

## **A CASE STUDY IN KENYA**

### **.EXPAND POST OFFICES ITC TO RURAL AREAS, SCHOOLS, POLYTECHNICS**

The project was introduced at ICTP in Trieste by Dr **Thomas Onger Ombasa**.

Postal Corporation of Kenya and the Ministry of Information and Communication have developed a VSAT communication network with the objectives of recovering the communication gap in the country and of providing a number of communication services to the rural areas (Universal Service Obligations). The program is intended to:

- provide public call offices with bundled telephony, data services, internet access
- achieve better points of service sale in the existing Post Offices
- satisfy Universal Service/Access Obligation

600 Post Offices have, already, been provided with VSAT technology; more sites will be equipped, soon, up to a number of about 1000 across the country.

As the plan above will introduce new facilities (internet; e-learning, educational) and considering the large coverage of Post Offices, the project proposes to extend national ongoing communication plan to appropriately cover some Institutions located closely to Post Offices which, then, might become a concentration point (node) of the extended network

The network will be an hybrid of different technologies interconnecting different institutions. The initial proposed approach is to aggregate existing bandwidth by using terrestrial Wi-Fi links. This would provide high speed links/bandwidth to support access to the Internet, co-operation, e-learning programs, etc. The recipients of the project are, in particular:

*Middle Level Colleges, Polytechnics & Institutes of Technology.* These institutions hold the second largest collection of information resources. The institutions are widespread over the country; some are located where access to ICT is limited by available infrastructure.

*Post secondary management and business training institutions.* They are considered important because they train management resources and various vocational subjects to high school levels leading to certificate and diploma awards. They also hold some very special informational resources that are of value to develop techniques of management for national labour. They too are limited in access to electronic based resources due to their diversity.

*Primary and secondary schools.* There has been a remarkable expansion in both primary and secondary education, both in terms of the number of schools established and in the number of children enrolled over the past three decades. In response to the rapid increasing numbers there has been a general increase in the number of Teachers. Access to ICT to these institutions of basic learning is thus a vital parameter.

A number of stakeholders have been identified as possible partners to implement the project.:

1. Kenya Institute of Education (primary, secondary and post school institutions)
2. Teachers Service Commission (mobilising teachers to use ICT in teaching)
3. Ministry of Education (Responsible education sector in the country)
4. Ministry of Information and Communication (provide ICT policy initiatives to project)
5. Kenya Postal Corporation (provide necessary concentration points for the POPs)
6. JamboNET Kenya Ltd (provide internet access and bandwidth requirements)
7. Kenya Alldcan Satellite Network (project planning and management)
8. Kenya Communication Commission (regulatory equipment and link budget requirements)

### **Approach to project feasibility**

Economic feasibility of proposed project can be estimated by comparing the cost of additional network and central equipment with the economies (benefits in term of improving distribution of self-teaching programs, educational, training) it can provide. The estimate is made by using the IRR (Internal Rate of Return) model that compares, over a chosen study period, investment (initial cost), operating cost (maintenance, management) and expected revenue (quantification of benefits in monetary terms). The IRR is the discount rate that lets calculate the Net Present Value (NPV) of a series of cash-flows (expenses minus revenue) as to compare expected future income to certain initial investment.

### **Investment and annual expenses**

According to the scheme given at the presentation of project in Trieste, recipients (primary and secondary schools, middle level colleges, polytechnics and institutes of technology) are connected to central node (Post Office) by Wi-Fi links in a star configuration. The links not only connect nodes but also interconnect institutions hence providing co-operation (learning programs). At the time the project was presented, it was not possible to be precise about the number of sites to connect so that, waiting for details, the cost components per each connection was assumed as reference.

*Capital cost.* In absence of detailed information about the equipment to install to implement the project, no Central Unit was considered (supposed to be in the node) so that the purchasing cost refers to a Web Server hardware and software for a total purchasing cost of **13800 US\$** (8000US\$+5800US\$ respectively).

*Network cost* – The cost per each Wi-Fi link was detailed. It accounts for a purchasing cost of **8400 US\$** which includes the purchasing of Antennas, clients cards and other additional equipment. Total investment will be proportionate to the number of points to connect. Installa-

tion and configuration of network are supposed to account for an additional **1680 US\$** (20% of capital cost)..

*Operating cost* – If connections are maintained and operated from central node, operating cost is assumed zero: whether, instead, Schools have to provide operation, then 2 people are assigned to this task. Cost of operation is proportionate to the salary of two people.

*Individual cost* - cost of new PC together with relevant facilities (e-mail, training, database access) located in schools: **1200 US\$**. No mention was made about the number of new PC to operate within the structures to connect.

### **Estimate and quantification of benefits**

The recipients of project belonging to School Sector are, mainly: Teachers, Administrative Staff, Students. Again, it was not possible to get data upon the structure of each site so that number of Teachers, Administrative people and Students involved by the project are still unknown. The evaluation of benefit was, then, made per category of potential users to serve as reference for the final implementation of economic study.

First, the separation of activity per category into main duties theoretically set up, in detail, in **Annex 1**. It shows the possible use of annual working hours per category.

The benefits coming to School, are analysed in the following:

1. the School save money as Teachers, Staff and Students have less recourse to the so-called “intermediate consumption” (telephone, fax, courier, photocopies). **Annex 2** shows the situation before and after the implementation of the project.
2. Recourse to Library is justified by the need of getting information, of self-training, of updating files etc. **Annex 3** describes the benefit coming back to all categories of users. Total requests arriving per day were estimated as **48** per day and were supposed to be raised, mainly, by Teachers and Students.
3. The availability of files on line lets speed up working processes especially when preparing and circulating documents. **Annex 4 and Annex 5** shows the savings returning to Teachers and Administrative people who can improve their working efficiency.

Post Offices activity will take advantage from the national VSAT plan wanted by Ministry of Communication. It might be interesting to stakeholders to get an estimate of potential return the project can provide in this Sector. In particular, benefits similar to those analysed above might come back to Post Offices. The automation of working procedures, the direct contact with Central Post Administration, the possibility of self-training without leave the working location can easily drive the system to economies, provided an appropriate change of behaviour of final users. At this stage, relevant benefit is difficult to estimate without a close knowledge of local activity.

### **Schools: Teachers – estimating benefits**

Basic activities of Teachers deal with their fundamental duties (**Annex 1**). Such an activity does not take advantage from the availability of Internet. Rather, there are a number of complementary activities (attending Seminars, participating to Congress, prepare lectures, research text/information, write documents/books) where access to Intranet turns to be the appropriate support to short down working processes and facilitate access to information.

The assumed salary is **300 US\$/month**; the cost per hour is **4,21 US\$/hour** ( $=300 \times 12 / 856$ ).

*Intermediate consumption* – The lower recourse to intermediate consumption is quantified, in monetary term, with reference to unit salaries. Benefit to School coming from reduction of intermediate consumption accounts (**Annex 2**) for **167,04 US\$/year** per Teacher. It corresponds to **4,64 %** of annual salary ( $=167,04 / 300 / 12$ ) of one Teacher. Total saving is proportionate to total number of Teachers involved.

*Queuing at Library* - the project lets Teachers save 0,60 ( $=60 \times (0,11 - 0,10)$ ) minutes for queuing (**Annex 3**). On a year basis, it becomes **11,52 hours/year** ( $=0,6 \times 6 \times 6 \times 4 \times 8 / 60$ ) and corresponds to an increase of efficiency of **1,35%** ( $=11,52 / 856$ ). In monetary terms, Teachers would save **48,44 US\$/year** ( $11,52 \times 4,21$ ). Total saving coming to School is proportionate to total number of Teachers involved.

Further (**Annex 3**), the idleness of librarians moves from 0,71 to 0,76 per hour; it corresponds to a saving of 3,00 minutes per hour of duty or, on a year basis, of **60,00 hours/year** and per librarian ( $=3 \times 6 \times 5 \times 4 \times 10 / 60$ ). Theoretically (salary per month = 150 US\$; cost per hour = 1,55 US\$ ) the unit saving is **93 US\$/year** per librarian. ( $=60 \times 1,55$ ). Total saving is proportionate to total number of librarians.

*Producing documents* – It is supposed that, under paper-based process, 1,20 documents arrive in the reference hour (derived from Annex 2) and that 1,60 documents can be completed in the same time (**Annex 4**). During the period dedicated to this activity, Teachers are engaged at almost 75% of their working time. Under automatic procedures, the situation changes and Teachers can perform the same actions in less time. Their idleness moves from 0,25 to 0,28 with an increase of 0,03. That corresponds to a saving, in monetary terms, of **108 US\$/year** ( $=0,03 \times 300 \times 12$ ). Translated into hours, the figure gives a saving of 25,65 hours/year that drives to an increase in efficiency of **3,00 %** ( $=25,65 / 856$ ).per Teacher. Total saving is proportionate to total number of Teachers involved.

### **School: Students – estimating benefits**

Fundamental activity of Students is: to attend classes, to meet regularly teachers, to get ready for examinations. Out of such duties (**Annex 1**), the activity that gets profit out of the new facility (Internet) available concerns: apply School library, get information, prepare documents.

*Intermediate consumption* – benefit coming to School when Students reduce intermediate consumption (internal courier, photocopies) is given in **Annex 2**; total saving gives an amount

of **13,44 US\$** per year and per Student. Total benefit is proportionate to total number of Students involved.

*Impact of new facility* - like Teachers, students can save part of their working time when accessing library under automatic procedures. The queuing model (**Annex 3**) shows that, compared to paper-based process, the waiting time for students reduces by 0,6 minutes per hour ( $=60 \times (0,11 - 0,10)$ ) that is **11,52 hours per year** ( $=0,6 \times 6 \times 6 \times 4 \times 8 / 60$ ) which corresponds to an increase in efficiency of **1,30 %** ( $=11,52 / 884$ ).

### **School: Administrative staff – estimating benefits**

The main activities of administrative personnel concern: run accounting, deliver documents, manage personnel, deal with suppliers (orders, supply, payments), prepare salaries (**Annex 1**). For all of these duties the work automation lets saving time and improve efficiency.

The assumed salary is **150 US\$/month**; the cost per hour is **1,55 US\$/hour** ( $=150 \times 12 / 1162$ ).

*Intermediate consumption* – unit benefit coming to School for reduction of intermediate consumption (**Annex 2**) by Administrative personnel is **81,6 US \$** per year and per employee. If month salary is 150 US\$, it corresponds to **4,53%** ( $=81,6 / 150 / 12$ ) of unit annual salary. Total saving is proportionate to number of Administrative people involved.

*Producing documents* - Administrative people is supposed to concentrate main activity into producing document rather than applying Library. Number of documents arriving in the reference hour are supposed to be 1,90 per employee, while number documents that can be completed in the same time are 2,50. **Annex 5** shows that, moving from paper-based to automatic process, number of Administrative people idle are 0,24 and 0,29 respectively with an increase of 0,05. Corresponding saving is **90 US\$/year** and per employee ( $0,05 \times 150 \times 12$ ). Translated into hours the figure gives a saving of **58,06 hours/year** ( $=90 / 1,55$ ) which turns into an increase of efficiency of can increase their efficiency by **5,00%** ( $=58,06 / 1162$ ). Total saving is proportionate to number of Administrative personnel involved.

### **Conclusions**

Economic feasibility of project is, tentatively, calculated in **Annex 6**.

The analysis is carried out separately per each recipient Institution (Polytechnics, Post Offices, Primary & Secondary Schools) as economies provided differ case by case. The connection is supposed to be the same per each category of recipients, so that relevant investment and expenses are considered known. Economies provided are, at present, difficult to assess since real and detailed data (structure of Institutions; number and category of employees; working processes) are not available. Consequently only guidelines can be given in all cases analysed. It is assumed, in the following, that a single wireless connection is implemented.

No Central Unit is supposed to be necessary. Investment cost for the Web server is taken from current experience; investment cost per link is available (it was provided). Operating expenses might be apportioned as a function of people engaged. Revenue are assumed as the sum total of benefits earned by the School (intermediate consumption, self-training, educational).

### *Middle level colleges, Polytechnics & Institutes of Technology*

Within these Institution, Teachers, Administrative people and Students may derive significant benefit from the new facility introduced which they can use to get information, to search for Library, to self-training. Nevertheless, the recourse to Internet and the availability of e-mail might not provide significant return to Schools as an internal system like Intranet would have done; the benefit concerns partial reduction of intermediate consumption and a saving in working time. Labour saving may turn into a benefit in monetary terms only if resulting excess personnel is fired: which is not the case. So that economies back to Schools are assumed to concern mainly, external courier and use of telephone.

A detailed check should be carried out to understand the change in behaviour of personnel and to locate the real saving in term of economies. In this example, with reference to **Annex 2**, Teachers may reduce external courier by **134,43 US\$/year**. The same applies to Administrative people who take advantage of a better contact with external suppliers: in this case, a reduction of telephone calls (**33,24 US\$/year**) and of fax messages (**16,32 US\$/year**) may take place (**Annex 2**). Students might have access to Internet but are not supposed to make large use of facilities provided by the School. Benefit coming from this category is considered **6,72 US\$/year** (50% of photocopies are replaced by direct printing). To carry out the example a Polytechnic is taken as a reference where there are 100 Teachers, 40 Administrative people and 1500 Students. Investment are those estimated at paragraph "Investment and annual expenses"; operating expenses are given as the salary of two people.

Under these input conditions, the IRR model produces a return of -17,74%: the negative sign means that total economies, as quantified above, are not sufficient to cover total expenses incurred in the project. Such final result was expected so that even if, after turning working hypothesis into real data, the IRR keeps negative it does not necessarily mean that the project must be given up. As the main objective is social and educational the responsible of the project might be satisfied to have improved some activities of Teachers and Administrative people which will surely turn into a final benefit to Students. The IRR analysis warns:

- Variations of operating expenses (0-6 people) do not affect significantly IRR;
- Separating investment in two years does not improve final IRR;
- to cover total expenses economies should be 2,6 times the original ones.

### *Post secondary management and business training institutions*

Employees working in Postal Offices are, mainly, Administrative people: the introduction of new facility, possibly completed by automation of office process, lets speed up working procedures so that service to clients can be improved. Queuing models may show the advantages either for employees and for clients. Further, the new facility lets organising part of training in the same location avoiding that employees have to leave their working place to get courses and update their knowledge. Qualitative benefits may be quantified when details about working activity, number of workers, salaries, time of service provided are available. In absence of any information it is impossible to carry out any analysis or any example.

### *Primary and Secondary Schools*

In this case it is not expected that the School can raise significant economies as to face the expenses necessary for the connection to the Network. If some economies appear they concern Teachers and Administrative People and, to less extent, Students. In particular, Teachers may save time by using Internet to access information and Library: this may help them reduce external courier by **134,43 US\$/year (Annex 2)**. The same applies to Administrative people who take advantage of a better contact with external suppliers: in this case, a reduction of telephone calls (**33,24 US\$/year**) and of fax messages (**16,32 US\$/year**) may take place (**Annex 2**). Students might have access to Internet but are not supposed to make large use of facilities provided by the School. Benefit coming from this category is considered zero. To carry out the example a secondary School is taken as a reference where there are 50 Teachers, 20 Administrative people and 500 Students. Investment are those estimated at paragraph “Investment and annual expenses”; operating expenses are given as the salary of two people.

Under these input conditions, the IRR model produces a return of  $-17,96\%$ : the negative sign means that total economies, as quantified above, are not sufficient to cover total expenses incurred in the project. Such final result was largely expected so that even if, after turning working hypothesis into real data, the IRR keeps negative it does not necessarily mean that the project must be given up. As the main objective is social and educational the responsible of the project might be satisfied to have improved some activities of Teachers and Administrative people which will surely turn into a final benefit to Students.

An exercise carried out, with help of IRR model, shows again that:

- Variations of operating expenses (0-6 people) do not affect significantly IRR;
- Separating investment in two years does not improve final IRR;
- to cover total expenses economies should be 2,6 times the original ones