Prospects of the 3G Mobile Networks in Greece

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ABSTRACT

This paper analyses the financial impact of the deployment and operation of the UMTS networks on Greek mobile operators. A Greek incumbent operator with market share 30% throughout the ten-year period of the study has been examined. The methodology and the tool developed in ACTS-TERA and IST-TONIC projects have been utilized for this case study. Initial economic conclusions have been derived, presented and discussed using key profitability factors such us Net Present Value (NPV), Internal Rate of Return (IRR) and payback period. The techno-economic evaluation is followed by a sensitivity analysis in order to identify the impact of the most important parameters such us UMTS penetration, market share, tariff level and usage level.

I. INTRODUCTION

There are many different opinions whether UMTS or 3G will be successful. There are experts that believe in a UMTS migration of 50% by the year 2005 and average revenue per user (ARPU) above €110 per month. On the other hand there are others who believe it will be delays, low UMTS penetration and an ARPU not much higher than today. This paper investigates the financial consequences of the implementation of UMTS on Greek mobile operators. The analysis has been performed for an incumbent operator with a market share of 30%. The business case spans from 2003 to 2012 with UMTS roll-out start year 2003. Furthermore, sensitivity analysis has been carried out to show the needed UMTS penetration, market share, tariff and usage level for the operator to get a satisfying business case. The investment analysis was based on the tool, which was developed by ACTS-TERA[1] and IST-TONIC [2] projects.

II. REGULATORY CONTEXT

The Greek National Regulatory Authority (EETT) proclaimed four UMTS licenses, to be auctioned on June 2001. The frequency spectrum available on auction was 2x60 MHz paired bandwidth at 1920 – 1980 MHz and 2110 – 2170 MHz and 20 MHz unpaired at 1900-1920 MHz. Auction's initial price was set at 147 M€ for a license period of 20 years. Three corporations applied for the licenses in Greece, and three licenses were issued. The operators that acquired the licenses were Vodafone - Panafon, Cosmote and Telestet, all of which are incumbent operators with GSM and GPRS networks in Greece. All three of them paid the same license fee of 147 M€, which corresponds to a fee of €13.35 per inhabitant. 40% of the fee had to be paid with the license issue and the remaining 60% has to be delivered in four equal in amount, interest-free annual installments starting from the end of 2005. Each licensee has the obligation to cover at least 25% of the Greek population before December 2003, and 50% of the population before December 2006. Furthermore, the agreement included service coverage of all Athens 2004 Olympic Games sites all over the Attica province, as well as the main streets which lead to all Olympic Games sites, until June 2004.

III. FRAMEWORK AND ASSUMPTIONS

The analysis was based on a Greek incumbent mobile operator. It is assumed that this operator owns and operates both a GSM and a GPRS network. The operator starts with 30% market share in 2002 (only GSM users) and maintains this share for the whole ten-year period of study. Today the three existing players have market shares from 25 to 35% approximately.

The techno-economic modeling was carried out using the TONIC [2] tool. This tool is an implementation of the techno-economic modeling methodology developed by a series of EU co-operation projects in the field. The tool has been extensively used for several techno-economic studies [3] among major European telecom organizations and academic institutes.

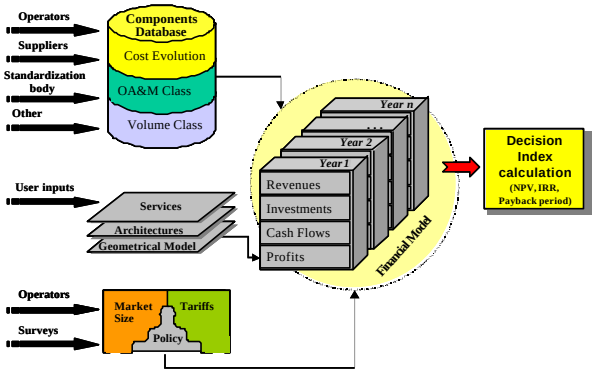

Figure 1 – Techno-economic Methodology

The base of the model's operation is a database, where the cost figures of the various network components are reposited. These figures are constantly updated with data gathered from the biggest European telecommunication companies. The database outputs the cost evolution of the components over time. A radio dimensioning model is used to calculate the number of BTSs as well as their cost, for the set of services and the network architectures defined. Finally the future market penetration of these services and the tariffs associated with them, which have been calculated through market forecasts and benchmarking, are inserted into the tool. All these data are forwarded into the financial model of the tool that calculates revenues, investments, cash flows and other financial results for the network architectures for each year of the study period. An analytical description of the methodology and the tool can be found in [4]

IV. NETWORK ARCHITECTURE

Since the operator already maintains and operates a GSM/GPRS network, it has been taken into consideration how current and future technologies can be merged in one common network, utilizing many of the GSM network elements and reducing network set-up costs.

For the Core Network the existing infrastructure can be reused in most cases. Specifically, MSC, SGSN and GGSN can be transformed into MSC server, SGSN server and GGSN server respectively. The HLR, and the SCCP Relays can be used both in GSM and UMTS networks. However, the MGW will be a completely new node.

As far as the Radio Network is concerned, the UMTS Terrestrial Radio Access Network (UTRAN) is in principle a network overlaid to the GSM BSS. The nodes are expected to be new ones and only limited equipment reuse capabilities are available. However possibilities to reuse common transmission, power supply, cooling system, feeders and antennae with GSM do exist and will be pursued.

The architecture of the UMTS network infrastructure used in our study is illustrated in the following diagram.

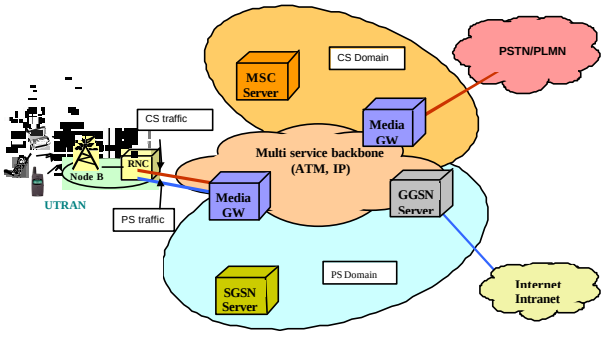

Figure 2 – Network Architecture

Except of the Network Elements, other components, such as the DNS, mediation and billing systems can be shared with GSM/GPRS.

V. MARKET FORECAST

Based on the official data for the Greek market, announced by the operators (figure 3), and assuming a subscription penetration of 120% until 2012, we can estimate the demand for mobile services in Greece.

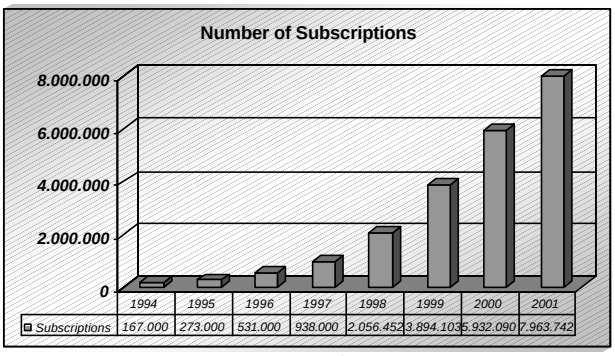

Figure 3 – Number of Subscriptions

Based on these results and assuming that the percentage of subscribers holding more than one mobile station starts from 0% and saturates to 33%, the subscriber penetration has been estimated as well. For the estimation of both demand curves a logistic model with four parameters [5] was applied. The curves are illustrated in the diagram below.

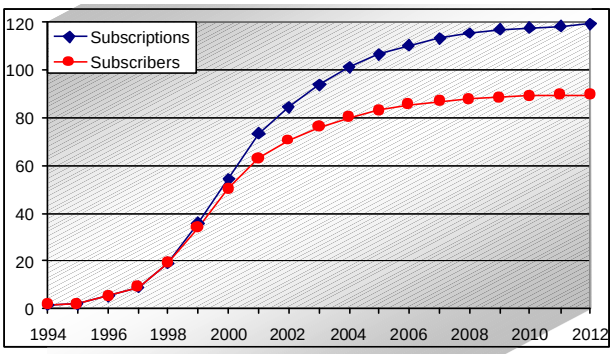

Figure 4 – Subscriptions and Subscribers vs Year

The total subscriber penetration is split into three different mobile system generations, namely GSM or 2G, GPRS or 2.5G and UMTS or 3G. When the period of study starts in 2002 only GSM users are considered to be in the mobile market. Their number will constantly decrease until 2012 when they will totally disappear. The first GPRS users will appear in 2002. The saturation level for 2.5G is 40% for Greece and will be reached in 2007. Following that period there will be a decline in the demand down to the level of 25% until 2012. As for the UMTS users, they will appear at the end of 2003 and their number will increase to reach a percentage of 75% of the total mobile market in 2012 when the case study finishes. A logistic model [5] was also applied to estimate the percentages for the different system generations for the years 2002 – 2012. The results are illustrated in the diagram below.

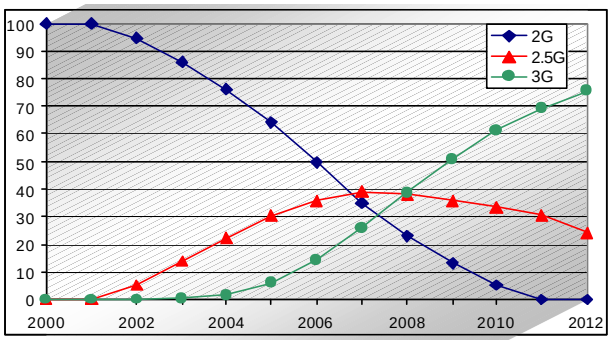

Figure 5 – Penetration Forecast for different Systems

Combining the results for the total mobile subscriber penetration and the market share of each of the mobile systems, the penetration forecast for these systems has been calculated.

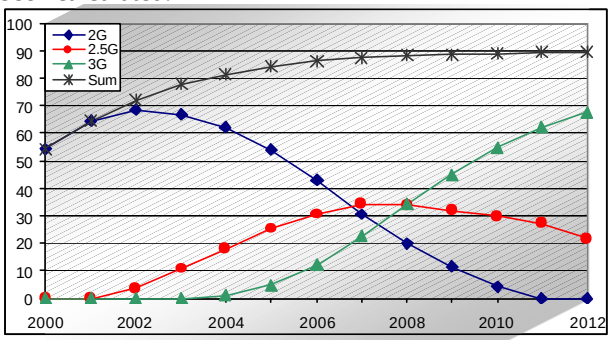

Figure 6 – Mobile Subscriber Penetration Forecast

In order to achieve a better approach of the real market the subscribers have been divided in business and residential users based on the network usage and the services they use. The main characteristics of each category are:

- business users, with intensive and professional use during the day and with private use during the evening
- residential users, with low private use. Almost all the prepay users belong to this category.

Subscriber penetration in the two market segments has been taken into account in our study. The first users who are going to adopt the service will be the business users. Their difference in numbers from residential users is going to grow until the end of 2006 when the first suburban areas will be covered. In the following years and until 2012 the service will penetrate rapidly in the mass market and the proportion will change for the benefit of the residential users. In 2012 the ratio will be three residential users to one business user.

VI. SERVICES AND TARIFFS

In order to determine the impact of various services on network dimensioning and revenue for the operator, specific service classes in terms of bandwidth quality of service has to be defined. The UMTS Forum [6] has listed a broad range of services, which should be made available with the advent of UMTS. These services are grouped in six main categories. The required bandwidth, as well as some examples for these categories are shown below.

Table 1- Categories of 3G Services

Category	Service bandwidth UL/DL [kbit/s]	Sample Services
Voice Services	28.8/28.8	Voice, IVR, Voice Mail
Messaging Services	28.8/28.8	SMS, E-mail
Switched Data Services	43.2/43.2	Low speed internet/intranet access, fax
Medium Multimedia	20/768	Interactive games, lottery, betting, simple e-commerce
High Multimedia(MM)	20/1000	m-commerce, m-portals, LAN access, Audio/ video on demand
High Interactive MM	256/256	Video-telephony, videoconference

For the above services specific tariffs have been assigned based on tariffs of existing fixed services [3],[7] plus a 50% premium for mobility. A 5% reduction per year in the tariff prices has been implemented for the whole period of study, resulting to a 50% price cut-down by the end of the decade.

VII. RADIO DIMENSIONING

After the penetration estimation of subscribers, each of the two market segments and each service respectively, the computation of the set up cost of the network is the next step. The roll out will be progressive. First the dense urban and urban areas will be covered so as the service will be available to the 25% of the total population at the end of 2003 fulfilling the initial license agreement. Then the suburban areas will be covered until 2006 and finally the operator will start the coverage of the rural areas at 2008. The analysis of the population distribution in Greece is based on data from the National Statistical Service of Greece [8] and shows that 45 – 55% of the population is in urban area, which is 4% of the whole area, 10 – 15% is in suburban area, which corresponds to 10% of the whole area and the rest is in the rural area. Further the peak of spectrum demand comes from the urban pedestrian environment.

The radio dimensioning procedure takes into account first coverage then capacity. Initially physical coverage to the whole area of interest is ensured. Dimensioning is based on the service with the most demand for capacity, which is in this case 1 Mbps. According to the existing number of BTS sites, the number of cells per site and the number of TRX per cell, the available capacity per square kilometer in a specific area is computed. This capacity is matched against the data rate required to

accommodate the maximum number of users in the area and when the user load exceeds the capacity, it is necessary to add UMTS base stations. Advanced services will delay to be adopted from the mass market, therefore the main dimensioning criterion, which determines the roll-out cost is coverage.

VIII. FINANCIAL RESULTS

Apart from subscriber penetration, penetration of each service, capacity demand and set up costs many other factors have been taken into consideration in order to evaluate the viability of the project. These factors are input parameters to our model. Firstly we have taken into account an additional percentage of 5% to the annual revenues due to roaming agreements. Secondly we have counted in a percentage of 15% to the operational costs for content provision [9], as well as a cost of €120 per subscriber for terminal subsidy. Thirdly the operator will have to invest €1 annually per subscriber for marketing costs. Finally the license fee is €146.735.200 that corresponds to €13.35 per inhabitant.

Three techno-economic criteria have been computed in order to evaluate the viability of the project; NPV, IRR and payback period. The main financial results after the end of the tenth year for the Greek incumbent operator with market share of 30% are illustrated below.

Table 2 – Financial Results

Name	Value
NPV	80.594.261
IRR	11.2 %
Pay Back Period	8.61
Number of Customers	2.232.430
Total mobile penetration – end	90.0%
Total UMTS penetration – end	75.6%
Investments	664.926.391

The investment is profitable and the Payback period for the operator is 8.61 years. Furthermore the IRR for the planning horizon of ten years is 11.2%.

The following figure illustrates the investments, revenues and cash balance for the basic scenario.

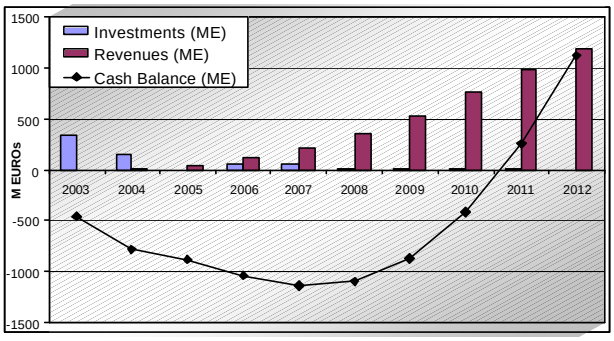

Figure 7 - Investments, Revenues, Cash Balance

The biggest amount of the investments is required in the first two years in order to install the UMTS BTSs in urban and suburban areas. Rural areas network implementation in 2006-2007 will call for substantial investments. The lowest point of the cash balance curve indicates the maximum need for funding. For the operator of our study this amount is €1.137 billion. The significant slope of the cash balance curve at the end of the period indicates good future earning potential.

IX. SENSITIVITY ANALYSIS

The above results regard a basic scenario with given parameter settings. Given that there are a lot of uncertainties in the business and different forecasts about the development of UMTS, a comparison of results for different scenarios would prove to be of interest. In order to gain a more complete picture of how the investment project performs in regard to the modification of these settings, sensitivity analysis is needed. The value of each of the parameters has been modified in order to evaluate its impact on the most important techno-economic criteria, Cash Balance, NPV, IRR and Payback period. The four parameters with the greatest impact for which the sensitivity results are presented here are UMTS penetration, market share, tariff level and usage level.

A. UMTS Market Penetration

The most significant factor of uncertainty for the UMTS project is the penetration of the service. In the basic scenario the UMTS users are 75% of the total mobile users at 2012. This is rather optimistic. Recently, the UMTS Forum [10] has reviewed its forecast for the UMTS penetration at the end of 2010, and announced significantly lower percentages. Given that penetration is not expected to exceed 75%, only the negative variation of the parameter has been examined.

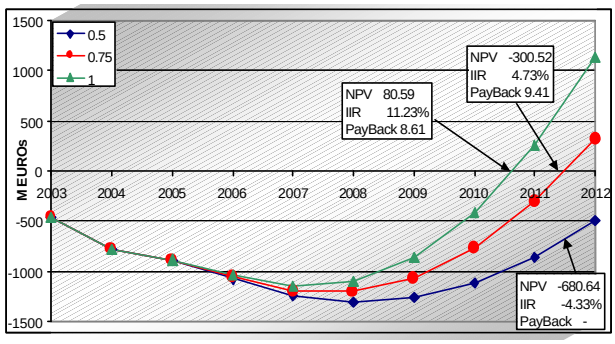

Figure 8 - Sensitivity on UMTS Market Penetration

The change of the main techno-economic criteria has been investigated by multiplying the UMTS penetration by a factor of 0.5 and 0.75, corresponding to penetration 37.5% and 56.25% respectively and the results have been compared with those of the basic scenario.

In both cases we ended up in negative NPV. Moreover in the occasion of penetration 37.5% at 2012, we get negative IRR and the payback period is not within the ten year period of our study.

From the analysis we also conclude that the UMTS penetration must be at least 49.5% in order for the operator to take its money back in ten years' time. The NPV becomes positive for penetration values more than 70.5%. Finally the IRR value exhibits similar behavior for penetration values more than 46.5%.

B. Market Share

In the basic scenario the operator has a market share of 30% throughout the study period. The variation of +/- 50% of its market share has been examined, corresponding to market share 15% and 45% respectively. The IRR remains positive even in the 15% case. On the other hand NPV changes to positive for market share more than 27.8% and the payback period is less than 10 years for market share lower than 15.5%

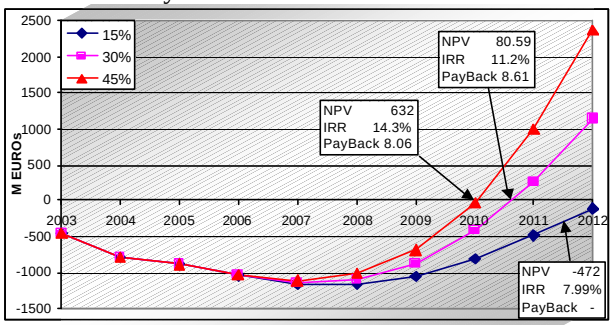

Figure 9 - Sensitivity on Market Share

C. Tariff Level

Another very critical factor for the viability of the project is the tariff level. The competition is expected to be very hard and there is a lot of uncertainty concerning the values where the tariffs will be stabilized. The tariff level has been modified by +/-30% from the nominal value and the impact of the modification has been observed.

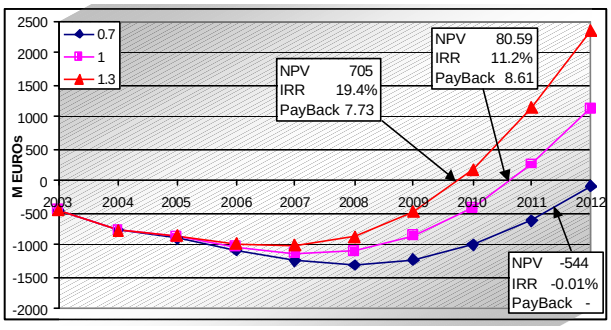

Figure 10 - Sensitivity on Tariff Level

In case of 30% higher prices, our criteria indicate very good potential for the operator' s investment. The values for NPV, IRR and Payback period are more promising even from the case of market share 45%. In contrast, for the -30% scenario all three of our criteria have negative values, a more discouraging case than the 15% market share scenario. In order to have positive NPV and IRR the tariff level should be at least 96% and 71% of the nominal values respectively.

D. Usage Level

Modifying usage affects our criteria in a way similar to the modification of tariff level. This behavior is rather expected, since the parameters are strongly associated.

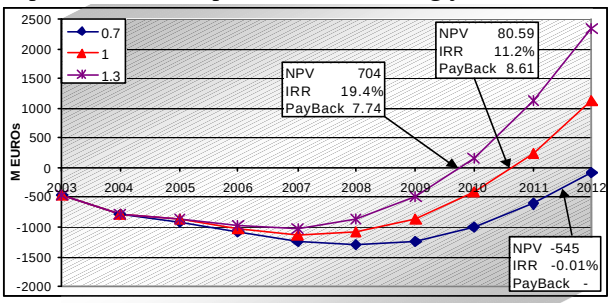

Figure 11 - Sensitivity on Usage Level

NPV and IRR turn to negative for usage levels corresponding to 96% and 70.4% of the ones used in the basic scenario respectively.

X. CONCLUSIONS

The techno-economic prospects for an incumbent operator planning to build and operate a UMTS network are found to be encouraging, according to the base scenario of this study. However, this might prove to be a pitfall. Due to the struggling financial circumstances worldwide, and especially the telecom sector' s downturn, UMTS forum has announced a less optimistic penetration forecast to the one initially announced. Furthermore, there are many concerns on the usage of the services as well as the profit margin due to the strong competition expected. The sensitivity analysis showed that for the most critical parameters the project is very sensitive to modifications of them. In many cases we get negative results and payback period greater than ten years even for small variations of them. As a result of this the operators must have enough financial resources to stay in debt for a long period of time.

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