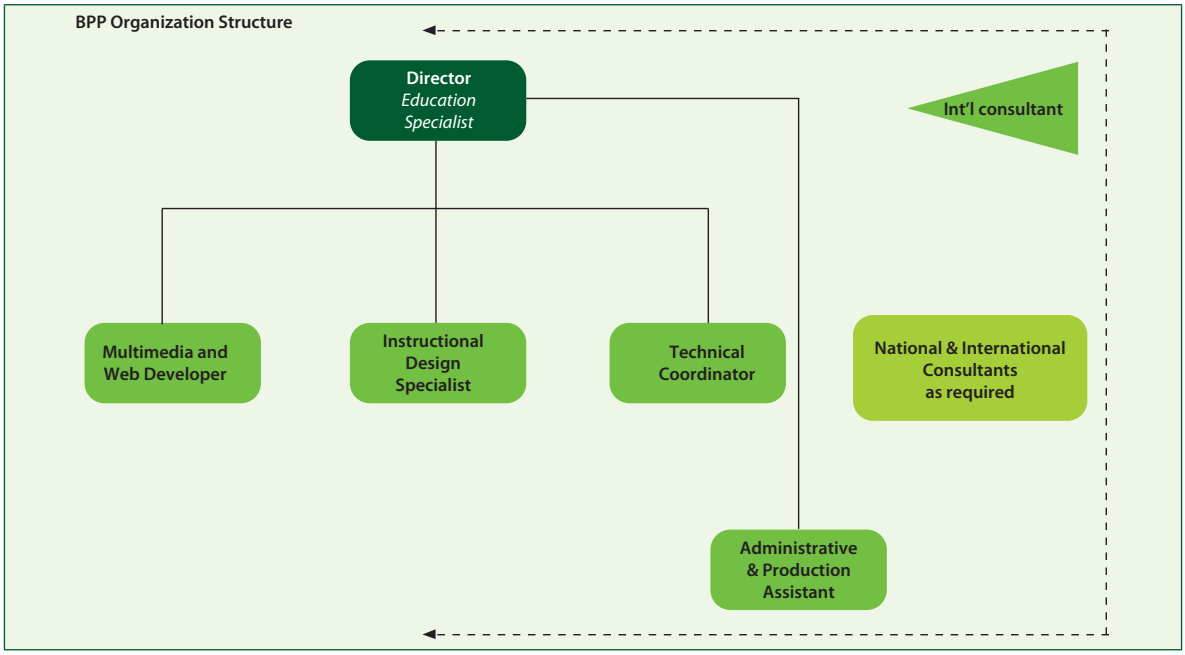
Although content will be developed for access on the Internet, all BPP activities and outputs will be designed to be appropriate for the range of ICT installations in Papuan schools. Web-based content may be disseminated on DVD or via multicast, depending on the progress of hardware installations in schools, completion of the Palapa Ring, and intended uses and audiences.

B. Development and Implementation

The focal point for all activities in this project component is the BPP. BPP staff will participate in professional development and will undertake the development of supporting resources and of Web-based "environments" for teachers. In addition, the BPP will gain the ability to effectively disseminate learning resources via the Internet to Papuan schools with all levels of connectivity.

Staffing. To make the BPP an effective agency for both development and dissemination of learning resources, additional staff may be required. Suggested staffing for the BPP emphasizes the need to combine effective management, educational expertise, and technical expertise.

Close review of current BPP staffing and operations is required, however a proposed staffing model for the BPP during Phase 1 is per Figure XII-1:



As BPP develops and as the project as a whole progresses, additional staff may be required.

- **Director**
  The BPP director will plan and manage all of the unit's activities, and will be responsible for ensuring the quality and accessibility of BPP resources
- **Multimedia and Web Developer**
  The multimedia and web developer will serve as a "hands-on" developer of resources to be distributed via DVD, and the developer of Web- and e-mail based collaboration environments for teachers and students.
- **Instructional Design Specialist**
  The specialist in instructional design will be (with the BPP Director) the primary designer of all activities and resources, such as classroom activities and support for TV-e materials and collaborative projects for students. This position will also require technical skills.
- **Technical Coordinator**
  The BPP technical coordinator will support the activities of other staff, and manage resource multicasting, Web sites, and other means of communicating with and supporting teachers.
- **Administrative and Production Assistant**
  This position will support administration of the BPP and also coordination of content development and publishing. Outside entities may be involved in any aspect of BPP resource development and distribution.

Additional analysis is required to determine how this proposed model intersects current staffing of BPP, and constraints, objectives and other factors affect staffing decisions made by DIKPORA Papua.

Multicasting. Estimates of the cost of providing multicasting capacity should be considered provisional. Multicasting costs vary greatly based on volume and other considerations, including vendor pricing models and whether multicasting is included in bulk connectivity pricing provided under an SLA. More accurate estimates can be acquired through research and direct communication with vendors. The estimates provided in the summary are loosely based on fees associated with the Kencast multicasting package.

Design Decisions About Multicasting Capacity. Overall design of the Papua ICT in Education Project may rely on multicasting to a degree that suggests that the multicasting service (or hardware) should be managed by DIKPORA Papua rather than the BPP. If, for example, multicasting is regularly required to support teachers' professional development and to support information management in schools, multicasting capacity and costs will need to be shared with these program components.

Working with Outside Entities. The BPP will draw on contributions from specialists, other units in DIKPORA Papua, national education agencies, and others. Such contributions might include content developed by specialists in a subject area (e.g., biology, physics, literature), licensing of video or audio content, and other forms. Agencies such as PUSTEKKOM may be asked (or contracted) to revise materials to better support their distribution to and use in Papuan schools.

Technical Assistance. Throughout the course of the Papua ICT in Education Project, BPP staff will benefit from technical assistance provided by national and international consultants. The BPP will be called on to provide a wide range of services; technical assistance should be available for any of these as needed. Technical assistance might be provided for activities such as:

- Developing the BPP action plan for learning-resource support
- Evaluating available learning resources
- Developing and implementing strategies to support use of specific resources
- Planning and implementing system-wide resource distribution
- Instructional design and development of new resources

National and international consultants will provide technical assistance to BPP staff in these and other areas. Discretionary budget will be allocated, enabling BPP to focus technical assistance on areas of immediate need.

BPP Development Plan. DIKPORA Papua and the BPP have released a BPP Master Plan. This project component does not address costs or objectives identified in that plan.

Learning-resource Design and Distribution Methods. As discussed in the *Strategy* section, development and dissemination of learning resources will rely on three critical practices to ensure that resources are accessible, easily used, and effective:

- Simplicity of design:
  Learning resources will include lesson plans and localizations of national curricula to ensure that they can be used by the widest range of teachers
- Web-based support:
  Web sites will be used to help connect teachers and students for email-based projects, contests and other support for collaborative learning
- Redundant distribution:
  In addition to Web sites requiring real-time access to the Internet, learning resources will be distributed through multicasting, email and other means appropriate to low-bandwidth environments

Action Plan for Learning Resources. A detailed action plan for the distribution, support and development of learning resources will comprise the first major project output developed by BPP staff. The action plan will specify broad objectives to be achieved over the course of the five-year project, and will detail Phase 1 activities.

An initial overview of BPP activities appears on the following page.

	Phase 1	Phase 2	Phase 3
Planning and management	• Develop action plan for learning resources • Complete staffing requirements for BPP	• Revise action plan based on project needs • Revise staffing based on action plan	• Revise action plan based on project needs • Revise staffing based on action plan • Develop plans for sustainable, long-term operation (in collaboration with DIKPORA Papua leadership)
Technical	• Procure multicasting capacity for learning resources • Develop, test, and refine multicasting processes	• Multicast learning-resource support materials and other content t • Support development and launch of Web-based environments	• Continue multicasting of learning resources • Continue support of Web-based tools • Expand services based on need and capacity
Learning-resource support	• Build in-house capacity • Assess teacher and student needs • Evaluate available electronic learning resources • Begin development of support materials	• Continue development of support materials • Integrate support-material units into teacher PD • Design collaborative, contests and other activities and resources for BPP Web sites	• Continue development of support materials • Continue contests and other Web-based activities • Begin localization and enhancement of electronic learning resources

Web, print and multimedia	• Begin design and development of Web-based support environments (later in Phase 1) • Support development of learning-resource support materials	• Launch Web-based support environments • Continue support for learning-resource support materials	• Continue development of new Web-based support resources • Continue support for learning-resource support materials • Begin localization and/or development of new multimedia resources

C. Financial Summary

Financial information for the learning-resource project component currently includes only estimated costs of technical assistance and of multicasting. *DIKPORA Papua will incur increased staffing costs should additional hiring be needed.* Costs assume that Phase 1 and Phase 2 are 18 months each; Phase 3 is 24 months. Estimates for software licensing fees, which are priced on a per-year basis, have been adjusted to reflect the duration of each phase. The estimated levels of effort for international consultants are projected as being high in Phase 1, decreasing in Phase 2, and remaining roughly constant in Phase 3, which is 24 months rather than 18. Table XII-1 presents details of this estimate:

Phase 1						
Technical Assistance, Capacity assessment						
Technical assistance	National consultant	Month	3,000	1	3,000	27,900,000
	International consultant	Month	18,000	0.5	9,000	83,700,000
Travel and other costs	Int'l travel	Trip	7,500	2	15,000	139,500,000
	National travel	Trip	1,000	2	2,000	18,600,000
Sub-total, BPP assessment					USD 29,000	IDR 269,700,000
Technical Assistance, Planning & staffing						
	Int'l consultant	Month	18,000	2	36,000	334,800,000
	National consultant	Month	3,000	4	12,000	111,600,000
	National travel	Phase subtotal	5,000	1	5,000	46,500,000
	Hiring costs	Phase subtotal	15,000	1	15,000	139,500,000
Subtotal, Planning					USD 68,000	IDR 632,400,000
Technical Assistance						
	Int'l consultant	Month	18,000	6	108,000	1,004,400,000
	National consultant	Month	3,000	8	24,000	223,200,000
	International travel	Phase subtotal	22,500	1	22,500	209,250,000
	National travel	Phase subtotal	15,000	1	15,000	139,500,000
Subtotal, General T.A.					USD 169,500	IDR 1,576,350,000
Subtotal, Ph 1 T.A.					USD 266,500	IDR 2,478,450,000
Multicasting service						
	Server	Server PC	2,000	1	2,000	18,600,000
	Client software licensing, Phase 1	Client/year	100	95	19,000	176,700,000
Subtotal, Multicasting Phase 1					USD 21,000	IDR 195,300,000

Sub-total, Phase 1					USD 287,500	IDR 2,673,750,000
Phase 2						
Technical Assistance.						
	Int'l consultant	Month	18,000	4	72,000	669,600,000
	National consultant	Month	3,000	6	18,000	167,400,000
	International travel	Phase subtotal	15,000	1	15,000	139,500,000
	National travel	Phase subtotal	15,000	1	15,000	139,500,000
Subtotal, Phase 2 T.A.					USD 120,000	IDR 1,116,000,000
Multicasting service						
	Software licensing	Client/year	100	742	111,300	1,035,090,000
	Service fee	Contract / year	1,500	1	2,250	20,925,000
Subtotal, Multicasting					USD 113,550	IDR 1,056,015,000
Subtotal, Phase 2					USD 233,550	IDR 2,172,015,000
Phase 3						
Technical Assistance						
	Int'l consultant	Month	18,000	4	72,000	669,600,000
	National consultant	Month	3,000	6	18,000	167,400,000
	International travel	Phase subtotal	15,000	1	15,000	139,500,000
	National travel	Phase subtotal	15,000	1	15,000	139,500,000
Subtotal, Phase 3					USD 120,000	IDR 1,116,000,000
Multicasting capacity						
	Client software licensing, Phase 3	Client/year	100	1,245	186,750	1,736,775,000
	Multicast software service fee	Contract / year	1,500	1	3,000	27,900,000
Subtotal, Multicasting Phase 3					USD 189,750	IDR 1,764,675,000
Sub-total, Phase 3					USD 309,750	IDR 2,880,675,000
Total, Learning resources					**USD 830,800**	**IDR 7,726,440,000**
Technical Assistance costs						
Personnel					372,000	3,459,600,000
Travel					134,500	1,250,850,000

Program Management

Subtotal, T.A.				*506,500*	*4,710,450,000*
Multicasting costs					
Licensing and service				322,300	2,997,390,000
Subtotal, Multicasting				*322,300*	*2,997,390,000*

A. Overview and Objectives

Development and implementation of large-scale technology and capacity-building projects, especially those relying on several sources and modes of funding, requires intensive management. The unfamiliarity of many Papuan teachers with ICT, coupled with geographic isolation and challenges to communication and oversight, suggest that coordination and support should extend to the local level.

This section outlines one approach to ensuring that DIKPORA Papua has both capacity and resources to provide the level of management necessary.

Effective program management has as its baseline objective providing effective planning and management to all program components. Management should extend to budget forecasting and financial management and coordination with relevant provincial agencies and program funders.

In addition, the process of managing the program currently proposed should have as a projected outcome the development of increased management capacity, including capacity specifically related to technology projects, within DIKPORA Papua.

B. Needs Assessment and Analysis

First steps in relation to program management must involve assessment of current management capacity within DIKPORA Papua. Areas to be assessed should include: staff levels and hiring practices, budget forecasting and financial management, procurement processes, knowledge and experience in technology

projects, implementation management, and leadership and organizational structure

At this stage in the planning process, the appropriate management structure in relation to the organization of DIKPORA Papua is not known. Factors influencing design of a management component include capacity and availability of management staff, current organizational structures and levels of cooperation and coordination with other provincial and national government agencies and departments.

Establishing Program Management Within DIKPORA Papua. The approach outlined here is the establishment of a Program Management support facility within DIKPORA Papua. Current program-management capacity within DIKPORA Papua is likely to require additional staff and resources to manage and implement the program described above. In addition, development of management capacity for ICT projects in DIKPORA Papua will be desirable over the long term.

Locating program-management responsibility within DIKPORA Papua, but augmenting current capacity through additional hiring and through technical assistance, is projected to be the most cost-effective approach to long-term management of the program described in the *ICT in Education Strategy* and of the technology assets distributed to schools, and of any "next-generation" technology projects that emerge as offshoots of these efforts.

BPP. Respondents have suggested that BPP is the appropriate organization within DIKPORA Papua to take on program management. Communication with BPP leadership supports this suggestion, although further assessment and planning is required.

Program Management Organization. The proposed facility will rely on a structure in which three "leads" assume responsibility for key areas of focus within the program. The roles and responsibilities of these leads will expand as the proposed program transitions from planning and development to early implementation to larger-scale implementation. The three areas of responsibility are: Education initiatives, Technology initiatives, and Management initiatives

A Program Director, reporting to the director of DIKPORA Papua, will oversee the activities of the three leads. A Deputy Director (Finance and Administration) will provide budget planning and financial-management services.

During Phase 2 and Phase 3 of the program, program-management staff will be expanded as appropriate to support all program components within the three areas of focus.

Technical Assistance. The organizational structure is intended to emphasize regular and on-demand access to technical assistance for the Program Director, the Deputy Director, leads of each of the three focal areas. As appropriate, technical assistance will support on-the-job performance while building management skills and sector-specific knowledge in areas of: planning and management; formalisation of partnerships and service agreements, and plans for specific components

Consultants may further advise on relations with specific vendors, partners and other stakeholders, and in relation to the outputs and activities of specific initiatives, such as capacity building for ICT teachers or integration of ICT-enabled school-management processes with provincial reporting. Such consultants might include Papua-based experts and expert staff based elsewhere in Indonesia (e.g., at UPI Bandung or UT).

C. Advisory Board

Because success of a Papua ICT in Education Program will depend on support from provincial and national government agencies, development partners, and on school- and district-level staff, an Advisory Board should be formed.

Advisory Board members will represent their respective agencies and organizations. In this capacity, they will guide the development of MOUs, ensure that the interests, policies and processes of their organizations are adequately addressed, and facilitate interactions between their organizations, DIKPORA Papua leadership, the program director and deputy director.

The Advisory Board will be comprised of representatives of stakeholder organizations, plus one or more head teachers, teachers and district staff. Government representatives should be drawn from the highest levels possible in their organizations. The Advisory Board will receive periodic program reports per their own reporting requirements and general good practice. Selected members will be asked to review program plans and designs, or specific aspects of initiatives or policies.

D. Program Management Structure, Phase 1

The organizational structure for program management will be determined based on discussion with DIKPORA Papua. Discussion will also clarify hiring needs and the availability and capacity of available department staff.

A proposed structure appears on the next page.

Emphasis on Technical Assistance. The organizational structure is intended to emphasize regular and on-demand access to technical assistance for the Program Director, the Deputy Director (Finance and Administration) and for coordinators of each program component. For coordinators, technical assistance will be intended to support on-the-job performance while building management skills and sector-specific knowledge.

During Phases 2 and 3 of the program, coordinators will take on responsibility for larger teams.

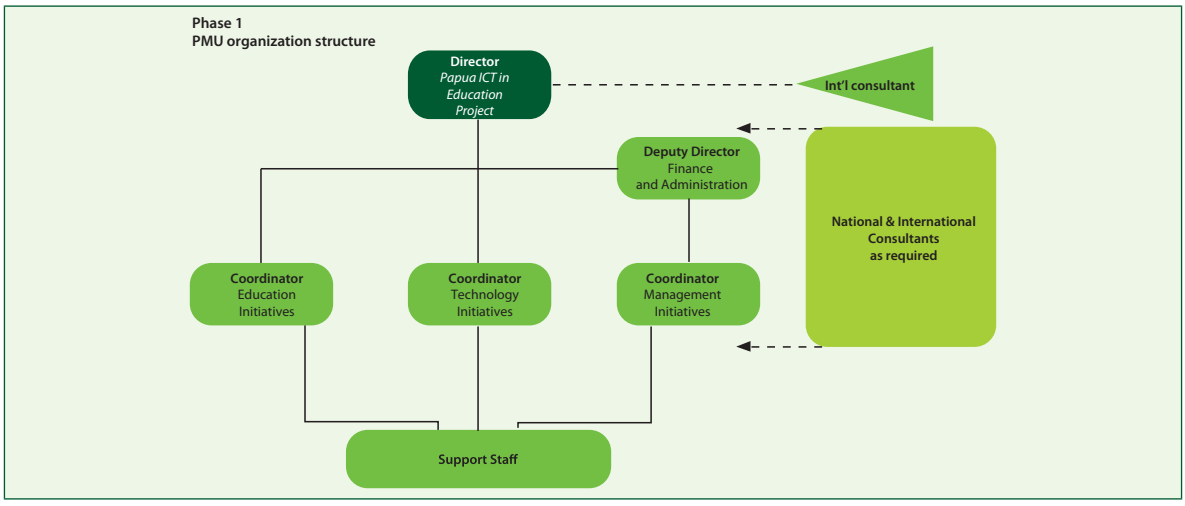
Support for Program Components. Coordinators will support each of the main program components. Depending on their field, coordinators will be required to work closely with both outside agencies and with the private sector. Coordination will include responsibility for activities in areas such as:

- Vendor-provided technical support and maintenance services
- Vendor-provided teacher professional development
- School- and district-level reporting
- Monitoring and evaluation activities

These and other areas and activities may be provided wholly or in part by outside agencies. Establishing (and supporting) single points of contact for large-scale program-oriented activities is essential for effective program management and for smooth implementation.

Specific program activities, such as technology Help Desk services, may require direct communication between school staff and service providers. Activities such as maintenance requests or enrolling in professional development may be most efficient when systems are in place to enable teachers to communicate directly with service providers. However in those instances, oversight by coordinators will ensure accountability.

Roles and Responsibilities. Program-management



staff will have the following broadly described responsibilities:

- **Program Director**
  The program director will participate in program design and implementation planning. Over the course of the three-phase implementation, the program director will assume management responsibility for all program activities and for ensuring that vendors and government agencies are accountable for services that they have agreed to provide. In addition to oversee program-management staff, the program director will also:
  - Report to Director, DIKPORA, on all program components and activities
  - Report periodically to the Advisory Board (in coordination with Director, DIKPORA)
  - Interact with director-level staff, and higher, at national and provincial agencies involved in the program
  - Serve as a strong "advocate" for the program through reports, presentations and meetings, and by serving as a main point of contact for media

- **Deputy Director, Finance and Administration**
  The Deputy Director will assume specific responsibility for financial management, accounting and reporting. The nature of this responsibility will be determined by consultation with DIKPORA Papua and as a result of the requirements of donor funding vehicles for disbursement, fiduciary management, reporting and related activities.

  The Deputy Director will also manage the Coordinator of Management Initiatives to ensure that the program's resources, capacity building and reporting processes remain aligned with provincial and national information-management processes as these evolve.

- **Coordinator, Education Initiatives**
  The Coordinator for Education Activities will assume responsibility for all program activities directly related to teacher development, learning resources and student learning. Initial program activities will include development and delivery of capacity building and localization of learning resources. Phase 2 activities will expand to include development of new learning resources. The Coordinator for Education Activities will work with TEIs, BPP and other organizations involved in teacher professional development and the development of teaching and learning resources. At the point at which the program addresses curriculum and assessment issues, the coordinator of teacher and student education will have responsibility for these activities as well.

- **Coordinator, Technology Initiatives**
  The Coordinator of Technology Initiatives will oversee all technology-related operations initiated or supported by the program. The range of such activities might include development of a hardware specification and of agreements for bulk purchases from vendors, monitoring of technical support and maintenance services, communication with ICT teachers in schools, software reviews and updates, and development and maintenance of Web sites, among others.

- **Coordinator, Management Initiatives**
  The Coordinator of Management Initiatives will assume day-to-day responsibility for the program component in education and financial management. The nature of this responsibility will be determined in part by the Deputy Director, however activities might include monitoring of participation by program schools, communication with other provincial stakeholders in school management, on-demand support for school heads and district staff, and revisions to and dissemination of resources and instructional materials, among others.

- **Support Staff**
  Support staff will very likely include an executive assistant (reporting to the program director), an administrative assistant (reporting to the Deputy Director but supporting coordinators as well) and others. Roles, management and staffing levels of support will be determined in conjunction with DIKPORA Papua.

E. Program Management Structure, Phases 2 and 3

The management structure will evolve over the course of the program to accommodate the increased scale of the initiatives and activities, and as appropriate to support the transition strategy of DIKPORA in relation to the end of the initial disbursement of donor support.

During phase 2 and phase 3, the number of schools, teachers and students served by the program will expand significantly. This expansion will increase demands on management and coordination in areas such as:

- Use of ICT Centers to provide training to teachers
- Technical support and maintenance for schools in remote areas
- Monitoring of teacher-development programs at TEIs

As these and other activities increase in scale, additional staffing will be required for program management.

F. Regional and Local Coordination

Successful implementation depends on direct coordination and support in schools: teachers will require encouragement and oversight to participate in training, ICT teachers will require assistance in their roles as trainers and coaches, schools overall will require support in solving maintenance and other technical issues.

To provide intensive school-level support, a network of regional and local coordinators will be developed over the course of the five-year program. Coordinators will be trained and outfitted; travel budgets will be allocated to ensure that each school with an ICT installation is visited once per month. While local coordinators will require technical skills that can be developed by training, it is critical that they have experience in schools and that they support the use of ICT across the curriculum. Local coordinators will be drawn from ICT teachers and from computer-using master teachers as these gain experience.

The projected number of local coordinators is based on the assumption that each secondary-school coordinator can serve approximately 12 schools, while each primary-school coordinator can serve approximately 20 schools. Seven local coordinators required in Phase 1 will become regional coordinators in Phase 2, managing and supporting new local coordinators, as shown in Table XIII-1:

Local coordination & support	Schools per staff	Phase 1	Phase 2	Phase 3
Regional coordinators		0	7	8
Local coordinators				
Secondary coordinators	12	5	24	45
Primary coordinators	20	2	10	10
Total, local support personnel	32	7	41	63

Primarily as a result of the high cost of travel, local coordination and support contribute significantly to projected operating costs, exceeding 25 percent over five years. Given the substantial barriers to successful implementation of ICT in Papua, however, this program component is essential.

G. National and International Consultants

Based on assumed need for technical assistance, directors and coordinators providing program management will have access to regular and on-demand support from national and international consultants.

National consultants will primarily provide consultation and advicement in relation to collaboration with specific vendors, partners and other stakeholders, and in relation to the outputs and activities of specific initiatives, such as capacity-building for ICT teachers or integration of ICT-enabled school-management processes with

provincial reporting. National consultants, then, might include Papuan-based experts and expert staff based elsewhere in Indonesia (e.g., at UPI Bandung or UT).

International consultants will primarily provide consultation and advicement at the strategic level, addressing areas such as:

- Planning and management
- Partnerships and service agreements
- Plans for specific components

International consultants might also be asked to contribute review of specific outputs, and to provide troubleshooting in the event of unforeseen challenges.

In addition to regular consulting services, the management staff within DIKPORA Papua should be provided with discretionary fund for on-demand technical assistance and consultation.

H. Advisory Board

Since the success of the Papua ICT in Education Program will depend on support from both provincial and national government agencies, on donors, and on school- and district-level staff, an Advisory Board should be formed.

Advisory Board members will represent their respective agencies and organizations. In this capacity, they will guide the development of MOUs, ensure that the interests, policies and processes of their organizations are adequately addressed, and intervene in the event that their organization fails to provide agreed-upon support as scheduled.

I. Monitoring and Evaluation

A plan for monitoring and evaluation should be developed following finalization of the *Strategy*. Key steps in planning for effective monitoring and evaluation include:

- Assessment of the capacity of organizations in Papua
- Determination of appropriate local, national and international organizations to perform monitoring and evaluation
- Determination of scope and objectives of monitoring and evaluation in conjunction with stakeholder and partner organizations

Budget for these activities should comprise 10 percent of respective program components. These costs are not included at this time.

J. Budgeting and Finance for Program Management

Cost of program management over the course of the program will vary depending on the availability and capacity of current DIKPORA Papua staff and other government staff. Among the influences on cost are potential for secondment of staff within DIKPORA Papua and the provincial government, required levels of technical assistance, and other factors.

K. Financial Summary

The potential variation in budgeting for the program management support unit is affected not only by the variables outlined previously, but also by the scope and structure of the Papua ICT in Education Program and, ultimately, by hiring decisions in relation to program management.

For this reason, provisional Phase 1 costs are outlined; estimates for Phase 2 and Phase 3 are expressed as multiples of Phase 1 costs.

N.B.: The work of national and international consultants on all program components will be coordinated by program management. However costs of these consultants have been included in the financial summaries of those components.

The table on the following page outlines costs for program management within DIKPORA Papua. Included are costs of technical assistance and costs of full-time management personnel within DIKPORA Papua.

A separate table outlines costs of local coordination.

Assumptions. Among the assumptions used to create this estimation are the following:

- Salary estimates for program-management staff are based on average IT salaries in Indonesia, as reported by ZDNetAsia (13 April, 2007); future budget planning should be based on current civil-servant salary packages.
- Only hiring costs for director-level staff are included (as 25% of annual salary); the provincial government may incur costs in the hiring of other staff.
- Estimated level of effort for international consultants are projected as being high in Phase 1, decreasing in Phase 2, and increasing again slightly in Phase 3.

Table XIII-2: Central project management

Activity	Item	Units	Unit cost (IDR)	No.	Cost (IDR)	Cost (USD)
Scoping and executive hiring						
Technical assistance						
	National consultant	Month	27,900,000	2	55,800,000	6,000
	International consultant	Month	167,400,000	2	334,800,000	36,000
Travel and other costs						
	National travel	Trip	27,900,000	2	55,800,000	6,000
	Int'l travel	Trip	93,000,000	2	186,000,000	20,000
	Hiring costs	.25 ann'l salary	33,000,000	2	66,000,000	7,097
Sub-total, scoping & design					IDR 698,400,000	USD 75,097
Phase 1						
Personnel, Phase 1						
	Director	Month	6,000,000	18	108,000,000	11,613
	Deputy Director, Finance	Month	5,000,000	18	90,000,000	9,677
	Coordinator, Education	Month	4,500,000	18	81,000,000	8,710
	Coordinator, Technology	Month	4,500,000	18	81,000,000	8,710
	Coordinator, Management	Month	4,500,000	18	81,000,000	8,710
	Staff (3 staff)	Month	6,000,000	18	108,000,000	11,613
Subtotal, Personnel					IDR 549,000,000	USD 59,032
Technical assistance costs, Phase 1						
	Int'l consultant, Management	Month	167,400,000	6	1,004,400,000	108,000
	Int'l consultant, Finance	Month	167,400,000	6	1,004,400,000	108,000
	National consultant	Month	27,900,000	8	223,200,000	24,000
	Discretionary, int'l	Month	167,400,000	4	669,600,000	72,000
	Discretionary, nat'l	Month	27,900,000	12	334,800,000	36,000
Travel and other costs						
	National travel	Trip	27,900,000	20	558,000,000	60,000
	Int'l travel	Trip	93,000,000	16	1,488,000,000	160,000
Subtotal, Technical assistance					IDR 5,282,400,000	USD 568,000

Activity	Item	Units	Unit cost (IDR)	No.	Cost (IDR)	Cost (USD)
Add'l operating costs, Phase 1						
	Facility, communications, etc.	Month	7,625,000	18	137,250,000	14,758
	Add'l national and local travel	trip	27,900,000	18	502,200,000	54,000
Subtotal, Add'l operations					639,450,000	68,758
Sub-total, Phase 1					IDR 7,169,250,000	USD 770,897
Phase 2						
Personnel, Phase 2	1.5x Phase 1 personnel				IDR 823,500,000	USD 88,548
Operating costs, Phase 2	1.5x Phase 1 OpEx				IDR 1,782,675,000	USD 191,685
Technical assistance costs, Phase 2						
	Int'l consultant, Management	Month	167,400,000	2	334,800,000	36,000
	Int'l consultant, Finance	Month	167,400,000	2	334,800,000	36,000
	National consultant	Month	27,900,000	4	111,600,000	12,000
	Discretionary, int'l	Month	167,400,000	3	502,200,000	54,000
	Discretionary, nat'l	Month	27,900,000	8	223,200,000	24,000
Travel and other costs						
	National travel	Trip	27,900,000	12	334,800,000	36,000
	Int'l travel	Trip	93,000,000	7	651,000,000	70,000
Sub-total, Technical assistance					IDR 2,492,400,000	USD 268,000
Subtotal, Phase 2					IDR 5,098,575,000	USD 548,234
Phase 3						
Personnel, Phase 3	2.5x Phase 1 personnel	24 months			1,372,500,000	147,581
Add'l operating costs, Phase 3	2.5x Phase 1 OpEx	24 months			1,598,625,000	171,895
Technical assistance costs, Phase 3						
	Int'l consultant, Management	Month	167,400,000	3	502,200,000	54,000
	Int'l consultant, Finance	Month	167,400,000	3	502,200,000	54,000
	Discretionary, int'l	Month	167,400,000	4	669,600,000	72,000
	Discretionary, nat'l	Month	27,900,000	12	334,800,000	36,000
Travel and other costs						
	National travel	Trip	27,900,000	15	418,500,000	45,000
	Int'l travel	Trip	93,000,000	10	930,000,000	100,000
Sub-total, Technical assistance			651,000,000		IDR 3,357,300,000	USD 361,000
Subtotal, Phase 3					IDR 6,328,425,000	USD 680,476
Total, Project Management					IDR 19,294,650,000	USD 2,074,597

Activity	Item	Units	Unit cost (IDR)	No.	Cost (IDR)	Cost (USD)
Total Technical assistance					11,700,300,000	1,272,694
Total personnel					2,745,000,000	295,161
Total add'l operating costs					4,020,750,000	432,339

Local Coordination. Estimated cost of providing local coordination to schools is based on the following major assumptions:

- Salary, regional coordinator – IDR 3,500,000 / month
- Salary, local coordinator – IDR 3,000,000 / month

Additional cost assumptions address travel (i.e., roundtrip airfare within Papua, IDR 2,000,000), costs of laptop computers and maintenance, and other factors. Although local coordinators will be based in their respective district beginning in Phase 2, travel costs, including surface travel to remote locations, will be significant, as shown in Table XIII-3:

Activity	Item	Units	Unit cost (IDR)	Units/ item	No.	Cost per phase (IDR)	Cost per phase (USD)
Phase 1							
Regional coordinators							
Regional coordinator, secondary		1 staff	264,200,000	1	5	1,321,000,000	142,043
Regional coordinator, primary		1 staff	84,200,000	1	2	168,400,000	18,108
Subtotal, Regional coordinators						IDR 1,489,400,000	USD 160,151
Phase 1 Training							
Coordinators intensive							
	Facility	Week	5,000,000	3	1	15,000,000	1,613
	Incentive	Course	1,000,000	1	7	7,000,000	753
	Per diem	Week	2,800,000	3	7	58,800,000	6,323
ICT & Support course							
	Per diem	Week	2,800,000	3	5	42,000,000	4,516
Subtotal, Training						122,800,000	13,204
Subtotal, Regional coordination, phase 1						IDR 1,612,200,000	USD 173,355
Phase 2							
Regional Coordinators							
Regional coordinators, secondary		1 staff	3,300,000	1	5	16,500,000	1,774
Regional coordinators, primary		1 staff	239,100,000	1	2	478,200,000	51,419
Subtotal, Regional Coordinators						IDR 494,700,000	USD 53,194
Local Coordinators - Secondary							
Local coordinator (new hire)		1 staff	251,000,000	1	24	6,024,000,000	647,742
Subtotal, Secondary local coordinators						IDR 6,024,000,000	USD 647,742
Local Coordinators - Primary							
Local coordinator (Tier 1 and 2 new hire)		1 staff	900,000	1	8	7,200,000	774
Local coordinator (Tier 3 new hire)		1 staff	94,550,000	1	2	189,100,000	20,333
Subtotal, Primary local coordinators						196,300,000	21,108

Activity	Item	Units	Unit cost (IDR)	Units/ item	No.	Cost per phase (IDR)	Cost per phase (USD)
Phase 2 training							
Coordinators intensive							
	Facility		Week	5,000,000	3	1	15,000,000	1,613
	Incentive		Course	1,000,000	1	34	34,000,000	3,656
	Per diem		Week	2,800,000	3	34	285,600,000	30,710
	Travel (Air RT to TEI)		Trip	2,000,000	1	17	34,000,000	3,656
	Travel (Surface RT to TEI)		Trip	200,000	1	17	3,400,000	366
ICT & Support course							
	Per diem		Week	2,800,000	3	24	201,600,000	21,677
	Travel (RT to TEI)		Trip	2,000,000	1	12	24,000,000	2,581
	Travel (Surface RT to TEI)		Trip	200,000	1	12	2,400,000	258
Subtotal, Training							594,880,000	64,516
Subtotal, Regional & local coordination, phase 2							IDR 7,205,380,000	*USD 786,559*
Phase 3								
Regional Coordinators								
Regional coordinator, secondary (from Ph 2)			1 staff	3,600,000	1	5	18,000,000	1,935
Regional coordinators, primary (from Ph 2)			1 staff	260,400,000	1	2	520,800,000	56,000
Regional coordinator, primary (new hire)			1 staff	84,200,000	1	1	84,200,000	9,054
Subtotal, Regional Coordinators (phase 3)							IDR 623,000,000	USD 66,989
Local Coordinators - Secondary								
Local coordinator (retained from Phase 2)			1 staff	11,600,000	1	24	278,400,000	29,935
Local coordinator (new hire)			1 staff	359,200,000	1	21	7,543,200,000	811,097
Subtotal, Secondary local coordinators							IDR 7,821,600,000	USD 841,032
Local Coordinators - Primary								
Local coordinator (Tier 1 and Tier 2, retained from Phase 2)			1 staff	11,600,000	1	8	92,800,000	9,978
Local coordinator (Tier 3, retained from Phase 2)			1 staff	108,800,000	1	2	217,600,000	23,398
Local coordinator (Tier 1 and Tier 2 new hire)			1 staff	108,800,000	1	12	1,305,600,000	140,387
Subtotal, Primary local coordinators							IDR 1,616,000,000	USD 173,763
Phase 3 training								
Coordinators intensive								
	Facility		Week	5,000,000	3	1	15,000,000	1,613
	Incentive		Course	2,000,000	1	32	64,000,000	6,882
	Per diem		Week	2,800,000	3	32	268,800,000	29,204
	Travel (Air RT to TEI)		Trip	2,000,000	1	16	32,000,000	3,441
	Travel (Surface RT to TEI)		Trip	200,000	1	16	3,200,000	344
ICT & Support course								
	Per diem		Week	2,800,000	3	21	179,200,000	18,968
	Travel (Air RT to TEI)		Trip	2,000,000	1	11	22,000,000	2,366

Annexes

Activity	Item	Units	Unit cost (IDR)	Units/ item	No.	Cost per phase (IDR)			Cost per phase (USD)
	Travel (Surface RT to TEI)			Trip	200,000	1	11	2,200,000	237
Subtotal, Training								583,600,000	62,753
Subtotal, Regional & local management, phase 3								IDR 10,644,200,000	USD 1,144,538
Total, Regional and local management								**IDR 19,571,400,000**	**USD 2,104,452**

Annex A: Risks and Mitigations

A. Introduction

- Table A-1, on the following page, identifies key risks and possible mitigations.
- The column labeled "Potential impact" provides an estimate of the scope of negative outcomes (high, moderate, limited) that might result if the identified risk is not mitigated. Note that this is not equivalent to estimations of the probability that a given risk will be realized. All of the risks identified in this section have affected ICT projects in education; they can be considered likely if mitigating actions are not adopted. Potential impact is intended to provide a very general sense as to the importance of this risk in relation to positive impact from program activities.

Potential impact	Risk	Mitigation
	ICT Infrastructure	
High	Hardware and network maintenance is irregular and inadequate resulting in widespread failure of equipment	• Establish comprehensive maintenance program with clearly designated management responsibility at DIKPORA Papua • Establish performance-based service-level agreement (SLA) with private-sector provider (including Help Desk and remote maintenance and repair) with penalties for non-compliance • Standardize all hardware packages to be used in schools (public, private) through large-scale purchasing from a single vendor • Include budget for includes travel costs for on-site repairs in maintenance-budget allocation and SLA • Train local coordinators and ICT Teachers in basic equipment maintenance and "troubleshooting," with refreshers as needed
Moderate	Computer equipment degrades rapidly in hot and humid environments	• Train local coordinators and ICT Teachers in basic equipment maintenance and "troubleshooting," with refreshers as needed • Deploy low-power and appropriate computer hardware in all school and most other installations to reduce heat generation • Include ventilation measures in civil-works planning when appropriate • Install computers in climate-controlled facilities in select schools (e.g., TEIs) Include operations and maintenance of air conditioning, when installed, in planning and budget estimations
High	Computer software failures result from malware, user errors and other problems	• Address user permissions and other system safeguards (e.g., antivirus) in training of ICT teachers and coordinators • Address routine software maintenance (including backup and system restore) in training of ICT teachers and coordinators • Require remote monitoring and system maintenance in maintenance SLA • Install licensed software and install (via remote maintenance) in routine update • Install, update and run anti-virus and other maintenance software
High	Lack of supporting infrastructure (e.g., electricity, school facilities) impedes ICT installation	• Plan and allocate funds for civil works addressing facilities upgrades in areas such as electrical wiring, ventilation, security, etc. • Plan ICT infrastructure roll-out based on a school-by-school basis, accounting for infrastructural "readiness" • Specify low-power-consumption hardware, rugged solutions, and other appropriate tools • Use solar-power installations for electricity as needed • Consult existing facilities-upgrade cost estimates of DIKPORA Papua for initial information regarding civil works requirements
High	High cost of connectivity diminishes sustainability	• Shift to use of fiber-optic access (Palapa Ring) where available. Current plan and financing of Palapa Ring consortium targets deployment up to Sorong, West-Papua by May 2011. Timing and financing of the extension to Jayapura and Merauke are still uncertain and regional Government can play a key role to accelerate deployment. • Use multicasting, cacheing and other strategies to reduce reliance on broadband or real-time Internet • Negotiate bulk purchase agreements with telecommunications vendor (e.g. for wholesale satellite capacity) when warranted • Allocate adequate funds for connectivity costs during program cycle and in all subsequent fiscal planning

Potential impact	Risk	Mitigation
	Program Management	
High	Limited capacity at DIKPORA Papua results in poor planning and implementation	• Designate full time Program Director with day-to-day management responsibilities • Locate management within BPP to maximize current human capacity per request of DIKPORA Papua, if further assessment supports this decision • Assign consultants during pre-planning and Phase 1 to assist in program planning and management • Include T.A. and capacity building for management staff • Use remote monitoring to generate data on program metrics (computer uptime, email and Web traffic, etc.) • Develop program management and monitoring tools (e.g Database Management Information System [DBMS]) • Include DINAS district in management processes and communications as appropriate
Moderate	Lack of support and participation in DIKPORA PAPUA impedes program implementation	• Conduct outreach workshops and offer ICT-related professional-development opportunities provided by BPP
High	Lack of interest, understanding and participation by schools, school leadership and teachers limits program impacts	• Provide intensive coordination and support in schools via a network of trained local coordinators • Include appropriate incentives (e.g., financial, professional, etc.) for effective participation and high levels of performance
High	Resistance or non-support from head teachers reduces use of ICT installations, limits sustainability in schools or impedes teachers practicing new methods	• Reinforce program vision, objectives and overall importance to head teachers during "ICT Leadership" courses • Include school-level ICT-related processes in performance-review criteria and other professional assessments
Moderate	Limited human capacity impedes hiring of local coordinators	• Keep requirements for coordinators to a minimum during Phase 1 • Hire Phase 2 and Phase 3 coordinators from outstanding project personnel (e.g., ICT teachers, other teachers) •
Moderate	High turnover among coordinators in response to private-sector opportunities or other factors weakens management staff	• Include performance and length-of-service incentives, both financial and professional, in terms of employment • Continuously identify potential coordinators throughout the system • Generate ICT-literate teachers in pre-service teacher education
High	Change in current leadership within DIKPORA Papua results in reduced support for program.	• Establish Advisory Board with representation by all stakeholders and by other prominent Papuan citizens • Link program objectives to provincial and national policy goals • Conduct regular outreach to other departments in Papuan government

Potential impact	Risk	Mitigation
	Teacher Professional Development	
High	Lack of interest and participation by teachers reduces effectiveness of training	• Incentives for completion of TPD programs (e.g., financial, professional certification, etc.) • Basic ICT training addresses educational contexts, models active-learning methods • "Mainstreaming" of ICT courses in pre-service teacher education
High	Lack of capacity among TEIs reduces quality of training	• Pre-qualification of TEI partner(s) • Limit reliance to one central TEI for training of ICT teachers and school heads • T.A. for course development and delivery • Capacity building among instructors
High	Cascade model of teacher training produces poor results in terms of competencies gained and retained by teachers	• Integration with "cluster-based approach" building off of ICT Centers, MGMPs and other groups • Intensive support from local coordinators • Development of Web-based resources (Phase 2) to encourage participation and to increase effectiveness of TPD • Integration of resources such as gurupintaronline (UT)
High	Lack of connection to Indonesian curriculum thwarts efforts by teachers to adopt ICT	• Focus in Basic ICT course on access and effective use of existing resources such as TV-e, edukasi.net, text-books online, etc. • Specific attention to curriculum and exam issues during training • Plan for support of local-content / cultural curriculum initiatives of DIKPORA Papua and PUSTEKOM
High	High turnover among ICT teachers in response to private-sector opportunities or other factors weakens management staff	• In-service training of ICT teachers throughout the project and in project out-years • Development of pre-service teachers with good grasp of ICT and pedagogy • Incentives for length-of-service and other benchmarks (financial, professional, etc.) • Eventual partnership with private-sector institutions
High	Teachers are selected to participate in training based on favoritism, so as to receive incentives and per diem payments	• Adjust per diem payments to accurately reflect costs of participation • Maintain a rational and balanced incentive structure, using professional certification and other forms rather than direct payments whenever possible • Award incentives for completion and in relation to demonstrations of benchmark competencies, not for attendance • Pay expenses such as accommodation and on-site meals centrally rather than as per diem • Establish selection criteria for training candidates • Explore requiring up-front financial contribution by candidates that is followed by incentives for completion and/or increased salary levels

Potential impact	Risk	Mitigation
	Information Management	
Moderate	High levels of complexity required by EMIS solutions prevents adoption or limits effective use	• Begin with detailed process analysis mapping information needs and flow • Develop simple, spreadsheet based reporting form • Support current reporting practices only (no additional back-office or DBMS)
Moderate	Low rates of participation by Head Teachers and others fail to improve reporting frequencies	• Increase sharing of information by DIKPORA Papua and DINAS Kab. school participation • Include information-management unit in ICT Leadership course • Emphasize simplicity and ease of use • Require electronic submission following ICT installation and TPD for Head Teacher
	Learning Resources	
High	Lack of capacity within BPP and Learning Resources Development Center restricts support for and development of learning resources	• Gradual, step-by-step approach to building expertise and skills • Emphasis on support of currently available learning resources • Rely primarily on T.A. for early-phase development of resources • Provide "shadow training"-based capacity building in instructional design, multimedia development and pedagogical support
Low	Low-quality of currently available resources yields poor results in field	• Develop lesson plans, classroom activities and ICT activities that increase the value of these resources • Develop Web-based tools emphasizing communication and collaboration • Multicast and cache high-quality, third-party resources (within limits of IPR) with high relation to curriculum
Moderate	Poor Web access by schools and teachers limits access to learning resources	• Use redundant distribution media (e.g., DVD, Web) and methods (multicast, delivery by local coordinator) as necessary
	Environmental Risks	
High	Generation of eWaste	• Conform to government regulations during procurement and disposal • Implement Total-Cost-of-Ownership budget planning • Purchase higher-quality hardware when possible to maximize service lifecycle • Purchase hardware from suppliers that participate in trade-in or recycling programs • Track, plan and allocate budget for component upgrades to existing computers (e.g., memory, motherboard, etc.) to extend lifecycles • Track and support emergence of used-computer market mechanisms in Papua over next five years, with planned participation by DIKPORA Papua as computers near end of service life • As computers age explore repurposing as "typing tutors," "thin clients" and other implementations that require less processing power

Annex B: Issues for Future Planning and Implementation

A. Introduction

This Annex lists issues that should be addressed in greater detail during planning and implementation.

B. Planning and Management

- **Total Cost of Ownership**
  A Total Cost of Ownership (TCO) model should be used to estimate and compare all hardware costs. This model, by including electricity, maintenance and repair, disposal and other costs provides a more accurate representation of overall project costs. The TCO model also provides a more accurate means of comparing costs of different hardware components (e.g., LCD vs. CRT monitors).

- **Program Direction within BPP**
  Respondents within DIKPORA Papua have suggested the BPP is the appropriate agency to house program-management activities (and that the current director of BPP is a preferred candidate for program director). Additional assessment of BPP capacity and organization is required.

- **Terms of Reference (Resumes) for project personnel**
  DIKPORA Papua has specifically requested assistance in preparing Terms of Reference, job descriptions or sample resumes for project-management and other personnel.

- **ICT-Center school selection**
  Some DINAS district (e.g., Kab. Biak Numfor) have selected schools to be ICT Centers as of June 2008, while others (e.g., Kab. Supiori) remain undecided. Kapala DINAS should receive briefing and guidance in relation to planned program activities as soon as possible, and should be asked to share their school selections with DIKPORA Papua as those selections are made.

C. ICT Infrastructure

- **Site-specific roll-out planning**
  A roll-out plan for the installation of ICT infrastructure must be developed based on specific school locations, available infrastructure (e.g., electrical power, wiring, etc.), faculty readiness and other factors. During this process, any civil works required to upgrade school facilities, including in relation to security, should be identified and incorporated into planning and budgeting.

- **Adjustments based on Palapa Ring fibre-optic backbone**
  Planning and budgeting should be updated in relation to provision of service to Papua by the Palapa Ring fibre-optic telecommunications backbone. The need for frequent updating is specially acute given the delays in the Palapa Ring East deployment and the uncertainties with respect to the financing of the extensions from Sorong to Jayapura and from Sorong to Merauke.. Affected factors include the need for VSAT connectivity in ICT Centers (Phase 1) and the possible re-allocation of VSAT hardware to schools outside of coastal centers once Palapa-Ring connectivity is available.

- **eWaste**
  National and provincial government regulations must be followed in relation to the eventual disposal of ICT hardware. Those regulations must be analyzed for their financial and procedural impact on program plans prior to completion of budget planning.

- **Possible expansion of ICT minilab installations**
  Students' limited access to computers in

schools is frequently cited by ICT-in-education projects as a barrier to success. ICT Centers and ICT minilabs should be adjusted based on school size to ensure that student access is adequate. (Respondents at DIKPORA Papua have suggested that minilabs should be increased from 10 computers per school to 20 computers per school.) In the larger residential (or boarding) SMPs currently planned by DIKPORA Papua, student enrolment may suggest that two or more minilabs be allocated per school.

D. Teacher Professional Development

- **Synchronization with hardware roll-out**
  Provision of TPD to teachers must be coordinated in relation to the roll-out of ICT hardware to schools to ensure that staff are trained when computers are installed, but that training is not allowed to "go stale."

- **Support for MGMPs, KKGs and other teacher "clusters"**
  MGMPs, KKGs and other teacher groups should be fully supported by planned ICT activities. In many instances, cluster-based approaches provide increased TPD effectiveness in comparison with cascade models. Additional research and communication with responsible organizations is required. Such research should include assessment of the "Mitra 1700" program of MGMP partnerships at SEAMOLEC.

- **Teacher participation in skills-upgrade courses**
  Outcomes of the proposed activities will increase teachers' abilities to access and participate in distance education in general. Providers of skills-upgrade courses, including UT, the HyLite program and others, should be invited to take advantage of this outcome to increase teachers' participation in their programs.

- **Teacher development for multigrade teaching**
  Integrating TPD focused on multigrade teaching techniques into other teacher-education initiatives, including those in outlined in this program where appropriate, has potential to improve learning outcomes in schools. There are many "one-roof" schools in Papua, some of these emerging impromptu from teacher absenteeism. However few if any teachers have received training in classroom management and pedagogical approaches suitable for these situations. Multigrade teaching comprises a core set of well-defined techniques that have been shown to have highly positive impact and that, in some circumstances, will effective in ICT Centers and minilabs.

- **Modeling as a teacher-training technique**
  TPD courses and instruction should be based on the principle of "modeling," in which teacher-trainees are asked to learn in ways similar to learning activities that are proposed for students.

- **Ensuring that "the right people" participate in TPD**
  It is critical to develop effective means of ensuring that teachers who participate in professional development are enthusiastic and well positioned to introduce ICT-supported activities into their schools. Among other actions, incentives, per diem and other benefits afforded to teachers who receive training must be adjusted to reasonable levels.

- **Assessment of available ICT-focused courses**
  More detailed analysis and evaluation of ICT-focused TPD courses and units should be conducted prior to the selection or development of teacher-training curricula. HyLite, UPI Bandung, UT, and other programs and institutions, for example, offer courses that may be relevant and effective in relation to program objectives for TPD. The USAID DBE2 program offers effective teacher development that may be appropriate and available for re-purposing.

E. Learning Resources

- **Learning Resources Development Center capital costs**

BPP plans to launch a Learning Resources Development Center (LRDC), which will undertake activities related to learning resources that are described in this ICT in Education Strategy. The LRDC may require computer hardware and other equipment in excess of allocations included in program budget estimates.

F. Outreach

- **Vision-sharing activities among stakeholders at all levels**
  At every level ranging from the national government through the provincial government and DIKPORA Papua to the local level of schools and DINAS, it is essential to involve stakeholders in achieving project goals and objectives. Within DIKPORA Papua, the Director and others should conduct vision-sharing and outreach activities, and ensure that all personnel have access to ICT hardware and training appropriate to their job responsibilities.

- **Participatory planning and design (DINAS)**
  Stakeholders should be involved in planning to the extent feasible. In particular, however, DINAS district leadership and personnel should be asked early on to respond to planned activities.

G. Monitoring and Evaluation

- **Planning for monitoring and evaluation**
  Monitoring and evaluation (M & E) should address each project component in addition to the overall program undertaken by DIKPORA Papua. An appropriate budget allocation will be in the range of 10 percent of five-year program costs.

- **Involving international parties in M & E**
  Respondents at DIKPORA Papua have requested that international parties be involved in M & E to the extent possible to ensure that information and analysis are accurate and that performance failures, if any, are fairly noted.

- **Initial design and baseline information collection**
  Planning, budgeting and contracting for M & E activities should begin with initial project planning, and should target development of an initial M & E approach that supports, at a minimum, collection of baseline data.

- **Outcome mapping**
  Consideration should be given to Outcome Mapping as a framework for project planning in relation to objectives and as a basis for M & E activities.

- **Formative reporting**
  M & E activities should be seen as contributing to planning and implementation over the course of any program. Periodic assessments should be conducted to support program revisions that increase impact.

- **Evaluating impact, not only performance**
  M & E should attempt to assess program outcomes and impact—such as changes in teachers' behaviors or in levels of information literacy among students—as well as performance metrics such as numbers of computers installed or numbers of teachers trained. Impact indicators should when possible be developed with recognition of national and provincial policy, such that program impact, if any, is seen as helping to meet policy objectives and goals.

Annex C: ICT Infrastructure Cost Details

A. Introduction

This section provides more detailed information about the assumptions used to create ICT infrastructure estimates. Cost information about hardware costs for ICT Centers, Minilabs, and SD Stations is included, along with cost information for Internet connectivity.

B. Phase 1 Hardware Costs & Deployment

ICT Centers in TEIs. Deployment of 8 ICT Centers in Teacher Education Institutes will include both pre-service and in-service TEIs in Jayapura and at DIKPORA Papua Multicampus teacher colleges. The cost estimate for these deployments is as follows:

	Basic ICT Center	VSAT/ site	Solar Power/site	Unit cost
ICT Center cost (8 est)	$ 20,000	$ 3,000	$ 5,000	$ 28,000

ICT Centers in SMAs. Deployment of 60 ICT Centers, **locations determined by DIKNAS.** Deployment planning should include standardization of ICT Center configurations (hardware, software, networking), plus tendering of contracts for hardware, solar power and connectivity, and installation/supervision. The cost estimate for this 60-school deployment is:[22]

	Basic ICT Center	VSAT/ site	Solar Power/site	Unit cost
ICT Center cost (60 est.)	$ 20,000	$ 3,000	$ 5,000	$ 28,000
(Less est. Block Grant)	$6,000	$2,000	$2,000	($10,000)
Total	$14,000	$1,000	$3,000	$18,000

ICT Stations in SDs. All schools will be in accessible locations in or near Kota Jayapura and possibly another location, such as Timika. Schools will be "clustered" so as to explore the possibilities for inter-school communication and establishment of informal "communities of practice." Deployment planning entails: standardizing the SD configuration; tendering the SD "Station" and installation/ supervision.

The cost estimate is:

	Basic ICT	VSAT / Site	Solar Power	Trans-port	Unit cost
ICT Station (Tier 1 and Tier 2) ·	$800	$500 (DSL)	-	-	$1,300

C. Phase 2 Hardware Costs & Deployment

Phase 2 involves deployment of ICT Minilabs (smaller than ICT Centers) to the remaining secondary schools in Papua (SMAs and SMKs), and to accessible SMPs, with continued roll-out of SD Stations to accessible SDs. A pilot test of SD Stations in 30 remote SDs will also begin.

ICT Minilabs at the SMAs and SMKs. Costs of ICT Minilabs is based on the following estimates:

22 Complete information about the PMPTK block grants has yet to be acquired. For estimation purposes, six laptops and one server are priced at US $6,000; one VSAT terminal at $2,000 (leaving some additional budget for site improvements and installation, solar power (not necessary in every ICT Center) is reduced by a $2,000 estimate contribution for "electrical supply" from PMPTK.

	Basic school lab	VSAT/ site	Solar Power/ site	Unit cost
ICT Minilab Tier 2 version	$ 10,000	$ 2,500	$ 5,000	$ 17,500
ICT Minilab Tier 1 version	$10,000	$ 500 (DSL)	-	$10,500

Costs for the above deployment will decrease if the PMPTK block grant is extended to these schools in 2009-10.

ICT Minilabs at SMPs. ICT Minilabs for SMPs will have hardware and connectivity configurations similar to the SMA ICT Minilabs, also installed in Phase 2. Standardization and scale may reduce costs below these estimates. Costs for this deployment are based on the following estimates:

	Basic school lab	VSAT/site	Solar Power/ site	Unit cost
SMP Tier 2	$ 10,000	$ 2,500	$ 5,000	$17,500
SMP Tier 1	$ 10,000	$ 500 (DSL)	-	$10,500

Internet connectivity costs for Tier 1, Tier 2 and Tier 3 SDs. Connectivity costs for this deployment are based on the following estimates:

	Basic ICT	VSAT/ site	Solar Power	Trans-port	Unit cost
Tier 1 SDs	$ 800	$ 500 (DSL)	-	-	$1,300
Tier 2 SDs (with electricity)	$ 800	$ 2,500	-	$500	$3,800
Tier 3	$ 800	$ 2,500	$ 2,200	$ 1,000	$6,500

D. Phase 3 Hardware Costs & Deployment

Phase 2 accomplishes provision of ICT Minilabs (smaller than ICT Centers) to the remaining SMPs, plus roll-out of SD Stations to the remaining accessible Tier 1 and Tier 2 SDs.

Deployment of ICT Minilabs at the remaining SMPs. Costs for this deployment are based on the following estimates. They would likely decrease if block grants are made available to these SMPs in 2010 –11.

	Basic school lab	VSAT/ site	Solar Power/ site	Unit cost	Total
SMP Tier 2	$ 10,000	$ 2,500	$ 5,000	$ 17,500	$ 2,800,000
SMP Tier 2	$ 10,000	$ 500 (DSL)	-	$ 10,500	$ 420.000

SD ICT Stations for accessible SDs. These will include a mix of schools with high-speed/low-cost connectivity and low-speed/moderate-cost connectivity, with additional variation resulting from access to electrical power. Costs for this deployment are based on the following estimates:

	Basic ICT	VSAT/ site	Solar Power	Transport	Unit cost
Tier 2 SDs	$ 800	$ 2,500	-	$ 500	$3,800
Tier 1 SDs	$ 800	$ 500	-	-	$1,300

There should be major opportunities to optimise the design and to reduce the cost/SD due to economies of scale.

THE WORLD BANK | BANK DUNIA

Kingdom of the Netherlands