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DISTANCE EDUCATION IN TUNISIA

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Distance Education in Tunisia

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Abstract—*The paper presents the situation of telelearning in Tunisia. The main objective of this project is to support consolidation, condensing and rationalising of deployment guidelines for introduction of advanced communication services and networks in Tunisia. In This paper , a set of important narrowban residential applications are examined and grouped in the following classes: traditionnal learning,telelearning on narrowban and telelearning on braodband. The application classes are ranked according to the interest in the residential and Tunisian telecommunications market. The potential use of the applications is estimated based on a set of alternative prices. The paper shows the utility of broadband connections and compares the results from a similar survey performed in traditional learning. The forecasts in the two studies are quite similar and underline that there will be a substantial demand fore broadband services during the next ten years.*

1. INTRODUCTION

Tele-learning is nowadays in a phase of rapid evolution. Emerging techniques, for network and tools for co-operative work cover a variety of needs. The modularity of current tools satisfies various pedagogic requirements such as conference, tutorials, in diverse institutional contexts: universities, professional training, enterprise, etc.

High bandwidth networks upgrade the quality of service yielding flexible and user-friendly systems. Such infrastructure is likely to provide services with maximised quality-to cost ratio. Low bandwidth alternatives are currently foreseen as a first telelearning solution in many developing countries. Upgrade to broadband will provide higher quality and additional services. TERA will investigate the cost-effectiveness of such an upgradeability highlighting the pertinence of advanced telelearning and its applicability to the north African countries.The first objective of the telelearning business case is to assess and characterise the telelearning services adapted to north Africa. A cost/benefit evaluation of the current Tunisian solution from the user's point of view will be carried out. The study will be completed by assessing the costs of traditional learning afforded by the average university student and comparing to the costs of Internet-based telelearning.A second objective is a perspective technico-economic analysis of key advanced telelearning alternatives such as ISDN or satellite. These will offer better transmission quality, more services and will address a wider user community such as SMEs for technical training, administrations for continuous learning etc.

2. ASSUMPTIONS

Tunisian traditional learning implies sizeable travel and accommodation expenses. In average, we assume 2 hours travel in both directions. The following expenses are associated to conventional learning and tele-learning:

CONVENTIONAL LEARNING

ITEM	AVERAGE COST (EURO)
TRAVEL EXPENSES PER YEAR PER STUDENT (6 ROUND TRIPS PER YEAR)	270
EXTRA SURVIVAL COST PER STUDENT PER YEAR	2000
EDUCATION COST OF THE STUDENT PER YEAR	1500

TELELEARNING

ITEM	AVERAGE (EURO)
EQUIPMENT AT STUDENT'S HOME PER STUDENT	1650
EQUIPMENT IN THE LEARNING CENTRE	16000
TELELEARNING SOFTWARE CENTRAL	1500
COST OF MAIN LEARNING CENTRE PER HOUR	50
COST OF REMOTE LEARNING CENTRE PER HOUR	50
TRANSMISSION (TELECOM COST) PER STUDENT PER YEAR - PSTN	2025
EXTRA TEACHER COST PER ONE HOUR COURSE	165
TECHNICAL PERSONNEL COST PER ONE HOUR COURSE	100
EXTRA DOCUMENTATION COST PER STUDENT PER YEAR	150
SOFTWARE EDUCATIONAL PACKAGE PER STUDENT PER YEAR	50
TRAINEE LABOUR COST DURING TRANSPORT PER HOUR	20
NUMBER OF STUDENTS	200
NUMBER OF TRAINEES IN REMOTE LC PER LECTURE	10
INFLATION RATE	5,00%
NUMBER OF TL HOURS PER YEAR	450
DISCOUNT RATE	5,00%
NUMBER OF REMOTE LEARNING CENTRES	10
COST OF ONE MINUTE DISTANT CALL - PSTN	0,09
DURATION OF ONE LECTURE [MIN]	50
ISDN – CONNECTION	185
ISDN – RENTAL PER YEAR	115
ISDN – TRANSMISSION PER MINUTE	0,11

3. SERVICES

In Tunisia, IRSIT carried out two experiments on distance learning. These were linking IRSIT in Tunis to Mohammadia School of Engineers (EMI) in Rabat-Morocco and to the National School of Engineers of Monastir in Tunisia (ENIM). These experiments checked the feasibility of real time, low-bandwidth distance learning. A course has been given by IRSIT in direction of either the EMI or the ENIM. This course consists of an HTML document (transparencies) accompanied by real time commenting by the professor. Full verbal or written interactivity. A point-to-point connection ensuring data and voice traffic was established on two lines of the switched telephone network (PSTN). This choice is due to the low bandwidth available on PSTN. The measurements recorded an average productive flow of 14.400 Kb/s, which is insufficient to transport voice and data on a same channel. In order to share equitably the communication costs, the data call was initiated by the remote trainee whereas the voice call was made by IRSIT. Appropriate voice communication was ensured by good quality telephone terminals equipped with the free-hand call and sound amplification. At IRSIT side,

the sound signal was fed into a hi-fi amplifier with good quality loudspeakers. The data connection has been established on a second point-to-point PSTN line between a customer located at the remote training centre and a server located at the local training side. This connection has supported a TCP/IP traffic. The tool for data synchronisation, OXALIS, has been assembled on this connection, the server function being ensured by the local training side. The image quality has been significantly improved by the use of a 1024*728 pixel data-processing video-projector.

4. ARCHITECTURES

4.1. CURRENT TELELEARNING ARCHITECTURE IN TUNISIA

The architecture of the narrow band telelearning system based o PSTN transmission comes out from the experiments carried out in co-operation between IRSIT and CNET. For these experiments CNET offered the OXALIS software and the necessary assistance to its implementation. IRSIT was in charge of installing the server and realising the support of the demonstration lectures. The basic architecture developed is illustrated in the figure 1. Two other versions were derived from this basic one :

- PC communicating to one PC
- LAN communicating to another LAN

4.2. ADVANCED TELE LEARNING ALTERNATIVE 1: ISDN

4.2.1 Objective

The educational quality of telelearning is closely related to the degree of interactivity between the various actors. Interactivity should be fully transparent and should be ensured for video, voice and text as well. Consequently, the remote interactivity tool must operate under "noiseless" conditions. OXALIS is a telelearning system developed by France Telecom/CNET within the "Information Highway" project. It is built on two associated networks in order to provide full interactivity between the conference centre and the various telelearning sites or auditoriums. In each auditorium, the trainees can see and listen to the speaker in the conference centre thanks to the H320 videoconference technology, operating over a synchronous ISDN network. The speaker and the trainees can interact at every moment, locally or remotely . Furthermore, an Internet-based technology, enables the speaker and the trainees to browse through HTML documents. The speaker and the trainees have various tools to annotate the documents: mouse, electronic pen or even tactile board. This system, commercialised by Mob'Activ is currently in use by a number of Universities in Brittany (western France) and Paris.

4.2.2 The solutions

These imply point to point or multipoint alternatives, depending on the protocols used : H320 or H323 and on the bit rate available, *i.e.* the number of ISDN accesses per site. Two scenarios are described below : one involving a point to point solution and H320 equipment and another consisting of a multipoint alternative with H323 equipment.

Scenario 1

Two sites are involved, each with the following equipment :

- ISDN access,
- multimedia PC,
- an appropriate communication set-up : modem or ISDN adapter and
- H320 videoconferencing kit.

The PC at the teaching site is equipped with Windows NT 4.0 (server or workstation). It bears FTP server services, HTTP server, OXALIS server and Remote Access Server configured on its ISDN adapter .

Scenario 2

Here all sites can be used either from the professors or the trainees. All server services (HTTP, FTP, OXALIS, H323 Cnet Conferencing) are clustered in an ad hoc site . In this configuration all traffic is implicitly IP et H323. Therefore it is much easier to handle the communications. For example, by dedicating the voice channel to co-operative work on a document. The site hosting the supporting services must have as much ISDN lines as trainee + teacher's terminals in the service. Teaching services can be upgraded using tele-writing (electronic board).

4.3 ADVANCED TELE LEARNING ALTERNATIVE 2 : BROADBAND SATELLITE INTERNET SERVICES

In September 1999, the US operator Tachyon is expected to offer a Europe-wide fast Internet access through satellite. In practice, these access services will be asymmetric: downstream bit rate up to 45 Mbit/s and upstream up to 256 Kbit/s. High bandwidth web services will be hosted by the national access providers in order not to penalise the satellite link performance. This offer will be valid all over the European territory. This suits particularly the multi-site enterprises requiring fast Internet access even in remote areas with poor telecommunications infrastructure. This is also likely to allow the development of high performance mobile workstations, since the system configuration is fully automatic from the moment the control PC is linked to the satellite. Then, mobility is achieved by simply moving the dish and the control PC. Three service levels will be proposed :

1. Premium Priority Service, equivalent to E1 link at 2 Mbit/s, will cost about 1200 Euros/month.
2. Medium Enterprise Service, equivalent to DSL Lite access, will cost about 800 Euros/month.
3. Small Enterprise Service, equivalent to ISDN basic access, will cost about 400 Euros/month.

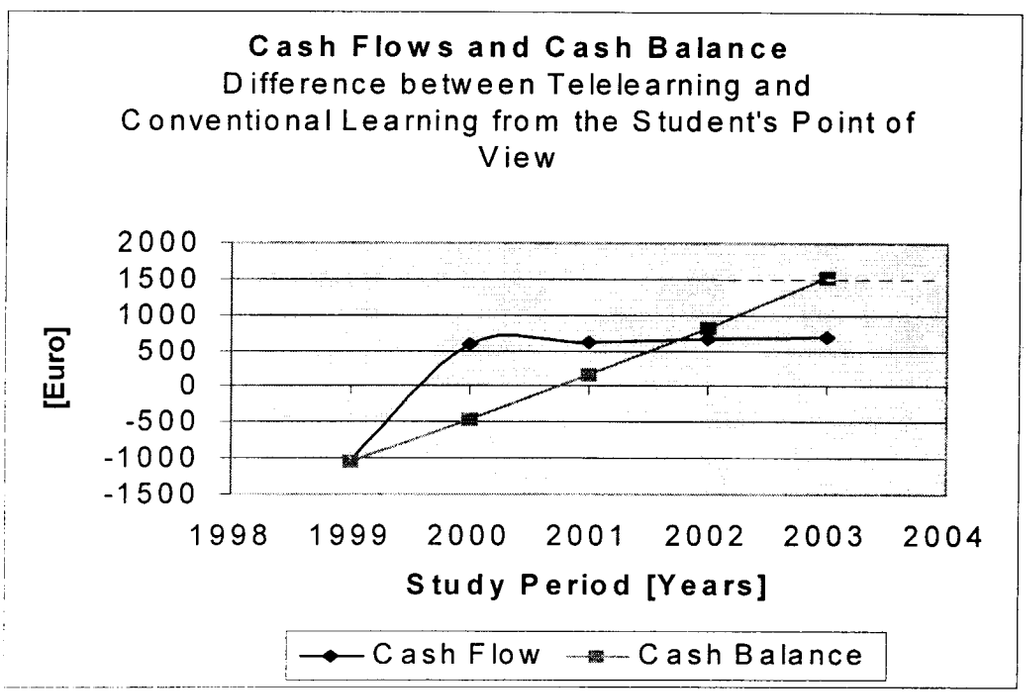
The user must acquire a satellite kit including a 90 cm dish and a router PC with the decoder. Tachyon guaranties an installation delay less than 14 days. The customer premises equipment and its installation and test will cost about 3500 Euros.

5. TECHNO-ECONOMIC ASSESSMENT

5.1 COST/BENEFIT ANALYSIS

Cost/benefit analysis is a prerequisite to the « before » phase of an investment project. This is a process of making shared assessments of investment projects which identifies, measures and compares actual and potential costs and benefits of an application over the entire application life cycle. It incorporates all costs and benefits incurred during the entire life cycle and includes operating costs as well. Cost/benefit analysis in TERA focuses on the end user point of view. The goal of cost benefit analysis is to assess the costs and benefits of new telecommunications services to a specific group of users compared to the costs and benefits of traditional solutions for this user group. This is a critical step for decision makers, since it helps to identify and manage costs, run the project in a more business-like manner, optimise return on investment and compare the financial and non- financial impact of a project. The framework for the cost benefit analysis consists of six steps:

1. Identification of key user groups, life span of the application and discount rate.
2. Identification of benefits (by business owner) and costs (by cost/benefit project manager), both direct and indirect over the life span of the application.
3. Calculation of Net Present Value
4. Definition of key parameters and performance indicators
5. Sensitivity and impact analyses
6. Assessment of the worthiness of the project, evaluation of options and go/no go decision



The objectives of the cost/benefit studies are the :

- Identification of the costs and benefits of a telecommunications project
- Use of the technique of the discounted cash flow
- Calculation of the net present value for after-tax cash flows and comparison with the conventional alternative
- Calculation of the willingness to pay of the user
- Cost/benefit analysis as a comparison of alternatives over a study period

Commonly, the time period considered for economic evaluation ranges from 5 to 10 years. For telemedicine and telelearning, a time period of 5 years was considered appropriate, since new emerging technologies may thoroughly alter a scenario over a longer period.

5.2 RESULTS

The TERA software tool has been used for the cost/benefit calculation of the Business Case both for the current telelearning system in Tunisia based on the PSTN and for the advanced system based on the ISDN transmission. Going out from the above assumptions the following calculations have been carried out: Cash Flows (CF), Cash Balance (CB) and Net Present Value (NPV) for both PSTN and ISDN and for the ISDN system also the economics of the telelearning services provider. The CFs, CBs and NPVs have been calculated for conventional learning and telelearning from the point of view of student (end user). Since there are no revenues for the end user the NPV, CFs and CBs are always negative. Therefore the results of cost/benefit analysis presented here are expressed in terms of differential of CFs and CBs between telelearning and conventional learning. It turns out that the differential of CFs and CBs are positive in favour of the telelearning. Also the absolute value of the negative NPV for telelearning is less than for conventional learning.

5.3 NET PRESENT VALUE – PSTN TRANSMISSION

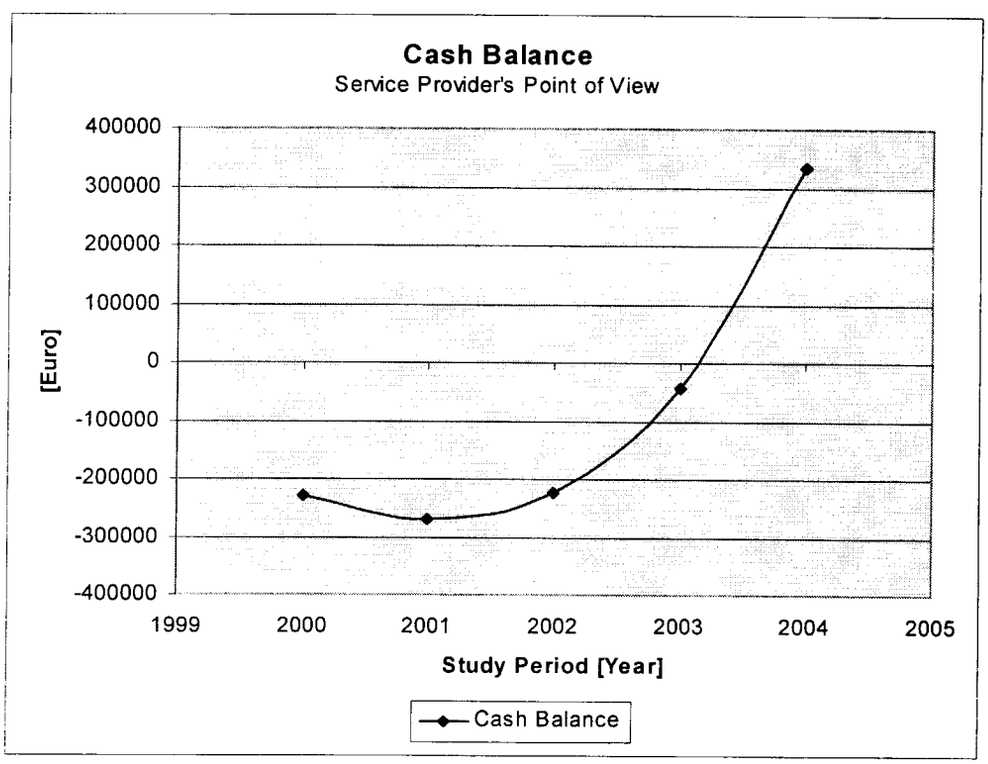
In this evaluation based on PSTN and directed to individual students a most of cost (investments and substantial part of running cost) are covered by society – Ministry of school and education. The economy of such a project is influenced by number of parameters from which the significant two are the transmission cost and number of participating students. Results of the sensitivity analysis based on these parameters are carried out in Figure 7 in terms of the difference between NPV for telelearning and for conventional learning for two numbers of students. The transmission cost ratio represents the portion of total transmission cost paid by student.

The rest is covered by the society. It can be seen that also from the point of view of the society the project of the telelearning could be economically advantageous and that increasing the number of students who will use the telelearning system will increase in a significant way the differential between telelearning and conventional learning, in favour to telelearning. The analysis of the telelearning system based on the ISDN transmission goes out from different form. It has been supposed that the telelearning services are offered by a provider and used by organisations (companies, SMEs) for groups of trainee in telelearning centers. These centers are built up, equipped and operated by the service provider and the end user pays for the lectures. In the following two graphs - the differentials between Cash Flows and between Cash Balances and also NPVs for telelearning and conventional learning from the point of view of the user - are carried out (one week course per year, ten trainee in the group). As can be seen from the calculation results the system of the tele education brings financial savings to the end user also in this analysed case of ISDN transmission. But the system can be economically interesting for the service provider as well. The economy of the project from the point of view of the telelearning services provider is summarised in the following table. The last graph shows the Cash Balance which is out of red figures after the fourth year of duration.

ECONOMY OF THE ISDN TELELEARNING PROJECT

NPV	560 733	2000	2001	2002	2003	2004
IRR	40,4 %					
Investments		184 321	62 112	72 254	87 018	110 441
Running Costs		358 271	512 927	741 688	1 089 663	1 621 341
Revenues		279 189	520 664	885 091	1 434 345	2 274 255
Cash Flows		-263 402	-54 375	71 149	257 664	542 472
Depreciations		36 864	49 287	63 737	81 141	103 229
Profits		-115 946	-41 549	79 666	263 541	549 684
Taxes		-34 784	-12 465	23 900	79 062	164 905
Retained Cash Flows		-228 619	-41 910	47 249	178 602	377 567
Cash Balance		-228 619	-270 529	-223 279	-44 677	332 889

CASH BALANCE OF THE ISDN TELELEARNING PROJECT



6. CONCLUSIONS AND PERSPECTIVES

In the contemporary education system the role of tele education applications is of increasing importance. The previous paragraphs show that also the economical aspect of the service can be interesting both from the point of view of the end user and from the point of view of the service provider. Let us to try to bring together the conditions of introducing of telelearning systems specific to North African countries. It is possible to split these conditions basically to the three different groups:

Needs and requirements:

- All the North African countries have expressed the need for applying new approaches to learning through the adoption of distance learning methods;
- Many of the countries have plans for distance learning, however they are not in place in terms of implementation and operation;
- All countries need to develop their professional skills;
- Institutional as well as national interest and need was highlighted by all countries and organisations;

National Communication Services and Infrastructure:

- All countries have an adequate communication infrastructure capable of supporting the operation of the network;
- Basic telecommunication services exist in all the countries, and Internet access is available through public and private providers;
- The telecommunication tariffs are relatively high in most of these countries, but this is to be expected due to the nature of state monopoly of telecommunication services in all countries;
- Telecommunication tariffs are expected to decrease during the next few years due to deregulation, privatisation and the fact that most countries are joining the WTO, which requires the deregulation of telecommunication services;
- Although different schemes for on demand bandwidth exist in all countries, not all of them are capable to provide ISDN services (which is the recommended medium for connectivity), but all have alternative scenarios.