PAKISTAN TELECOMMUNICATION AUTHORITY
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DETERMINATION ON COST-BASED INTERCONNECTION CHARGES FOR FIXED-LINE AND MOBILE OPERATORS

Dates of Hearings:	26th February 2008 and 30th April 2008
Venue of Hearings:	PTA H/Qs, Islamabad
Date of issuance of the instant Determination	14h May 2008

The Authority Present:

Maj. Gen. (R) Shahzada Alam Malik:	Chairman
S. Nasrul Karim Ghaznavi:	Member
Dr. Muhammad Yaseen:	Member

The Issue:

"Cost-based interconnection charges for fixed-line and mobile operators".

Determination of the Authority

1. INTRODUCTION

The Pakistan Telecommunication Authority (the "Authority") is a body corporate established pursuant to Section 3 of the Pakistan Telecommunication (Re-organization) Act, 1996 (the "Act"), which performs, among others, the following functions:

(i) regulate the establishment, operation and maintenance of telecommunication systems and the provision of telecommunication services in Pakistan;
(ii) promote and protect the interest of users of telecommunication services in Pakistan;
(iii) promote the availability of a wide range of high quality, efficient, cost effective and competitive telecommunication services throughout Pakistan;

(iv) regulate arrangements amongst telecommunication service providers of sharing their revenue derived from provisions of telecommunication service; and
(v) regulate competition in the telecommunication sector and protect consumer rights.

Whereas under clause (h) of sub-section (2) of Section 5 of the Act, the Authority is empowered to provide guidelines for, and determine, the terms of interconnection arrangements between licensees where the parties to those arrangements are unable to agree upon such terms.

Sub-rule (11) of Rule 13 of the Pakistan Telecommunication Rules 2000 (the "Rules") requires the Authority to take into account the following matters when determining the terms and condition of an interconnection agreement, including the interconnection charges:

(a) the promotion of non-discrimination between operators in similar circumstances providing similar services;
(b) the promotion of competition;
(c) relevant operators should allow flexibility to the other operators as to the points of connection, manner of conveyance of traffic and the routing of intelligence;
(d) protection of the interest of customers;
(e) maintenance of the public switched network and inter-operability of services; and
(f) the relative market position of the parties.

Sub-rule (4) of Rule 16 of the Rules provides: *"The SMP operator's interconnection charges shall, as soon as practicable, be based on LRIC in the manner determined by the Authority and shall include a reasonable rate of return on LRIC costs but the SMP operator shall not be obliged to charge on the basis of LRIC until it has put in place the necessary accounting and management information systems which shall enable it to do so in accordance with a reasonable time table determined by the Authority. The SMP operator shall also be entitled to recover a contribution to its common costs in the manner determined by the Authority. For these purposes, "common costs" means costs that are incurred in connection with the production of multiple products or services and remain unchanged as the relative proportion of those products or services varies. Pending the introduction of LRIC in accordance with this sub-rule the SMP operator's interconnection charges shall be based, as far as possible, on cost-oriented interconnection charges for similar services provided by telecommunication operators in other countries providing comparable telecommunication services to those provided by the SMP operator."*

Pursuant to the powers given under clause (h) of sub-section (2) of Section 5 of the Act, the Authority issued the Interconnection Guidelines, 2004 (the "Guidelines"). The Guidelines provides certain principles of interconnection, which includes:

(i) interconnection and related services and facilities shall be provided on the basis of unbundled network elements and charged accordingly. A requesting operator shall only pay for the network components or facilities of the interconnection that it requires;

(ii) the operators shall not unfairly discriminate the terms of interconnection among different operators. An operator shall offer same interconnection terms to other operators as compared to his own similar operations or affiliates;

(iii) charges for interconnection services shall be cost-oriented;

(iv) cost of inefficiencies of an operator should not be passed on to other operators through higher interconnection charges; and

(v) *interconnection arrangements should encourage efficient and sustainable competition.*

Clause 18 of the Guidelines requires the Authority to approve the level and structure of interconnection charges. As per clause 18.2 of the Guidelines, interconnection charges are to be based on following principles, namely:

(a) *The structure of interconnection charges shall reflect the behavior of the underlying costs. Relevant interconnection costs may have different relationships with interconnection activity i.e. some costs may be fixed while others may vary with usage. To the maximum possible extent, fixed costs shall be recovered through fixed charges while variable costs shall be recovered through a per unit charge related to the underlying activity. Moreover, peak and off-peak charges should be set where there is a significant difference in costs.*

(b) Interconnection charges shall be set on objective criteria and follow the principle of transparency and cost orientation. The burden of proof that the charges are derived from relevant costs, including a reasonable rate of return on investment, shall lie with the operator providing interconnection to his network. The Authority has the right to demand full justification for the interconnection charges being demanded by the operator providing interconnection. The interconnecting operator may set and charge different rates, terms and conditions for providing interconnection for different categories of telecommunications services, where such differences can be objectively justified on the basis of the type of interconnection provided. The Authority shall ensure that such differences do not result in distortion of competition.

(c) Interconnection charges shall be sufficiently unbundled to ensure that an operator requesting interconnection is not required to pay for network elements or facilities not required for the service to be provided.

(d) Interconnection charges shall not include hidden cross-subsidies, particularly of anti-competitive nature.

(e) Interconnection charges shall include a fair share of joint and common costs and costs incurred in providing equal access and number portability, and of the cost of ensuring essential requirement.

The Guidelines provide that the interconnection charges that do not conform to the Guidelines may be varied by the Authority. The Guidelines also provide that where adequate cost information is not readily available, the Authority may establish interconnection charges on the basis of benchmarking.

2. BACKGROUND

The Authority through its Determination No. 14-223/L&A/PTA dated 6th May 2005 determined the interconnection charges for PTCL (the incumbent fixed-line operator) on the basis of international benchmarking and cost estimates submitted by PTCL. The charges determined were as follows:

Origination & Termination Charges:

PKR/min.

Call Type	Peak	Off Peak -1	Off Peak –2
Metropolitan	0.52	0.40	0.30
National 25 - 80 km	0.85	0.43	0.32
National 80 -160 km	1.25	0.70	0.35
National > 160 km	1.35	1.03	0.52

Transit Charges:

PKR/min.

Call Type	Peak	Off Peak –1	Off Peak –2
Metropolitan	0.10	0.07	0.05
National 25 - 80 km	0.33	0.23	0.16
National 80 - 160 km	0.73	0.50	0.36
National > 160 km	0.83	0.59	0.42

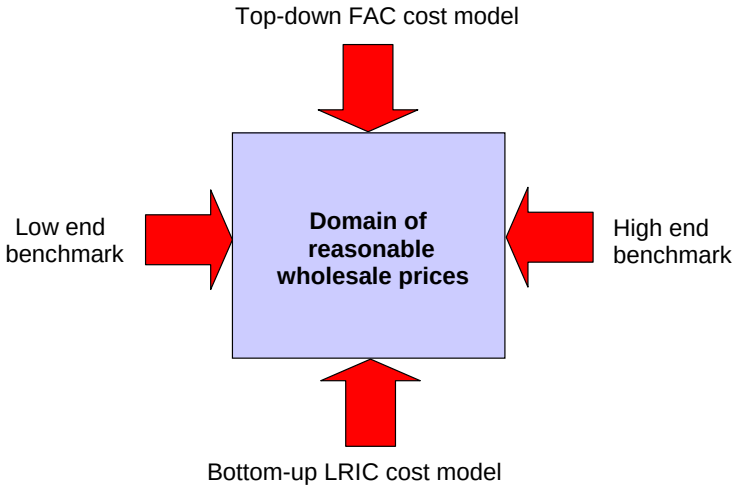
During the same year, the Authority through its Determination No. 15-30/05/(CA)/PTA dated 7th July 2005 determined the Mobile Termination Rata (MTR) on Fully Allocated Cost (FAC) basis at the level of Rs.1.25/minute. A glide path was given to the industry for implementation of the MTR, with initially MTR fixed at Rs.1.60/minute for one year and from 1st July 2006 onwards the currently applicable rate of Rs.1.25/minute was applicable.

During the said costing study by the Authority, the mobile operators demanded that an independent consultant should be hired by the Authority to undertake this task in future.

Based on this, the Authority engaged UK-based consultant Ovum plc., in collaboration with the World Bank, to provide consulting services to determine various interconnection charges for both fixed-line and mobile operators, using FAC under historical costing, bottom-up LRIC approach and international benchmarking. The consultancy contract was signed on 25th September 2006 and the work commenced on 1st October 2006.

3. THE APPROACH USED FOR SETTING THE INTERCONNECTION CHARGES

The Authority has adopted both Bottom-Up Long Run Incremental Cost (LRIC) and Top-Down Fully Allocated Cost (FAC) approach to determine the level of interconnection charges for both the fixed incumbent and mobile operators. In addition, the Authority has also referred to the benchmarking to see whether the results obtained from the cost models are broadly within the range.



Based on the results of cost models and the benchmarking, interconnection charges has been finalized keeping in view other relevant factors into considerations.

4. DATA COLLECTION PROCESS FOR COST MODELLING

- On 20th March 2006, Telenor and Warid (two new cellular licensees) were directed to submit their cost of call termination to the Authority as envisaged under the Mobile Policy and their respective license conditions.

- On 22nd March 2006, PTCL and Mobilink (being SMP operators) were asked to make necessary arrangements so that disaggregated technical and financial data such as network architecture, call routing factors, fixed assets, operating costs, revenues, retail and wholesale services offered, subscribers/traffic level and profile etc. can be made available to the consultants without unnecessary delay. They were also requested to nominate two senior officers to maintain close liaison with the Authority during the Project tenure.

- PTCL, Mobilink and other non-SMP mobile operators were issued 'Data Request' on 7th November 2006, 15th November 2006 and 21st November 2006 respectively. They were directed to submit their initial responses or indicative timescales for delivery of all elements of the 'Data Request' with the deadline for provision of all requisite data within a month.

- In order to explain the 'Data Request' in more detail, a meeting was also held with PTCL on 8th November 2006, where the consultants delivered a presentation of the fixed-line data requirements, explaining the nature of the data, reasons for requesting it and the proposed timescales for delivery.

- Similarly, a conference call with Mobilink's representatives with the consultants were arranged on 17th November 2006 to explain the 'Data Request' along with the methodology followed for the determination of interconnection charges.

- Mobilink raised certain queries on the 'Data Request' on 24th November 2006 including busy hour data, network elements, physical infrastructure etc, which were responded on 1st December 2006.

- On 7th December 2006, the Route Factor Table along with guidance notes was issued to PTCL and all mobile operators with the request to provide the filled Table by 28th December 2006.

- On 22nd December 2006, PTCL was requested to provide information regarding network maps, collocation, carrier selection, accounting separation systems and network transmission. Mobile operators were also requested to provide network diagrams. Clarifications on certain points were also provided to them. These were supported with data request supplement guidance and templates.

- Due to non-participation in data submission process, Paktel, Instaphone and Warid Telecom were given another opportunity on 19th January 2007 to provide the requested data to the Authority by 31st January 2007. Ufone was also reminded on 22nd January 2007 to submit the complete data by 31st January 2007.

- 'Data Gaps' for Bottom-Up LRIC model were issued to PTCL on 7th June 2007 with the advice to submit the missing data by 20th June 2007. A meeting was also conducted with PTCL on 28th June 2007 where the consultants explained the data deficiencies of PTCL. Top-Down FAC models 'Data Gaps' were issued to PTCL on 4th July 2007 and the missing data was requested by the final deadline of 25th July 2007.

- Mobilink, Telenor, Warid and Ufone were requested on 12th June 2007 to submit 'Bottom-Up LRIC Data Gaps' by 26th June 2007 which were later supplemented with 'Guidance Notes'. Data Gaps for Top-Down FAC Models were issued to Mobilink and Telenor on 4th July 2007 and the missing data was requested by the final deadline of 25th July 2007.

- The industry was asked to provide all the missing data by the given deadline. It was also made clear to the operators that the Authority may choose not to consider the data, which was requested and not provided to the Authority by the given deadline.

- Paktel and Instaphone did not participate at all in the data submission process, although they later submit their views on cost methodologies. Regarding Warid and Ufone, enough data was not provided to the Authority due to which operator-specific Top-Down FAC models could not be developed for these operators.

- The Authority gave almost nine months to concerned operators to submit the data necessary for the purpose of developing cost models, which is quite an appropriate period of time by any standard.

5. OPERATORS' COMMENTS ON BROAD COSTING METHODOLOGIES AND THE AUTHORITY'S RESPONSE

Before the development of cost models, the Authority found it appropriate to consult the stakeholders on the broad costing methodologies that would be used in the models. For this purpose, a workshop was conducted on 14th December 2006 for mobile operators and PTCL. The consultant gave presentations on the issue and also responded to queries of the participants. The copy of the presentation was shared with all the participants and they were requested to provide their comments on the issues highlighted in the presentation.

Following are the operators' comments and the Authority's responses on these comments, which were also communicated to these operators:

(i) PTCL's Comment: PTA should give a reasonable time frame after development of consensus on methodologies to be used. First of all a top down HCA FAC model be put in place on the methodologies agreed. Once exhaustive discussion has taken place and results are accepted then next step will be a top down CCA FAC and LRIC. Once operator, regulator and industry are familiar with this approach only then bottom up LRIC be introduced.

PTA's Response: There is a clear need to distinguish between the cost-based modelling of indicative interconnection charges and the development of accounting separation systems. As explained earlier, it is our intention to develop bottom-up CCA LRIC and top-down HCA FAC (fully allocated cost) models, as well as undertaking benchmarking, in order to enable the Authority to determine reasonable interconnection charges for both fixed and mobile operators. This work can be conducted within a relatively short timescale. Concurrently, we are also working on the final determination of accounting separation guidelines and regulations which will provide a basis for the undoubtedly longer-term development of a regulatory reporting framework which will enable the Authority to monitor the ongoing profitability of regulated services and thereby assess the reasonableness of the determined interconnection charges.

While other bases of cost modelling are being conducted, we are firmly of the opinion that LRIC-based interconnection charges are in accordance with 'international best practice'. Certainly in Europe, a recent report[1] of the IRG (Independent Regulators Group), a body representing the member states' national regulatory authorities, has indicated that broadly half of all member states regulate fixed-line termination interconnection rates on the basis of CCA LRIC. This proportion rises to approximately two-thirds in respect of mobile termination rates.

We contend that the adoption of LRIC as a cost-based regulatory approach is likely to yield competitive wholesale interconnection charges and encourage the development of a thriving telecommunications sector.

(ii) PTCL's Comment: In order to ensure harmonisation and consistency in the application of LRIC modeling between the different telecommunications operators, it is highly desirable to lay down appropriate guidance. PTCL would therefore urge the PTA to issue guidelines on agreed methodologies, not only to ensure consistency of application but also to meet non-discrimination and transparency obligations under the Rules.

PTA's Response: We accept that it is desirable that the Authority should finalize guidelines and regulations in respect of ongoing accounting separation and regulatory reporting so as to ensure a consistency of approach between operators.

Furthermore, we are of the opinion that, in respect of the ongoing interconnection cost modelling, it is reasonable to assume that the appointment of independent consultants for the development of cost models for both fixed and mobile operators will encourage a consistency of approach, even though in practice, the cost experiences of fixed and mobile operations are fundamentally different.

(iii) PTCL's Comment: Ovum presentation on methodologies provides too little information. We believe that greater consideration needs to be given for providing more detailed guidance to ensure that there is consistency in application of these assumptions.

PTA's Response: We note that a number of key issues were raised during the recent methodology presentations and all operators were given an opportunity to raise any additional areas of concern both during and after the presentations. Indeed, the fact that it is not possible to anticipate every possible area of operator concern is the reason that we have invited operators to present their areas of concern/preference in a consultative manner.

(iv) PTCL's Comment: Some of the key issues which were not covered in the Ovum's presentation are as below:

(a) Capital maintenance (FCM Vs OCM) – PTCL prefer FCM, which was also recommended in draft consultation paper issued by PTA. For the purposes of comparing

1 Regulatory Accounting Practice - A Report prepared by the IRG Regulatory Accounting Working Group, April 2006 Ref: ERG (06) 23

accounting returns with the cost of capital, profit should be measured on an FCM basis. This is especially appropriate in case of commercial markets leading to valuation losses when it becomes important for the accounts to show the real return being made on capital invested.

(b) Depreciation methodology (Economic Vs other methods)- PTCL prefers economic depreciation. The purpose of any depreciation method is the assessment of value consumption within a specific period. Traditional accounting depreciation thereby implicitly assumes static environment and perfect information because the complete time path of value consumption is fixed at the beginning of the asset's life cycle. It therefore handles future events which influence assets value as perfectly predictable.

Economic depreciation on the other hand measures the period-by-period change in the market value of an asset. It frequently adjusts asset values for unforeseen changes like fluctuations of replacement costs or license valuation. For this reason economic depreciation allows timely adaptation of cost based tariffs to a changed environment.

PTA's Response:

(a) FCM (Financial Capital Maintenance)

We agree that the FCM approach is an appropriate basis for CCA adoption i.e. unrealised gains and losses arising from price changes in the CCA valuation of assets year on year are taken to the P&L account.

However, the initial adoption of CCA valuation should not permit the distortional effect of many years of divergence between HCA and CCA value in a single year. i.e. the FCM approach will have no impact in the initial year of adoption or the initial cost models developed.

Furthermore, if there is a significant divergence between the depreciated HCA and CCA valuation of the same network assets (i.e. a marked divergence between a high Net Book Value (NBV) and lower Net Replacement Cost (NRC)), it presupposes that HCA asset values may be too high. By implication, either assets have been insufficiently depreciated or an operator has failed to address a permanent diminution in value, potentially arising from technological change.

(b) Economic depreciation

In respect of depreciation, it is our intention to develop cost models which enable the computation of cost-based interconnection charges based on various different approaches to depreciation (i.e. the models will incorporate scenario switches in respect of depreciation methodology). Once the cost models have been developed, we will review the impact of different depreciation methodology scenarios to see if they have a material impact on the consequent cost-based interconnection charges implied.

Specifically, we expect to adopt a straight-line approach in respect of the top-down HCA FAC models (consistent with standard operator accounting practice) and to consider the impact of the straight-line and titled annuity approaches in the bottom-up CCA LRIC models.

The tilted annuity depreciation approach:

- recovers both the depreciation charge and the cost of capital
- revalues assets at their modern equivalent, which is consistent with an economically efficient network (and the basis for the ”tilt”)
- is consistent with the preferred approach by a number of regulators (e.g. ComCom in New Zealand, PTS in Sweden, Telestyrelsen in Denmark, ANRC in Romania).

(v) PTCL's Comment: PTA in its consultation paper on costing methodologies, has proposed following approach:

(i) Top down HCA FAC
(ii) Top down CCA FAC
(iii) Top down LRIC

Now PTA consultants have come up with quite a different approach where they are proposing Top down HCA FAC, bottom up CCA LRIC and bench marking, which shows lack of consistency in regulator's polices. In response to an inquiry by the PTCL before engagement of the Consultants for developing cost model the PTA has given a green signal to PTCL for moving forward according to guidelines given in the draft consultation paper.

Reason to use International benchmarks after calculating cost based interconnect prices is not understood however if there is at all necessity to use the benchmarks then the benchmark should be selected based on Digital Opportunity Index 2006 (DOI) published by the ITU.

PTA's Response: PTCL appears to confuse the ongoing process for accounting separation and regulatory reporting with the cost-model methodology to be used in enabling the Authority to determine interconnection tariffs.

While the former process may well follow a TD HCA FAC, TD CCA FAC and then TD (CCA) LRIC route, the interconnection service rates are intended to be set by reference to both TD HCA FAC and BU CCA LRIC cost models, coupled with a benchmarking 'sanity check' initially.

Benchmarking, in isolation, may not yield a suitable level of interconnection charges as it is particularly difficult to obtain standardised cost-based interconnection charges from comparable countries, which are appropriately reflective of the market conditions of Pakistan.

While the ITU's Digital Opportunity Index (DOI) may prove useful in identifying countries with similar attributes to those of Pakistan in terms of utilization, infrastructure and opportunity, it is likely that such countries may not have wholesale interconnection tariffs on cost-basis. As such, using the DOI as a criterion for comparable country selection may not prove particularly useful in arriving at a suitable cost-based benchmark for interconnection or other wholesale service tariffs in Pakistan.

While the Authority will consider the DOI as a basis for peer country selection, we feel that it is more appropriate to consider benchmark rates from countries which have adopted cost-based charges and which have competitive telecommunications markets.

(vi) PTCL's Comment: The logic behind LRIC-oriented price control in regulation can be taken straight forward from neoclassical economics. According to the model of perfect competition social welfare is maximized if prices equal marginal or incremental costs. From this equation regulators derive their motivation to heavily use LRIC orientation as a measure to enhance efficiency for consumer benefit.

However, because telecommunication networks show substantial economies of scale and scope marginal cost pricing does not provide for cost recovering. Furthermore, taking dynamic aspects into account, especially the incentives of firms to entry into a market or invest into their networks, sector-specific risks have to be covered by regulated prices.

Another theoretical problem occurs due to network differentiation and quality competition. With the development of alternative networks different qualities and different network standards become relevant as it is the case many LDIs are using IP based technology instead of switch.

CASE Associates in their study "REMEDIES UNDER EU REGULATION OF THE COMMUNICATIONS SECTOR" pointed out that:

(i) LRIC based pricing does generally not provide for the recovery of a) the opportunity costs of developing unsuccessful services or internally developed inputs, including transaction costs such as search and bargaining costs and b) the installation costs of shifting to new technology.
(ii) This creates strong incentives for SMP operators to (inefficiently) focus business development on unregulated areas.
(iii) Empirically the results of regulators cost estimations often vary to a large extend, so there is a high risk of significantly mis-estimating costs from the markets point of view, e. g., it is reported that US LRIC models of the same network components can differ by up to 70 percent while in Australia differences of 30 per cent have been found.

PTA's Response: In respect of unsuccessful development costs, we present the counter-argument that there is no reason why other operators should bear the costs of unsuccessful service developments in the wholesale charges paid for interconnection

services. Were they to do so, they would enable an SMP operator to achieve a rate of return on assets inefficiently deployed. Unsuccessful service development may, to some extent, typify inefficiencies associated with SMP operators and the abuse of monopolistic service provision.

In any event, it is our belief that unsuccessful service development should represent a small proportion of costs which are unlikely to be representative of existing fixed-line termination where there has arguably been little technological innovation.

In respect of the installation costs of new technology, we specifically point out that in valuing a hypothetical network design based upon modern equivalency and CCA asset costs, we have requested all the relevant costs in bringing assets to their 'location and condition' including freight costs, duty, insurance and other installation costs. We have also sought to ensure that PTCL have an opportunity to itemise such costs in relation to their existing fixed assets.

In the initial data request issued to PTCL, section concerning fixed assets specifically requests:

- Details of any related freight, delivery, insurance and duty charges
- Details of any related installation labour/consulting costs

Furthermore, section of the data request concerning CCA valuation specifically requests details of typical freight, delivery, insurance and duty charges. While installation charges are not explicitly requested, PTCL are at liberty to provide such cost information which was presumed to have been included within the "acquisition price".

We contend that a CCA LRIC cost modelling process does not exclude costs of installation of modern equivalent assets (MEA), although it is, in part, the responsibility of PTCL to draw attention to such efficiently incurred costs in their responses to the data request.

We believe that PTCL's concern in respect of variation in cost model estimation is unwarranted. As noted and explained in the recent cost modelling methodology presentations, it is our intention to develop three different views of the cost-based interconnection charges (TD HCA FAC, BU CCA LRIC and benchmarking), thereby mitigating the risk that charges will be determined solely on the basis of a single approach. That said, and subject to a review for reasonableness, it is likely that the eventual determination of interconnection charges is most likely to approximate to the implied service charges emanating from the BU CCA LRIC model, as befits the Authority's preferred efficient operator approach.

While it is not clear what PTCL's specific concern is in respect of quality of service and the use of IP technology by LDIs, we reassure PTCL that it is not our intention to adopt IP-based transmission as the modern equivalent form of PSTN transmission in the BU CCA LRIC modelling, as was discussed during the methodology presentations in

December 2006. We accept that, in respect of IP-based transmission, ensuring quality of service remains a major issue and significantly impacts the apparent costs of such transmission.

Equally, in respect of PTCL's assertion that a LRIC approach creates strong incentives for SMP operators to focus on unregulated areas of their businesses, we caution PTCL that any degradation in quality or scope of existing fixed-line service provision may well elicit direct regulatory intervention by the Authroity. It is the intention of cost-based interconnection modelling to permit operators to achieve a reasonable rate of return on capital employed and the recovery of the operating costs efficiently incurred in service provision.

(vii) PTCL's Comment: Decision to move to LRIC in haste will be counter productive. The high informational requirements and the subjective elements of calculating costs can hardly provide for reliable and time consistent prices. Even in Europe LRIC based prices are not implemented in all the countries despite persistent efforts by NRAs and ERG. Practical problems should lead to an even more cautious use of LRIC orientated regulation. In practice the relevant costs cannot be calculated precisely and objectively but are always mainly result of subjective judgments. In consequence there is a risk of errors that lead to unwanted market outcomes. As Sidak & Spulber pointed out:

"Too low costs/ prices can lead to excessive entry by transferring profits and rents to new entrants and weaken the incentives for facility based carriers. The massive entry by new service provider in Germany, after RegTP had set low entry conditions in 1998, and the lot of bankruptcy at the beginning of this century may be a good example for that."

An interesting observation made by Australian Productivity Commission is "A striking premise underlying the TSLRIC is that it presupposes that the regulator knows how to run an efficient network, and may know this even better than the incumbent. This premise is suspect – and the risk of regulatory error is high."

PTA's Response: We hope to move expediently to cost-based interconnection with LRIC as the appropriate cost standard, tempered by an awareness of the extent of divergence from indicative TD HCA FAC and benchmark costs/charges.

Once again, it appears that PTCL have failed to differentiate between the cost-based modelling and determination of interconnection rates and the introduction of costing methodologies for accounting separation and regulatory reporting.

While PTCL correctly notes that LRIC has not been implemented in all member states of the European Union, we feel it is important to emphasise that, as reported by the IRG (see earlier reference), it has been implemented by half of the 19 respondent European member state NRAs in respect of fixed termination interconnection rates (EU market 9). Furthermore, almost 80% have already adopted a CCA-based network valuation, with over 70% of IRG respondent countries adopting some form of cost-oriented charges.

LRIC is now widely adopted in European telecommunications market regulation. In the European Commission's 1998 regulatory framework, incumbent operators were required to provide interconnection according to the principles of transparency, non-discrimination and cost orientation, and to publish a Reference Interconnection Offer containing the relevant terms and conditions. In addition, the Commission recommended the use of Forward Looking Long Run Incremental Costs (FL-LRIC) as the most appropriate costing methodology for fixed network interconnection, and published a series of 'best current practice' prices for NRAs to use as guidelines when assessing interconnection charges. As a result, we contend that, even where LRIC cost modelling has not been used explicitly in Europe, there is still a predominant trend towards interconnection charges that approximate to cost-based LRIC charge levels.

(viii) PTCL's Comment: PTA consultant has given too little information to give any meaningful comments. PTA consultant may be requested to give some details as

(i) How direct operating cost will be applied on hypothetical PTCL network.
(ii) What volume will be used.
(iii) How the increment will be calculated.

<u>On Top down methodology:</u>
As already stated too little information has been given to give any meaningful comments. PTCL reserve the right to comment in detail as and when methodology becomes clear.

Ovum has provided very simple route table whereas reality on the ground is very complex. There are many call scenarios in a single service. For example a local call may originate and terminate in same local exchange. Some will go up to Tandem exchange level and some may even use Transit (Main) exchange. Some RLU/RCU are installed within the same local exchange thus RLU – LE link is not used where in other cases it is used.

<u>On Bottom up methodology:</u>
As already stated following information has not been given:

(i) How direct operating cost will be applied on hypothetical PTCL network.
(ii) What volume will be used.
(iii) How the increment will be calculated. The definition of the relevant increment is important to a proper identification of incremental costs and joint and common costs.

PTA's Response: The intention of the methodology presentations was to give operators an opportunity to raise areas of concern. As a result, the presentations merely raised some likely contentious areas of the intended cost modelling to stimulate debate but it would simply not be possible to anticipate every possible area that may be of concern to operators, prior to the commencement of the cost modelling. Naturally, PTCL remain at liberty to present further comments as work progresses with the interconnection cost modelling.

In respect of the three areas raised in PTCL's comments, we can provide the following information:

(i) Direct operating costs

In order to appreciate the differences in approach, it is worth considering both top-down and bottom-up cost modelling approaches separately.

Top-down

For the T-D HCA FAC (top-down, historic cost convention fully allocated cost model), all reasonable direct operating costs are expected to be reflected in the costs allocated to various PTCL services.

Clearly, there may be some issues surrounding which costs constitute direct operating costs (as opposed to overheads), whether such costs are reasonably incurred and whether such costs should be attributed to specific services provided.

As a general rule, all direct operating costs (i.e. costs directly incurred in the provision of services such as interconnection out-payments, directly incurred network engineering costs, licensing etc.) should be included as derived from the operator's accounting records.

These costs are then reviewed to ensure that they do not include cost elements not reasonably incurred in the provision of telecommunications services. Costs not related to telecommunications service provision or unreasonably incurred (e.g. excessive payments to related companies without suitable/relevant cost basis) are removed. Inevitably, this may require some discussion of specific cost items with each operator.

Finally, reasonable direct operating costs are then attributed to services on the basis reflective of the proportionate consumption of such cost inputs. i.e. allocation or assignment should be on the basis of cost causality.

Bottom-up

For bottom-up cost models, the approach to direct operating costs will vary depending on the nature of the relevant (and reasonable) direct costs incurred.

After dimensioning and valuing (on a CCA basis) a hypothetical network capable of serving the existing level of customers and service demand, it is then necessary to consider appropriate levels of direct operating cost that might be associated with such a network.

While some costs may be flexed proportionately with revised hypothetical levels of network infrastructure, other costs might appropriately continue to be derived and

attributed in a similar manner to those in the top-down model i.e. sourced directly from each operator's actual accounting records.

For example, a hypothetical network design may yield a more efficient means of core network transmission that may imply a lower overall level of network transmission engineering staff and related staff cost. However, direct operating costs of a largely 'fixed' nature or those that are known with some certainty and that are unlikely to flex with the operator's network design or value (e.g. licensing costs) may be modelled at the same level as those derived top-down' from the operator's financial records.

(ii) Volumes to be used

There are numerous instances where equipment, service and customer volume information has been requested in the detailed data requests.

For the purposes of cost attribution and network dimensioning, both service volume (billed and actual minutes, circuits etc.) and customer numbers are relevant while for the purposes of calculating the resultant unit costs of interconnection services, it is likely that the relevant service volume is purely actual (as opposed to billed) service durations.

In the specific case of bottom-up hypothetical network dimensioning, it is highly likely that any model will address both current service volumes and also those that are forecast with reasonable certainty over the next three financial years.

PTCL should endeavour to respond to all sections of the data request concerning volume information, whether current actual, historical or forecast, clearly indicating the nature of the data provided.

(iii) The increment

Proposed increments of the fixed network are clearly indicated in the route factor table data request issued to PTCL on 7th December 2006.

This will enable the development of a unit cost of interconnection services by reference to the element costs of network increments, the relevant service volumes and the service route factors.

As indicated during the costing methodology presentations in December 2006, the LRIC models developed are intended to yield unit LRIC costs of various interconnection services, together with some proportion of the joint and common costs of service provision, most probably allocated on an EPMU basis. Whether such joint and common costs will include all common and joint costs or simply those common to the provision of network services remains open to consideration.

Main increments will comprise Network, Access and Retail & Other services with the Network increment subdivided into specific increments comprising switching, transmission and other key 'building blocks' of network services.

Incremental costs of a particular increment comprise net operating and annualised capital costs arising directly from the ownership and operation of a particular category of network assets. While some costs are directly assigned to the increment, others may be apportioned to the specific increment.

Incremental costs are distinct from joint and common costs in that common costs may not vary significantly with increased or reduced levels of demand for the assets represented by the increment.

(ix) PTCL's Comment: WACC however is not sufficient to compensate shareholders for their opportunity costs of supplying any other firm with capital because cost of capital only provides a minimal return on equity. On average regulated operators have to pay a return on top the cost of capital. This is reflected by so called return on capital employed (ROCE). ROCE equals regulated operators Earnings Before Interest and Tax (EBIT) in a given period divided by the capital employed in that period. Thus ROCE contains the cost of capital as given by WACC and an on top return called EVA (economic value added), i.e. ROCE = WACC + EVA/capital employed or we can say ROCE = EBIT / capital employed.

As Ovum suggested CAPM to calculate cost of equity, it is important to calculate Equity Risk Premium (ERP). ERP has two components:

i. International Risk in Telecom Market
ii. Country specific Risk of investment.

As Pakistan Telecom Market is open for foreign investment it is essential to calculate both International risk and country risk calculating ERP.

One area of concern is Ovum's consideration to use financial structure of typical industry instead of PTCL. In the opinion of PTCL it will be erroneous to consider any other financial structure as no other company has such a huge network and investment requirements as PTCL.

PTA's Response: The comments of PTCL in relation to the weighted average cost of capital are confusing. The WACC rate that is intended to be applied to the net capital invested in various network components and services is that which should afford a rate of return on capital employed (ROCE) that is sufficient to compensate the reasonable expectations/requirements of return of equity and debt holders.

The proportions of debt and equity are relevant in arriving at the weighted average cost of capital (WACC) and the calculations of reasonable returns of debt and equity take account of the fact that equity returns are only achieved after the deduction of any

relevant effective corporate taxes, while debt holders are remunerated from pre-tax earnings of the company concerned.

While it may be appropriate to use the actual proportions of debt and equity capital that exist in a particular company, it is also apparent that many companies (and particularly large corporate investors) can manipulate the capital structure so as to appear to have little cheaper debt finance in a regulated entity. Consequently, on occasion, it may prove necessary to consider the capital structure of the holding company or, indeed, the typical capital structure of operators in the telecom market.

(x) PTCL's Comment: Customer acquisition, thus marketing and selling costs are necessary for an operator to sell any of its services and, are therefore, common costs. For instance, an operator cannot earn termination revenues without first acquiring customers.

For appropriation of common costs demand elasticities, including the sensitivity of customers to up-front charges in general, should be taken into account. Ramsey pricing has been criticized as difficult to implement in practice, especially due to the informational requirements.

Concerning the informational requirements one can easily refer to unregulated and highly competitive markets. There it is common that firms differentiate their prices and adjust them continuously to competitive pressure. There can be no doubt that the structures of competitive prices do in practice reflect Ramsey pricing.

This observation suggests that the most promising alley for implementing Ramsey prices in a regulatory context is to decentralise pricing decisions to the operator, which means to allow for price differentiation and flexible allocation of common costs.

In conclusion, the practical difficulties with Ramsey-Pricing seem to be even lower than the concept of marginal cost efficiency.

PTA's Response: We do not agree that Ramsey pricing approach is appropriate for the allocation of common costs, particularly when one considers the attribution of costs to interconnection and specifically termination services. We believe that EPMU is a more appropriate approach and one which has been widely adopted in the vast majority of regulatory cost models and systems.

Economists sometimes criticise the use of equi-proportionate mark-ups (EPMU) as being arbitrary and inefficient. They argue that mark-ups should be set so as to recover common costs by setting higher prices for those services to which consumers are price insensitive, or less sensitive, balanced by lower prices for services where consumers are more price sensitive i.e. a Ramsey pricing approach.

PTCL appears to argue that termination costs and charges in excess of LRIC are justified by Ramsey pricing and that the decision of how to allocate common cost should be left to PTCL by decentralising "pricing decisions to the operator".

Under Ramsey pricing, termination should attract higher mark-ups (i.e. a greater proportion of common cost) because of the relative price inelasticity of the service. However, this low price elasticity is a result of the bottleneck characteristic of the termination service - callers to the PSTN have no choice as to which operator terminates the call so, if they wish to make the call, they are bound to accept whatever termination price PTCL sets. It is important to note that this situation does not mean that consumers (in this case, callers to the PSTN) are price insensitive; it merely indicates that they have no competitive choice. In our view, this absence of competition should not be used as justification for a further reduction in consumer welfare by potentially skewing a disproportionate amount of common cost to an apparent price inelastic termination service.

Setting aside the conceptual arguments in respect of Ramsey pricing, it is highly unlikely that sufficient and reliable price elasticity data would be available to enable a Ramsey approach. This practicality appears to have already been accepted by PTCL who note that "Ramsey pricing has been criticized as difficult to implement in practice, especially due to the informational requirements".

While we would welcome any information that PTCL can provide in respect of market price elasticities, it is our intention to adopt EPMU as the basis for common cost attribution which is both widely adopted and expedient. We do not believe that it would be appropriate to adopt a Ramsey-based approach to the apportionment of common cost and instead believe that it is preferable to adopt the widely-used equi-proportionate mark up (EPMU) basis.

(xi) PTCL's Comment: Access deficit is a significant un-absorb cost of PTCL therefore a mechanism to absorb this cost by all the parties benefiting from origination and termination services is required to be put in place.

PTA's Response: In the course of cost modelling, it may become apparent that an access deficit exists in the provision of fixed-line services. As a result, PTCL are invited to suggest methods that it may wish to see applied in resolving any such deficit if, indeed, the current method of access deficit financing is considered insufficient/inappropriate.

(xii) PTCL's Comment: It is not encouraging that PTA, by going for LRIC straight away is not considering the application of rationale and logic on which the provisions of Deregulation Policy 2003, Telecom Rules 2000 and International best practices are based.

PTA's Response: PTCL's understanding that the Authority is going to LRIC straight away is not valid as the Authority intends to determine the interconnection charges by taking into account the results of Fully Allocated Costing (Historical Cost), Bottom-Up Long Run Incremental Costing (Current Cost) as well as international benchmarks.

(xiii) PTCL's Comment: Aims of both, LRIC based interconnect prices and accounting separation is same that interconnect prices of SMP operator are cost

based, transparent and non-discriminatory. The only difference between two approaches is that of timescale. Instead of adopting shortcut to make up for the delay in issuing guidelines so that operators could be able to establish cost accounting system, it is better to take some more time and evolve a more rational, workable and equitable legal and regulatory framework.

PTA's Response: We also do not agree with PTCL's stance that aim of both LRIC based interconnect prices and accounting separation is same. In fact the scope of accounting separation is much wider as it not only deals with cost but also revenues of both interconnect and retail services. Accounting separation also helps the Authority in examining the possible anti-competitive practices of SMP operator such as predatory pricing, margin squeeze, cross-subsidization etc. while these can not be done with LRIC based interconnect prices alone.

(xiv) PTCL's Comment: Para 16 (4) of Telecom Rules 2000 states that: *"The SMP operator's interconnection charges shall, as soon as practicable, be based on LRIC in the manner determined by the Authority ...."*. It is clear that Authority may determine the manner and not the interconnection charges.

PTA's Response: The reference to Rule 16(4) of Pakistan Telecom Rules 2000 which states that "the SMP operator's interconnection charges shall, as soon as practicable, be based on LRIC *in the manner determined by the Authority"* is concurred by the Authority. As you are aware that we have already initiated the consultation process on costing methodologies with all stakeholders. However, in case consensus could not be developed on certain issues, then the charges will be finalized/calculated *in the manner determined by the Authority.* The same approach was followed by the Authority when determining cost-based mobile termination charges in year 2005.

(xv) PTCL's Comment: Under the Deregulation Policy, PTCL was required to develop cost based interconnection charges in phased manner by June 2006. Similarly, PTA was required to develop cost and regulatory accounting guidelines by June 2004. From these obligations it is clear that:

- First PTA was supposed to issue guidelines by June 2004 and then
- PTCL was supposed to develop cost based interconnect prices by June 2006.

The para 16 (4) of Telecom Rules 2000:

> *"The SMP operator's interconnection charges shall, as soon as practicable, be based on LRJC in the manner determined by the Authority and shall include a reasonable rate of return on LRIC costs but the SMP operator shall not be obliged to charge on the basis of LRIC until it has put in place the necessary accounting and management information systems which shall enable it to do so in accordance with a reasonable time table determined by the Authority."*

The Rules emphasized on:

(i) Interconnection charges based on LRIC in the manner determined by the Authority; and

(ii) In a reasonable time table determined by the Authority so that SMP operators be able to put in place the necessary accounting and management information systems.

These clearly depict rule makers intentions that SMP operator be given ample time to establish cost accounting system and MIS in the manner determined by the Authority. Further under both, obligations fixed by GoP in Deregulation Policy and Telecom Rules 2000, role of PTA is limited to issue guidelines and not to calculate and then impose interconnect prices on operators.

PTA's Response: PTCL has rightly quoted that the Authority, under the Deregulation Policy, has to develop cost and regulatory accounting guidelines by June 2004. However, PTCL failed to recognize that the same Policy also obliges PTCL to produce FAC under historic accounting convention by October 2003 (which is quite earlier than the time by which Authority has to issue guidelines on cost and regulatory accounting; hence not interdependent), FAC under current accounting system by June 2004 and LRIC based accounting system by June 2005. In this regard, only partial information under FAC historic accounting has been submitted by PTCL with no supporting details despite various reminders by the Authority. We expect that PTCL would have installed necessary accounting and management information system with the assistance of its international consultants and any modification in the same as a result of Authority's guidelines can be implemented immediately.

(xvi) PTCL's Comment: In Europe, ERG issued its recommendation for Accounting Separation and LRIC based costing in 1998 and after eight years, less than half of operators adopted LRIC for fixed line call termination till April 2006. An interesting fact which PTA could not mention is that use of LRIC has actually been reduced from 58% in April 2005 to 47% in April 2006. In contrast, use of FDC methodology has increased from 37% to 42% and use of other methodologies from 5% to 11% during this period. This shows that operators in Europe are moving away from LRIC due to weaknesses of LRIC. One of the weaknesses of this method, and of all forward-looking studies, is that the results are estimates that may or may not occur in practice.

PTA's Response: The reference to ERG recommendation by PTCL in support of its argument that use of LRIC is decreasing while use of FAC is increasing worldwide is not understandable, as the present legislative and policy framework clearly provides for LRIC based interconnection charges. The Authority is also in favour of LRIC as its merits outweigh the perceived weaknesses and intends to use any other methodology such as FAC as an interim step to reach LRIC.

(xvii) PTCL's Comment: The route factor table proposed by Ovum is very simplistic and does not cover all call routing scenarios. For example local calls use MSU-MSU link and some will use MSU - Tandem link and some will even use MSU - Transit link.

Similarly some will use MSU switch twice, some will also use tandem and transit switch.

PTA's Response: PTCL pointed out that route factor table proposed by Ovum is very simplistic and does not cover all routing call scenarios. The fact is that 'Route Factor Table Guidance' which was provided to PTCL on 7th December 2006 clearly mentions that "*The proposed route factor table template accompanying these notes provides a list of fixed-line operator call types which are assumed to be 'most common'. However, operators should expand the table where there are significant volumes (>5% of network traffic) of services that are not listed in the template"*. Hence, PTCL is at liberty to amend the route factor table to cover all possible call scenarios.

(xviii) ***Mobilink's Comment:*** We understand that WACC has been argued to be the appropriate measure of the reasonable rate of return and has been used in the UK in LRIC models of interconnection costs. The use of WACC is also commonplace in other countries where interconnection tariffs are regulated. The Authority's intention to use WACC as the measure of a reasonable rate of return is therefore in line with international precedent.

When describing how it proposes to derive WACC for mobile operators in Pakistan, the consultant correctly identified the need to measure both the cost of equity (the return required by shareholders) and the cost of debt (the return required by providers of debt). It talks about "averaging" these two costs but does not specify how it proposes to do so. In particular, what weights does it intend to us? It also expects to use the capital asset pricing model (CAPM) to measure the cost of equity. Again, this is line with standard practice but it is not clear whether and, if so, how the consultant is going to be able to obtain the information that allows a reliable measure of WACC to be derived. In particular, how is β (which measures the extent to which the share price of the mobile operator varies with share prices in general and is taken to represent the systematic risk involved in investing in a company) to be derived.

What is the appropriate asset to use for measuring the risk free rate and what should be the term to maturity? How is the liquidity premium (the mark up added to the risk free rate to take account of the risk associated with providing debt which reflects the company's credit rating) to be derived?

The consultant refers to the possibility that "there may be some debate about typical industry versus actual operator financial structures to be used". This raises the question as to whether it is possible to specify a "typical" industry financial structure. Different companies have different structures for a variety of reasons and it is not clear on what basis either Ovum or PTA would be able to identify a typical structure or indeed what it would mean given the different circumstances of the different operators. Secondly, where there is the possibility of delaying investment, demand is uncertain and investment is irreversible, there is a value to a company from having the option to "wait and see" by postponing investment until market and other developments have become clearer. When an investment is made this option is lost so that its value is given up and there is a cost to

the company concerned. In the case of investment in mobile networks in Pakistan it is clear that it would be possible to delay investment, the outlook for demand is uncertain and that a substantial part of the investment is irreversible. We therefore require Ovum to prepare a paper describing a detailed methodology to work out the WACC.

PTA's Response: We are pleased that Mobilink acknowledge that the inclusion of a return on capital employed based upon the WACC is widely adopted. While work is not sufficiently advanced to provide a definitive answer to the manner in which detailed WACC calculations will be undertaken, we can provide some insight into our intended course of action.

In respect of the weighting to be applied in the WACC calculation, it is our intention to consider the weighting that exists in various operator capital structures (i.e. the proportions of long-term debt to equity finance). If such weightings lie within a normal range for the industry, then it is likely that they will be adopted in deriving a suitable WACC for that operator.

However, as individual entity capital structures of operators can be distorted, particularly when operators are part of a larger international group financing its investments, it may be necessary to consider what normal levels of gearing exist in typical industry operators and use such proportions as a proxy weighting.

In respect of both weightings and Beta, we may also consider the information presented by operators directly.

The risk-free rate of borrowing is likely to be derived by reference to the typical yields on Pakistan and/or regional government loan stock. This parameter in the WACC calculations may be relevant to the calculation of both the cost of debt and equity.

We also hope to consider the cost of debt (inclusive of any necessary premium) as experienced by various operators in Pakistan. It is for this reason that we have requested details of operator long-term debt, not solely considering the apparent rate of interest but also any capital element to maturity of loans, such that the effective yield rates can be considered.

We note that in the methodology presentation dated 14th December 2006, our Consultants indicated that some parameters (e.g. debt finance costs) of the cost of capital calculations "may be relatively straight-forward to ascertain". This is not to say that the cost of debt is easy to calculate but merely it is often easier to calculate with reasonable certainty than some of the other more contentious areas and parameters used in the calculation of an appropriate WACC.

We note that Mobilink requires that a detailed methodology paper should be prepared for describing the process used to calculate WACC. While we expect to compute a suitable WACC for use in the interconnection cost models, we suggest that Mobilink present its own views of its cost of capital and related parameters to inform the process (as indeed it

appears to have done), thereby ensuring that any significant matters are drawn to the fore expediently. Mobilink was encouraged to do this in the original data request.

(xix) Mobilink's Comment: The standard approach to modelling LRIC of mobile services is to define all calls (including SMS messages and data) as the increment. The costs associated with this increment are then allocated to individual services, such as voice call termination, according to the use they make of different types of network equipment. License and spectrum fees are clearly incremental costs as, if no calls were made, there would be no need to have a network and to incur such costs. At the same time, if all types of cost are avoidable then by definition there are no sunk costs. The costs of license and spectrum fees cannot therefore be excluded on the basis that they are not incremental costs and they cannot be excluded on the basis that they are sunk costs.

Ovum also appears to have misunderstood the basis for the European Commission's criticism of Ofcom's treatment of 3G spectrum costs when determining mobile termination costs in the UK. The Commission is not saying that such costs should not be included. What it is saying is that they need to be valued correctly. More specifically the Commission has argued that:

"The value of 3G licenses should be calculated at current value on a forward looking basis and not on the basis of spectrum values which approximate year 2000 levels. Termination rates should be set at the cost which would be faced by an efficient operator to provide the relevant service."

What the Commission is arguing is that, if the operators paid a price that exceeds the current value of 3G spectrum, they should not be allowed to recover the excess payment. In other words, the excess part of the spectrum costs is regarded as a stranded asset that should not be recovered in call termination charges. In this context, it should be noted that the high price paid by UK mobile operators has long been recognised. Moreover, the operators concerned have written down the value of spectrum in their accounts to reflect the fact that the current valuation is lower than what was actually paid.

However, the Commission clearly agrees that it is appropriate to recover the costs associated with the forward looking value of the spectrum (i.e. what it would cost to buy the spectrum today) in the prices of call termination and other network services.

We therefore strongly agree with what Ovum itself argues that there are sound arguments for the inclusion of license and spectrum costs in mobile termination costs because they represent a direct cost in the provision of mobile termination. It is important to note, however, that, contrary to what Ovum seems to be saying, license and spectrum fees are costs that are associated with running a network and are not therefore relevant to all services, only to network ones. This can readily be seen from the fact that a company that purely acts as retailer does not require spectrum in order to run its business, whereas a company with a network certainly does.

PTA's Response: Our Consultant was seeking to indicate, in a succinct manner, that there are arguments in favour and arguments opposed to the full inclusion of initial spectrum/license fees in interconnection charges. We welcome Mobilink's comments in respect of this important issue.

We intend to regard recurring licensing/spectrum costs as common costs of ongoing service provision which may be included in the cost-based charges of wholesale interconnection services, as well as in the charges for operator retail services.

However, the inclusion of initial licensing/spectrum costs in mobile termination charge is not generally allowed by the regulatory bodies. A notable exception to this approach is taken by Ofcom in the UK which has permitted the inclusion of annualised (amortised) upfront spectrum license costs in mobile termination rates (MTRs) as part of the second market analysis on mobile termination.

The issue is clearly far more important in markets where spectrum license costs have been particularly high i.e. it is more likely to be a significant issue in markets which have conducted auctions for spectrum licenses rather than, for example, 'beauty contests' between prospective licensees. In the UK, such costs currently constitute some 20-30% of the regulated mobile termination rate. It is these 'excessive' levels of such license costs to which our Consultant was referring and which have drawn 'criticism' from Commissioner Reding at the European Commission who has proposed to seek introduction of a power of veto on behalf of the European Union on national regulatory authority decisions in the light of the Ofcom decision.

While it might be argued that the EC has not directly criticised Ofcom for permitting the inclusion of spectrum license costs per se, it is fair to note that the high, 'excessive', levels of such costs within the consequent mobile termination rates has resulted in potential intervention by the influential pan-European regulatory body.

Nevertheless, the issue can be further explored in the light of international best practices. In this regard, Mobilink is expected to provide references in support of its argument.

(xx) Mobilink's Comment: Ovum makes no specific mention of the fees that Mobilink pays for know-how and bought in technical services as management fees to its shareholders. These are important costs, which are relevant to call termination. Mobilink pays IWCPL, which is a company affiliated to Orascom, a fee for services provided to it. These services, which are described in the Royalty and Technical Services Agreement 2002, include "technical information and know-how" and "technical services".

Technical information and know-how covers items such as:

- Drawings, specifications, data and know-how to operate a cellular telecommunications business;
- Relevant test standards and methods of quality control and advice of a technical and scientific nature;

- Advice and assistance in respect of cellular network systems and operations, including matters relating to network architecture, capability, interoperability, interconnection, roaming, co-location, maintenance, network upgrades and technical change and investment;
- Cell planning and traffic congestion management;
- IT facilities management;
- Billing systems developments and improvements;
- Fraud prevention and control systems and services;
- Human resources training and deployment;
- Strategic and operational techniques;
- Service quality and reliability.

As can be seen, most of the above activities are associated with running and operating a network. If they were not purchased from IWPLC, they would have to be bought locally or from some other source. They are therefore a legitimate cost that is caused by the need to operate a network and are part of the cost of terminating calls on mobile networks.

PTA's Response: We acknowledge that necessary technical expertise is a legitimate business cost that should be recoverable from services, it is necessary to assess whether the amounts paid constitute a reasonable cost for the services provided. Clearly such charges could simply be used to inflate the apparent costs of services (including interconnection services) while also reducing the apparent profitability of operations.

As a result, Mobilink should provide details of all such management charges, together with any related contracts and details of services provided. Details of transactions such as these were requested in the original data request, entitled Management service/Transfer charges and Inter/affiliate Company trading respectively.

In addition, many of the services described by Mobilink would appear to facilitate provision of information requested in other areas of the data request. In particular, as a result of its affiliation with IWCPL, it seems that Mobilink should possess cell planning and traffic congestion data highly relevant to its responses concerning network coverage and quality and may even have information concerning technical network audits as requested in the data request.

We welcome the provision of information relevant to the original data request and also details of the services provided and related costs arising from inter-affiliate trading.

(xxi) Mobilink's Comment: There are two main categories of common costs: network common costs and non-network common costs. Network common costs include items such as network management systems, licence and spectrum fees and royalty and technical service payments. Also, where a distinction is made between subscriber driven network costs (e.g. location registers) and call driven costs, the costs of a minimum coverage network are also regarded as network common costs. Although Ofcom, in the UK, used to make such a distinction, it no longer does so and has therefore fallen in line with the regulatory authorities in countries such as Sweden, Norway, Malaysia and

Oman. Our understanding based on past experience of Ovum cost models (e.g. in Romania) is that they also follow the approach now adopted by Ofcom.

As regards the method for allocating network common costs, economic efficiency requires that they be recovered in a way that reflects the market elasticities of demand for different services ("Ramsey-Boiteux Pricing"). Ovum has argued that Ramsey-Boiteux Pricing is the correct approach theoretically but that it is difficult to implement because it is necessary to specify the values of the relevant market price elasticities. In our view, however, the fact that something is difficult should not rule it out of consideration if it is potentially the correct method for allocating such costs. Estimates of the relevant price elasticities do exist in other countries and an attempt should be made to derive or estimate them for Pakistan. Moreover, it is possible to carry out the analysis using a range of estimates in order to test the sensitivity of the results to the assumptions and to provide a comparison with the results of applying an arbitrary approach to allocation such as EPMU.

In the absence of the use of Ramsey-Boiteux Pricing, network management costs, license and spectrum fees and royalty and technical service payments should be allocated to different network services, including call termination, according to the usage. Ovum has indicated that it intends to use EPMU rather than any other method. We disagree with this approach given that the use of EPMU leads to purely arbitrary and therefore potentially misleading allocations of costs. Only, if all else fails, should EPMU be used.

Non-network costs that are common to all areas of a mobile operator's business (i.e. network and retail activities) include items such as:

- Non-network depreciation and cost of capital (IT, office equipment and furniture);
- Property costs (leases, rents, depreciation and cost of capital);
- Human resources, finance, legal and regulatory affairs.

In this case, in the absence of Ramsey-Boiteux Pricing, it may be necessary to use EPMU to recover these costs because either there are no specific cost drivers or the information does not exist which shows the extent to which the costs are determined by different activities. However, Ovum has stated that:

"In particular, there is some argument that only costs which are common to network services (as opposed to retail and network services) should be recoverable from such interconnection services. Such an approach is often referred to as DLRIC (distributed LRIC)".

Ovum does not provide any information about the nature of "some argument" in support of its proposal. However, there are strong arguments against it. If an MNO cannot recover any non-network common costs in its all termination charges, it will be forced to recover all such costs from its retail service prices. This will put it at a disadvantage with respect to the fixed network operator, with which it competes for customers and calls, and which is able to terminate calls on the mobile network without making any contribution

to such costs. This is important not least because, in reality, a substantial proportion of the supposedly common non-network costs are likely to be driven by mobile network activities but, because of the lack of information about the underlying cost drivers, these costs cannot be separately identified.

It is for this reason and also because it is reasonable to expect all users of the mobile network to be treated equally and to make a contribution to genuine non-network common costs that is standard practice amongst regulatory authorities in other countries to allow non-network common costs to be recovered via EPMU. We see no reason why practice should be any different in Pakistan.

PTA's Response: We do not agree that a Ramsey pricing approach is appropriate for the allocation of common costs, particularly when one considers attribution of costs to interconnection and specifically mobile termination services. We believe that EPMU is a more appropriate approach and one which has been widely adopted in the vast majority of regulatory cost models and systems.

Economists sometimes criticise the use of equi-proportionate mark-ups (EPMU) as being arbitrary and inefficient. They argue that mark-ups should be set so as to recover common costs by setting higher prices for those services to which consumers are price insensitive, or less sensitive, balanced by lower prices for services where consumers are more price sensitive i.e. a Ramsey pricing approach.

Mobilink appears to argue that mobile termination costs and charges in excess of LRIC are justified by Ramsey pricing. Under Ramsey pricing, termination should attract higher mark-ups (i.e. a greater proportion of common cost) because of the relative price inelasticity of the service. However, this low price elasticity is a result of the bottleneck characteristic of the mobile termination service - callers to mobiles have no choice as to which operator terminates the call so, if they wish to make the call, they are bound to accept whatever price the mobile operator sets. It is important to note that this situation does not mean that consumers (in this case, callers to mobiles) are price insensitive; it merely indicates that they have no competitive choices.

Properly constituted Ramsey pricing would need to compare the price sensitivity of callers to mobiles (to changes in the level of termination rates) with the price sensitivity of mobile customers (to changes in the prices of retail mobile calls). Such data is quite difficult to obtain, particularly given the complexity and dynamism of mobile pricing plans, thus making application of this method practically unfeasible. Intuitively, it would seem likely that these two price elasticities would be similar. If anything, it may be that callers to mobiles are more price sensitive because the price of calls to mobiles is much greater than for the average call price paid by a fixed network customer.

In short, while the application of Ramsey pricing may be theoretically attractive, in practice such a behaviour is difficult to demonstrate, while its application by the SMP operators could be detrimental to competition (which is likely to develop in higher

elasticity services) and could therefore lead to market distortions that offset any potential welfare gains.

In any event, it is highly unlikely that sufficient and reliable price elasticity data would be available to enable a Ramsey approach. This practicality appears to have already been accepted by Mobilink in their earlier response to the PTA's 'Consultation paper on guidelines on costing methodologies for accounting separation purposes'. Mobilink's response to question concerning the adoption of EPMU states " Although there are many good arguments to support Ramsey pricing whereby more common cost is recovered in the call termination charge by the mobile operator it has been difficult to gather the necessary data even in the UK. It is therefore highly unlikely that such data can be gathered in Pakistan at this point in time."

While we would welcome any information that Mobilink can provide in respect of market price elasticities, it is our intention to adopt EPMU as the basis for common cost attribution which is both widely adopted and expedient.

With regard to 'common costs', our expected approach is that joint and shared costs (indirectly attributable costs) are attributed to products, services and network components using cost causative drivers wherever possible. Ideally, activity-based costing drivers should be used, although, in their absence and the absence of alternative driver metrics, it may be necessary to use normal industry experience for such cost attributions. This approach would include the attribution of network common costs.

Non-network common costs (unattributable costs), as long as they are reasonably incurred, are expected to be attribution to products, service and components on an EPMU basis. In the bottom-up model, such reasonable costs will be estimated, subject to an awareness of the typical cost levels incurred in the operator's underlying accounts.

In short, both network and non-network common costs (as long as reasonably incurred) will be attributed to wholesale interconnection services, except where specific treatment has been noted e.g. initial license/spectrum costs.

(xxii) Mobilink's Comment: Retail costs relate to activities such as customer acquisition (marketing, sales, handset subsidies etc), customer care (including call centres) and billing. Ovum has argued that retail costs are not causally related to mobile termination costs and so should not be included as part of the cost base. It has also argued that this is in line with the standard approach adopted in interconnection models worldwide. A number of observations can be made in response to these arguments. It is true that such costs are not included as part of call termination costs in most interconnection costs models. However, there are exceptions. For example, in Italy, Agcom, the regulatory authority, has decreed in 2002 that such costs are a legitimate element of call termination costs. In addition, Ofcom has in the past acknowledged that there is an argument for some inclusion of such costs in mobile termination costs but that because, in the UK, an allowance is made for handset and subscription subsidies in the

calculation of the network externality surcharge, it would be double counting to include them again.

The argument in support of inclusion of retail costs is that, when a mobile network operator incurs costs in acquiring and retaining customers, subscribers of other networks benefit because they now have the option to call those subscribers. In addition the operator of the other network benefits because its customers make more calls from which it derives a profit. For example, GSM Europe, which represents mobile network operators in Europe, when submitting its views on cost accounting and accounting separation to the European Regulators Group (ERG), argued that:

> *"In principle when a subscriber cost is common to all services it should be allocated to common costs so that it can be recovered appropriately across all services using a driver that cannot be 100% causal in all cases.*
>
> *An example of this is customer acquisition costs (which) are incurred by the MNO in order to create calling opportunities from which revenues and profits may be derived. These calling opportunities comprise both outgoing calls from the customer and inbound calls to the customer and affect both retail and wholesale services. In other words, by incurring customer acquisition costs, a mobile operator usually contributes to the development of the market, including the interconnection market. Customer acquisition costs are therefore common to all services and should be allocated accordingly.*
>
> *In addition, customer servicing costs, which might appear at first sight to be exclusively attributable to the retail level, should in part be allocated to network costs (e.g. complaint desks may handle problems about receiving inbound calls)."*

It seems to us to be clear and non-controversial that costs that result from providing inbound calls should be attributed to call termination and that some of these costs are included in retail costs. Consequently, Ovum should, at the very minimum, take steps to include such costs in its model(s). In addition the argument that callers on other networks benefit from customer acquisition costs has some validity. The question is how if, at all, this should be taken into account.

Customer acquisition and retention costs are not directly caused by call termination so that their inclusion in call termination costs is not consistent with cost causality. Our view is that the appropriate way to deal with them is via an externality surcharge as this takes into account benefits received by others when someone joins a mobile network. Such a surcharge is consistent with economic efficiency. We therefore support the approach adopted by Ofcom which has argued the following in the context of customer acquisition, retention and servicing costs (CARS):

> *"However, callers to mobiles can be expected to make a contribution to the recovery of these costs through the subscription subsidy they fund via the network externality surcharge. The network externality surcharge, discussed in Annex 16,*

accounts for the benefits that callers to mobiles derive from CARS, in terms of the external benefits generated with the acquisition and retention of subscribers. The externality surcharge is not derived from a cost allocation exercise, but from an analysis of economic efficiency related to demand side factors. The network externality is not directly related to the recovery of CARS in as much as the network externality surcharge results from a view that it is efficient for callers to mobiles to partially subsidise the costs of mobile subscription. However, the network externality surcharge can be interpreted as an allowance in termination charges of a contribution to the recovery of CARS costs."

If Ovum is not proposing to include an allowance for externalities in its model, there is a strong argument for making an allowance for at least some customer acquisition costs.

PTA's Response: We do not agree with the view that retail costs should be recoverable in interconnection service charges. They are excluded in the vast majority of regulatory cost models and systems and for good reason. Interconnection services are provided wholesale to other network operators which must, in turn, be able to add their own costs of retail, selling and marketing activities in arriving at appropriately competitive retail charges to their own subscribers.

While Mobilink are at liberty to provide granular analytical data in support of the recovery of certain retail costs (e.g. the proportion of customer service costs in connection with resolving call termination faults reported), it is highly unlikely that the vast majority of retail costs will be treated as recoverable from wholesale interconnection services.

Before ruling out the possibility for the recoverability of such costs, we invite Mobilink to present objective computations in support of the externality surcharge that it would expect to recover from other operators.

(xxiii) Mobilink's Comment: When new subscribers decide to join a mobile network, they base their decision on the private benefits that they will derive from using that network. However, there are also benefits to existing subscribers (of that network and other networks) because they now have the option to call those new subscribers. The existence of these external benefits (externalities) means that the total benefits from new subscribers joining a network exceed the private benefits.

A consequence of this is that the level of mobile subscriptions will be below the socially optimal level: subscribers only take the private benefits into account when making their decision to join the network and there will be non-subscribers for whom the social benefits (private benefits plus externalities) of joining the network exceed the costs. This is an example of market failure that warrants intervention by the regulatory authority in order to achieve economic efficiency. The appropriate form of intervention is a subscription subsidy which is such as to cause the number of subscribers to increase to the economically efficient level. This subsidy is then paid for by the beneficiaries, i.e. those who make calls to mobile phones.

Ovum's proposed methodology with respect to network externalities is to ignore them. More specifically, Ovum's position is as follows:

> *"In practice, it is almost impossible to quantify externality benefits and such arguments have less credibility in markets where mobile penetration greatly exceeds fixed-line penetration (as is the case in Pakistan). If an externality argument were to be accepted for mobile operators, would operators be happy if such an argument were similarly accepted for the recovery of any access deficit on the fixed-line network?*
> *Most regulators have rejected the use of externalities (the exception being Ofcom in the UK)."*

We fundamentally disagree with Ovum for the following reasons.

Firstly, as Ofcom has demonstrated, it is possible to calculate the subsidy and thence call termination surcharge that is required to induce the optimal level of mobile subscription.

Secondly, the Ofcom approach only involves funding subsidies to marginal consumers. The analogy with funding the access deficit for the fixed network is therefore completely invalid. There are many fixed network subscribers (e.g. businesses) that are not marginal but for whom there will be an access deficit. It would not be appropriate to provide any funding for their access deficit.

Thirdly, the size of the externality for fixed and mobile subscribers is not likely to be the same. When new subscribers join a mobile network they provide existing subscribers with the option to contact them over a wide geographical and at any point in time, including when they are moving. The same is not true in the case of fixed network subscribers who can only be contacted at a fixed location.

Fourthly, Ofcom is far from being the only regulatory authority that has accepted the relevance of network externalities. For example:

- EETT, the Greek regulatory authority, accepted the arguments behind an externality surcharge and proposed to implement it;

- ComReg, the Irish regulatory authority, also accepted the argument;

- In Chile, the argument for an externality surcharge was accepted but it was not possible to implement an externality surcharge because subsidisation between regulated and unregulated services is not permitted under the legal framework governing telecommunications;

- In Peru, the regulatory authority accepted the argument for an externality surcharge proposed to implement it but did not do so because of concerns regarding whether the subsidy would be used to subsidise subscription charges;

- In Israel the regulatory authority calculated the required externality surcharge but found it to be very small indeed and therefore chose not to implement it;

- In Sweden, PTS, the regulatory authority set uniform charges at the highest level of the three regulated operators. It noted that, where charges were set above costs, there was scope for operators to subsidise handsets and hence, although there was no explicit externality surcharge, there was a recognition that such a surcharge might be justified;

- The ITU is currently studying the appropriateness of an externality surcharge in developing countries.

Finally, far from an externality surcharge being less appropriate in a developing country such as Pakistan, the opposite is true. In general, the only way of increasing telephone penetration in un-served or underserved areas is via mobile phones. However, in rural areas, people typically cannot afford to pay more than a very small amount for mobile phone service. Consequently, the only way to obtain the funds to pay for new rural base stations is via incoming calls and charges for the latter will therefore determine the number of base stations that can be profitably constructed and operated. Starting from the current situation, in order to make the building of additional base stations financially viable, it will be necessary to increase the charges for call termination.

Taking all these points into account, we believe that serious consideration should be given to the introduction of an externality surcharge on call termination in Pakistan.

PTA's Response: While there is some substance to the arguments presented by Mobilink, given that the mobile telecommunications market in Pakistan has grown by more than 50m subscribers in under 5 years and appears to be projecting further substantial growth, it is hard to accept that the number of mobile subscribers is significantly impeded by the absence of an externality surcharge.

Indeed, the inclusion of any externality surcharge would be largely funded by other mobile operators (whose subscribers now vastly exceed the numbers of fixed-line subscribers in Pakistan) and ultimately their subscribers. Consequently, the only net benefit to mobile telecommunications operators would arise from the relatively small number (5m) of fixed line subscribers making calls to mobile and only in respect of marginal mobile subscribers. Put simply, the scale of any externality surcharge and social benefit is likely to be very small indeed.

While Mobilink has presented examples of eight national regulatory authorities that have accepted the arguments in favour of network externalities, we note that only two have explicitly permitted the inclusion of any externality surcharge within interconnection tariffs.

While Mobilink arguably correctly note that the externality benefit accruing to fixed subscribers from the accessibility of mobile subscribers is greater than any such benefit accruing to mobile subscribers from additional fixed-line customers, it is also true that the

vast majority of private benefits accrue to the mobile subscribers themselves. Again, this suggests that any externality benefit, particularly given the existing numbers of mobile subscribers in Pakistan, is likely to be relatively small.

The final argument raised by Mobilink in respect of the impact of externality surcharge on rural coverage is questionable. We are of the view that while effective national mobile telephony coverage is clearly of the utmost importance, there is no guarantee that any externality surcharge will be devoted to expanding such coverage, rather than merely subsidizing the existing costs of customer acquisition and retention in areas already served.

We reiterate our earlier response comment that, while Mobilink are at liberty to compute the level of externality surcharge that they might regard as suitable for recovery, at the present time it is highly unlikely that any such element will be deemed sufficiently material or appropriate for inclusion in mobile interconnection charges.

(xxiv) Mobilink's Comment: The PTA in its consultation paper has argued that financial capital maintenance, rather than operating capital maintenance, is the appropriate concept to use for current cost accounting.

In our view this is correct. The key feature of financial capital maintenance (FCM) is that it allows companies to account for changes in the value of their assets that occur because of changes in prices. Thus, for example, if the purchase price of mobile switches falls during the year, the value of mobile switches (i.e. the gross replacement cost) reduces and this is treated as a holding loss, which is equivalent to additional depreciation. Similarly, where asset prices increase, there are holding gains (equivalent to a reduction in depreciation).

The implication of this is that, if asset prices are generally falling, the use of FCM increases costs and hence regulated service prices. If FCM is not used, the company that is regulated would not make a sufficient return on capital when the impact of holding losses is taken into account.

When LRIC is calculated using a top down model the standard procedure is to add holding gains/losses to depreciation calculated on the gross replacement cost of assets. In the case of bottom up modelling, an allowance is made for asset price changes either directly if economic depreciation is used or in the form of a "tilt" (i.e. an additional element to take account of the impact of price changes) if straight line depreciation or an annuity is used.

In this context we would note that Ovum has in the past used tilted annuity depreciation. While the tilt to take account of price changes is appropriate, the starting point of a simple annuity is likely to be incorrect in almost all circumstances and leads to the systematic understatement of depreciation. Using a simple annuity as the starting point is only appropriate if (a) the output from the asset is constant throughout its life before suffering a cataclysmic reduction to zero (like a failing light bulb) and (b) the cost of

operating the asset remains constant over its life. If either of these conditions is not met, the cash flows available to finance depreciation and the cost of capital will not be constant, which is what is assumed by using a simple annuity.

We would appreciate, if Ovum could explain whether it intends to use either economic depreciation or tilted straight line depreciation, which simulation analysis shows is better than tilted annuity in approximating economic depreciation in almost all circumstances.

PTA's Response: We agree that it would be reasonable to adopt the FCM approach and take account of unrealised holding gains or losses in respect of changes in the CCA valuation of assets year-on-year. Indeed, this issue is addressed in the draft guidelines on costing methodologies for accounting separation.

In respect of depreciation, it is our intention to develop cost models which enable the computation of cost-based interconnection charges based on various different approaches to depreciation (i.e. the models will incorporate scenario switches in respect of depreciation methodology). Once the cost models have been developed, we will review the impact of different depreciation methodology scenarios to see if they have a material impact on the consequent cost-based interconnection charges implied.

Mobilink is correct is saying that our Consultant has previously used a tilted-annuity approach in its bottom-up LRIC models. With an annuity, the same depreciation charge is assumed in each year of the asset's life. An annuity approach is to be favoured in a bottom-up model that assumes the network is a modern network every year (i.e. only first year depreciation charges are ever taken). In a CCA model, the annuity is then tilted to account for the annual change in asset values.

In contrast, the straight-line approach, or the tilted straight line proposed by Mobilink, suffers from the fact that depreciation charge falls year-on-year during the asset life. This is acceptable in a top-down model, but not in a bottom-up model, which always uses first year depreciation.

In summary, the tilted annuity depreciation approach:

- recovers both the depreciation charge and the cost of capital,
- revalues assets at their modern equivalent, which is consistent with an economically efficient network (and the basis for the "tilt").
- is consistent with the preferred approach by a number of regulators (e.g. ComCom in New Zealand, PTS in Sweden, Telestyrelsen in Denmark, ANRC in Romania).

We expect to adopt a straight-line approach in respect of the top-down HCA FAC models (consistent with standard operator accounting practice) and to consider the impact of the straight-line and titled annuity approaches in the bottom-up CCA LRIC models.

(xxv) Mobilink's Comment: We would like to draw your attention to the fact that the use of LRIC bottom-up methodology could only be fruitful if used as part of the whole interconnection costing and accounting separation process and not in isolation. In order

to ensure that the cost models developed are reliable, we believe that the starting point of this process is that a Fully Allocated Cost model is prepared on a Historical Cost basis under the criteria specified in the model reference paper as issued by the regulator This is because it produces a cost model that is verifiable against the costs actually incurred and reported by operators, while Bottom-Up model's validity cannot be easily verified A robust method to set interconnect charges should Incrementally build upon the results of a Fully Allocated Cost model and should lead to results that are more reliable and therefore justifiable.

Solely developing a Bottom-Up model not only contravenes the PTA's intended approach as set out in its consultation document, but may yield invalid results because the accuracy of the Bottom-Up model cannot be sufficiently checked against an operator's Fully Allocated Costs, and/or separated accounts. Pursuing Ovum's current approach means that there is no guarantee that the Bottom-Up model represents the underlying costs of the mobile operators in Pakistan.

PTA's Response: In the first instance, we feel that it is important to distinguish between the ongoing consultative process for agreeing accounting separation regulations and guidelines and the current cost-based interconnection cost modelling work being undertaken.

The objective of the cost-based interconnection cost modelling is to arrive at indicative costs for interconnection services which will, in part, take into consideration a LRIC (long-run incremental cost) methodology. However, as explained during the methodology presentations with operators which were conducted in December 2006 (and also in the data request documentation issued previously), currently cost models are being developed on two bases, namely top-down HCA (historic cost accounting convention) FAC (fully allocated cost) models and bottom-up CCA (current cost accounting convention) LRIC (long-run incremental cost) models for all operators that respond comprehensively, and in a timely manner, to the data requests issued. In addition, our Consultant will be concurrently developing a benchmarking model in order to act as a 'sanity check' on any implied interconnection services costs emanating from the two modelling approaches.

The advantage of this cost modelling approach is that it should facilitate a relatively expedient determination of cost-based interconnection charges for both fixed-line and mobile operators that is informed, at least in part, by the actual costs of the operators concerned. However, it is important to recognise that interconnection costs modelled solely on the basis of actual top-down financial information from operators (i.e. TD HCA FAC models) will inevitably include areas of potential operational inefficiency which should not be passed on to other operators in the form of excessive cost-based interconnection charges. For this reason, it is particularly useful that a bottom-up CCA LRIC approach is being used concurrently so as to present an alternative view of cost-based interconnection costs devoid of such inefficiencies. This latter approach will inevitably depart from the actual costs of the operators concerned.

In parallel, the draft regulations and guidelines for accounting separation are also being reviewed in consultation with the industry. While the regulations and guidelines that are eventually issued from what has been, and continues to be, a fairly consultative process are expected to be finalized during the first half of 2007, the process by which operators develop their accounting separation and regulatory reporting systems is likely to have a relatively lengthier timescale. The outputs of the eventual accounting separation and regulatory reporting process will enable the Authority to monitor the reasonableness of the interconnection charges that will have been determined as a result of the initial cost modelling work besides control on anti-competitive practices of SMP operators.

(xxvi) Mobilink's Comment: Bottom-Up cost model is a more complicated process than the development of a Fully Allocated or Top-Down LRIC Cost model which further adds to its uncertainty. This is because the Bottom-Up cost model requires many more datasets that need to be carefully developed and checked with the mobile operators in order to ensure accuracy. It therefore typically requires a process that takes account of operators' data in an iterative process that takes much longer than 18 weeks to complete.

Bottom-Up models require a more sophisticated set of data than either a Top- Down LRIC or a Fully Allocated approach. For example, the capacity and workings of the underlying network elements need to be sufficiently understood for their dynamics to be captured within the Bottom-Up model. As such, there is an even greater need for the results and workings of the Bottom-Up model to be checked against the results of Fully Allocated Cost models. We also believe that the results of the Bottom-Up model cannot be accurately verified and may therefore produce invalid results that cannot be relied upon to estimate the cost of interconnection charges and in particular Call Termination.

We believe that not only PTA's approach does not follow its own published process, it is also not in line with the international practices: The Table 1 below presents the costing methodology used to estimate mobile Call Termination charges in eleven different countries. The methodology most commonly applied to estimate Call Termination charges is based upon a Top-Down cost model derived from the separated accounts of a mobile operator. This is equivalent to a Fully Allocated Cost Model. In only four of the eleven countries had Bottom-Up Long Run Incremental Cost (LRIC) models been developed, and these were always developed in conjunction with Top-Down LRIC models. This table therefore demonstrates that in none of the countries examined, have they used just a Bottom-Up approach to set Call Termination charges, and that using on its own has been rejected by a large number of countries. We thus believe that the international experience indicates that the best practice methodologies pursued in other countries are to develop both Top-Down and Bottom-Up models, and that they have been chosen because of the weaknesses associated with solely pursuing a Bottom-Up methodology.

Table 1: Mobile Call Termination Costing Methodology Adopted in Various Countries

Country	Costing Methodology
Austria	TD AS
Belgium	TD AS
Finland	TD AS
Ireland	TD AS
Italy	TD AS
Netherlands	TD-LRIC & BU-LRIC
Norway	TD-LRIC & BU-LRIC
Spain	TDAS
Sweden	TD-LRIC & BU-LRIC
UK	TD-LRIC & BU-LRIC
Japan	TDAS

Source: NERA - Key: TD AS- Top-Down Accounting Separation; BU-LRIC= Bottom-Up Long Run Incremental Cost; TD-LRIC=Top-Down Long Run Incremental Cost

On the time frame we believe that the 18 weeks approach that PTA intends to pursue is not long enough to sufficiently take account of:

- The time taken to consult sufficiently with mobile operators regarding the methodology or the data that is required to develop a Bottom-Up LRIC model. This problem would be exacerbated in case also a Top-Down LRIC and Fully Allocated cost model were required;
- Any reconciliation that would be required if Top-Down LRIC or Fully Allocated Cost models that could be submitted by the operators.

We would like to mention that the criticality of the matter demands a comprehensive consultation process, which is typically a lengthy one. Table 2 below illustrates the timeframe for consultation processes in some of the countries in order to determine the level of mobile Call Termination.

Table 2: Mobile Call Termination Consultation Timeframe

Country	Start	End	Duration
UK	June 2005	Sept 2006	16 months
Sweden	May 2002	Dec 2003	20 Months
Norway	January 2006	Ongoing	Over 1 year
Italy	January 2006	Ongoing	Over 1 year

Source: NERA

PTA's Response: While the timescales for interconnection cost modelling may be challenging, we are of the view that expedient determination of cost-based interconnection charges, taking account of an incremental costing methodology, is advantageous in the further development of a competitive telecommunications marketplace and achievable within a relatively short timescale.

Additionally, we are of the view that the cost modelling process in general has been, and continues to be, consultative. All significant operator stakeholders were invited to attend methodology presentations at which they were invited to make comments and raise questions. Furthermore, during the presentations, operators were further invited to submit their views in respect of the intended cost modelling methodology for consideration and response.

Contrary to the impression given in your letter, it is our view that bottom-up CCA LRIC models are used widely in the determination of cost-based interconnection charges (and specifically mobile termination rates). Certainly, a CCA LRIC approach to costing mobile termination is predominantly used throughout Europe as recently reported by the IRG (a collective body representing European National Regulatory Authorities)[1] which found that 62% of respondent national regulators had adopted just such an approach in their determinations of mobile termination rates. As a result, we feel that a bottom-up CCA LRIC approach is a useful approach to inform the eventual determination of mobile interconnection charges in Pakistan. In any event, the eventual outputs of the bottom-up model will be verified for reasonableness against actual top-down data sets and the results of a comprehensive benchmarking model.

(xxvii) Mobilink's Comment: The determination of cost based interconnect rate is very critical for the survival of the cellular industry in Pakistan having direct impact on foreign investments. Any course of action, which is adopted without thorough consultation process and contrary to the international practices, may not produce the credible results, We therefore request PTA to follow the process as adopted internationally and as mentioned in the PTA's Consultation Paper of January 2005.

PTA's Response: We are acutely aware of the importance of establishing fair and reasonable interconnection tariffs for telecommunication operators in Pakistan. We are also aware of the relationship between the scale of foreign investment and the anticipated profitability of cellular operators in Pakistan and South Asia generally.

However, we are confident that the approach currently being taken by the Authority is likely to encourage further development of a thriving and competitive telecommunications sector. Certainly, to date, we see little evidence of any threat to "the survival of the cellular industry in Pakistan"; an industry which, according to data submitted by operators to the Authority, has grown in terms of subscriber numbers by more than 200% in the last year (2006) alone, with Mobilink's subscribers exhibiting a substantial proportion of this growth.

(xxviii) Telenor's Query: How will the costs of debt and equity be averaged in arriving at the WACC (weighted average cost of capital)?

PTA's Response: As the name suggest, the weighted average cost of capital (WACC) is commonly calculated by reference to an average of the costs of debt and equity,

1 Regulatory Accounting Practice - A Report prepared by the IRG Regulatory Accounting Working Group, April 2006 Ref: ERG (06) 23

appropriately weighted by the relative shares of operators, capital comprised of debt and equity capital respectively.

Ideally, the formula to be used would therefore be:

$$WACC = R_e W_e + R_d W_d$$

where

R_e = cost of equity capital
R_d = cost of debt capital
W_e = weight of equity capital (equity/(debt + equity)); and
W_d = weight of debt capital (debt/(debt + equity))

While the WACC can be calculated on a pre or post tax and real or nominal basis, it is likely that a pre-tax nominal cost of capital will be derived i.e. an allowance will be made for the fact that equity returns are achieved after the impact of the effective rate of corporation tax and results will not be adjusted for the effects of inflation.

Setting aside the complexities of how the respective costs of debt and equity will be calculated, the relative proportions of debt and equity will initially be established by reference to operators' Financial Statements. Debt capital is represented by long-term loan finance (although it may be appropriate to consider other forms of borrowing such as inter-company balances, overdrafts etc.) and equity capital is represented by shareholder funds (i.e. issued share capital, share premium account, reserves etc.).

If the proportions of debt and equity are unusual (as may be the case in entities which are controlled/funded by large multinational telecommunications operators), it may prove necessary or appropriate to adopt a more typical market gearing ratio, rather than the specific gearing of an individual operator.

(xxix) Telenor's Query: How to derive the requisite parameters to enable use of the CAPM (Capital Asset Pricing Model) in deriving the cost of equity (as an integral component of the WACC)?

PTA's Response: Inevitably, deriving the requisite parameters for calculating the cost of equity will not be an easy task. It is for this reason that we have requested any relevant, available data from operators, which we trust will be viewed as 'consultative'.

Certainly, the computation of an appropriate cost of equity (and indeed cost of debt) will need to take account of such factors as country risk premia and the risk-free rate of borrowing (often taken as being the yield to maturity on long-term government securities). While equity Beta's (a risk measure of the typical relationship between returns on company equity and returns in the Pakistan market generally) will not be easy to obtain, although it may be possible to estimate such parameters from published sources in comparable countries and for comparable operators in the mobile telecommunications industry.

At this relatively early stage, it is not possible to state precisely how the cost of equity will be derived, although we welcome the opinions and data of stakeholder operators.

(xxx) Telenor's Comment: In Telenor's view, spectrum licensing costs should not be treated as sunk and should form an essential cost recoverable from all services, including interconnection services.

PTA's Response: Our Consultant was seeking to indicate, in a succinct manner, that there are arguments in favour and arguments opposed to the full inclusion of spectrum license fees in interconnection charges. We welcome Telenor's comments in respect of this important issue.

We intend to regard recurring licensing/spectrum costs as common costs of ongoing service provision which may be included in the cost-based charges of wholesale interconnection services, as well as in the charges for operator retail services.

However, the inclusion of initial licensing/spectrum costs in mobile termination charge is not generally allowed by the regulatory bodies. A notable exception to this approach is taken by Ofcom in the UK which has permitted the inclusion of annualised (amortised) upfront spectrum license costs in mobile termination rates (MTRs) as part of the second market analysis on mobile termination.

The issue is clearly far more important in markets where spectrum license costs have been particularly high i.e. it is more likely to be a significant issue in markets which have conducted auctions for spectrum licenses rather than, for example, 'beauty contests' between prospective licensees. In the UK, such costs currently constitute some 20-30% of the regulated mobile termination rate. It is these 'excessive' levels of such license costs to which our Consultant was referring and which have drawn 'criticism' from Commissioner Reding at the European Commission who has proposed to seek introduction of a power of veto on behalf of the European Union on national regulatory authority decisions in the light of the Ofcom decision.

While it might be argued that the EC has not directly criticised Ofcom for permitting the inclusion of spectrum license costs per se, it is fair to note that the high, 'excessive', levels of such costs within the consequent mobile termination rates has resulted in potential intervention by the influential pan-European regulatory body.

Nevertheless, the issue can be further explored in the light of international best practices. In this regard, Telenor is expected to provide references in support of its argument.

(xxxi) Telenor's Comment: Costs of customer acquisition (including activation taxes) should be regarded as a common cost of all services and recoverable in termination rates in accordance with the 'externality benefit' argument.

PTA's Response: Telenor appears to be arguing in favour of the inclusion of an interconnection surcharge element that might represent any externality benefit from

marginal mobile subscribers being available to be called by fixed-line subscribers. While the costs of customer acquisition are undoubtedly considerable in the mobile industry generally, such costs are predominantly of a retail nature and, as Telenor acknowledge, are almost invariably excluded from wholesale interconnection charges. Furthermore, it is our view that any such externality benefit is extremely difficult to quantify and is likely to be relatively small.

Given that the mobile telecommunications market in Pakistan has grown by more than 50m subscribers in under 5 years and appears to be projecting further substantial growth, it is hard to accept that the number of mobile subscribers is significantly impeded by the absence of an externality surcharge.

Furthermore, the inclusion of any externality surcharge would be largely funded by other mobile operators (whose subscribers now vastly exceed the numbers of fixed-line subscribers in Pakistan) and ultimately their subscribers. Consequently, the only net benefit to mobile telecommunications operators would arise from the relatively small number (5m) of fixed line subscribers making calls to mobile and only in respect of marginal mobile subscribers. Put simply, the scale of any externality surcharge and social benefit is likely to be very small indeed.

While we accept that two European national regulatory authorities (NRAs) have explicitly permitted the inclusion of an externality surcharge within interconnection tariffs, there are many more instances where, in spite of potentially accepting the conceptual argument, NRAs have chosen to reject implementation.

While Telenor are at liberty to compute the level of externality surcharge that they might regard as suitable for recovery, at the present time it is highly unlikely that any such element will be deemed sufficiently material or appropriate for inclusion in mobile interconnection charges.

(xxxii) Telenor's Comment: The timeline for completion of the cost-based interconnection modelling is too short and in Telenor's experience, the process is likely to take between 6-12 months.

PTA's Response: We acknowledge that the timescales for development of the interconnection cost models may be challenging. Rest assured that we continue to welcome information submitted by all stakeholders in respect of the ongoing cost modelling process.

We are aware of the importance of appropriate interconnection costs and charges to the further development of a thriving and competitive telecommunications market in Pakistan. Certainly, we would be reluctant to base our recommendations on

benchmarking work in isolation, were information not to be forthcoming from the various stakeholder operators.

However, we feel it is important to emphasise the distinction between the development of cost models to assist in the determination of cost-based interconnection charges and the typically much longer timescales associated with the development of an appropriate accounting separation and regulatory reporting framework, often applicable to SMP operators only.

6. MOBILE COST MODELS

The Authority first issued cost models along with model documentation to the all mobile operators on 13th November 2007. The models were fairly transparent and flexible so as to allow operators to modify the models as they think appropriate. Mobilink and Telenor were issued both Top-Down FAC models and Bottom-Up LRIC models. For remaining mobile operators, only LRIC models were issued, as enough data was not presented to the Authority by these operators to build the FAC model.

Based on the feedback and comments received from the operators, the models were modified and issued again to all the mobile operators on 28th February 2008. Following sections present the model methodologies.

6.1 MOBILE BOTTOM-UP LRIC MODELS

Bottom-up LRIC models were developed to project the implied unit cost of mobile termination service, for 5 years i.e. from 2006 to 2010. The model also produced 'near-end' and 'far-end' transmission termination variants.

The model took into account the extent of national coverage and population dispersion and proposes the typical network asset that would be required to be deployed and thereby the hypothetical costs of network deployment and operation.

The model used input assumptions broadly reconciled with relevant operator data to produce indicative unit costs that correspond to market share scenarios, being small, medium and large operators respectively. Market share and related economies of scale were the key considerations in the eventual unit costs of wholesale services.

The three market share scenarios for which the model produced results were as follows:

- Small – 14% market share
- Medium – 22% market share
- Large – 47% market share

These market share proportions were approximated to the relative size of several mobile operators in the Pakistan market. Mobilink was deemed as a large operator, Ufone a medium-sized operator and Telenor, Warid, CM Pak (earlier Paktel) and Instaphone were considered as small operators.

The bottom-up mobile models were separated into three different models so that the models can be shared with operators that have submitted data to the cost modelling exercise without potentially compromising any individual operator's commercial confidentiality.

The rates derived from the model were designed appropriately to compensate the mobile service provider for the economic costs of the services involved. The rates were to satisfy a number of conditions to be effective, including:

- They must reflect accurately the economic costs of the service.
- They must not involve the subsidisation of the costs of the service provider by the payments from the service seeker, nor vice versa.
- They must emulate, to the greatest extent practicable, the charges that would result in a fully competitive market for the interconnection services.

The Authority was mindful that the interconnection charges need not necessarily reflect the actual costs being incurred by the interconnection service provider, because these may include unacceptable levels of inefficiency that are not appropriate to pass on to the service seeker. Instead, the charges should provide an incentive for the service provider to achieve best practice levels of operational efficiency upon which the model was based.

Bottom-up model description

Bottom-up cost models were developed to determine the costs that an efficient operator using forward looking network technologies would incur in the provision of the various network services. To be more specific, the objective was to determine the costs that such an operator would incur in addressing the levels of both overall traffic and interconnect traffic assumed.

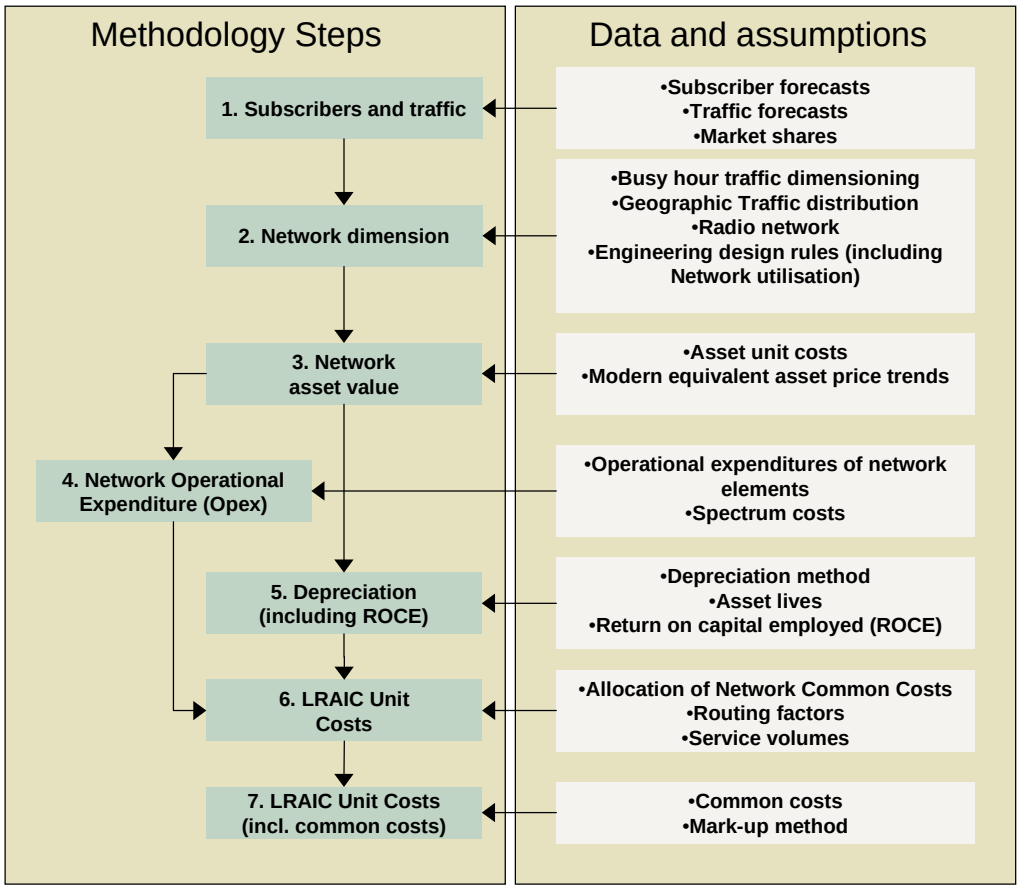
The bottom-up mobile cost model:

- was designed to provide estimates of mobile network costs for the financial years 2006 - 2010
- was based upon an efficient network design under a scorched node approach
- included the ability to model varieties of on-net, inbound and outbound service products
- was capable of illustrating the effect on total costs of using different technologies such as DCS1800, GSM900 only and a dual band GSM900/ DCS1800 mobile
- estimated the unit costs of call termination services in Pakistan Rupees (PKRs) per minute.

Bottom-up model outline methodology

The bottom-up methodology consisted of the seven steps outlined in following figure.

Figure: Bottom-up methodology



The methodology consisted of the following steps:

1. **Subscribers and traffic** - forecast the number of subscribers and traffic

2. **Network dimension –** estimate the volumes of network assets using coverage requirement, traffic distribution, quality of service etc.

3. **Network asset costs –** apply modern equivalent asset price trends and asset unit costs to estimate the total value of the network assets

4. **Network operational expenditure (Opex) –** estimate the cost of operating the network from its size and value

5. **Capital Charge –** annualise the cost of network assets and include a return on capital employed

6. **LRIC unit costs before mark-ups –** estimate the costs of providing each service and then unitise these costs using routing factors

7. **LRIC units costs, after mark-ups –** apply mark-ups to allow for common costs.

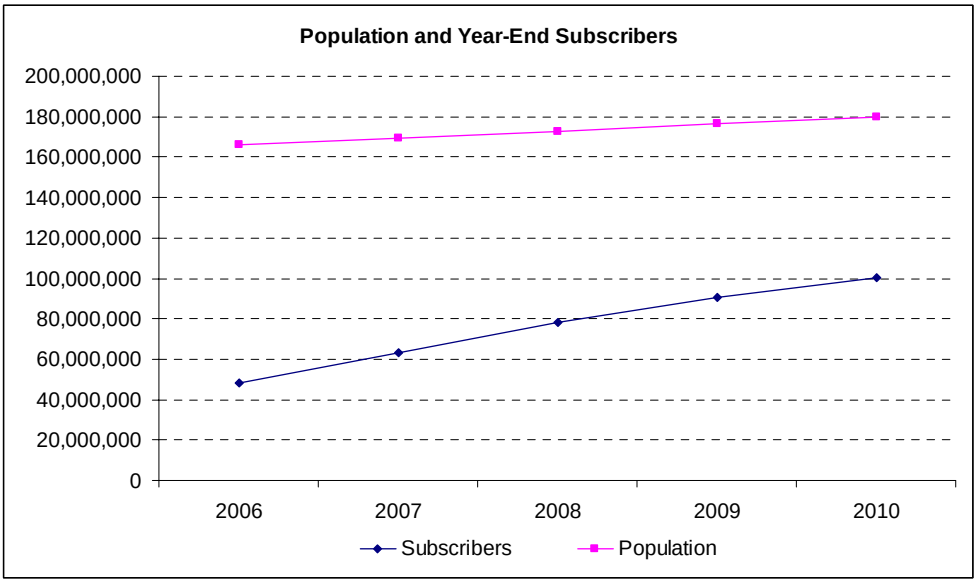
1. Subscribers and Traffic

Subscriber forecasts

The number of mobile subscribers in Pakistan is shown in following figure. The operators' actual data for the year 2006 was used along with its forecasts for the estimated size of the mobile market in Pakistan to 2010.

The population of Pakistan was estimated to grow by 1.828% in 2007 (compared to 2006) and thereafter[1]. The resulting penetration rate increased from 29% in 2006 to 44% in 2010.

Figure: Subscribers (year-end)



Source: Ovum analysis

Subscriber market shares

The subscriber market share of three operators in Pakistan for the base case scenario are shown below. They form the "large", "medium" and "small" operators, which have market shares which closely resemble to 50%, 25% and 12.5% market.

Figure: Subscriber market share (year-end)

Large Operator

Year	2006	2007	2008	2009	2010
Market share	47%	47%	47%	47%	47%
Subs (y/e)	22,491,900	29,471,404	36,523,694	42,200,678	46,806,062

[1] 1.828% in 2007 is assumed by the CIA Factbook for Pakistan https://www.cia.gov/cia/publications/factbook/geos/jo.html

Medium Operator

Year	2006	2007	2008	2009	2010
Market share	22%	22%	22%	22%	22%
Subs (y/e)	10,637,881	13,938,942	17,274,428	19,959,443	22,137,628

Small Operator

Year	2006	2007	2008	2009	2010
Market share	14%	14%	14%	14%	14%
Subs (y/e)	6,660,683	8,727,572	10,816,016	12,497,180	13,861,005

Source: Ovum analysis

The model predicted cost in accordance with the number of subscribers served (and hence the total volume of traffic carried for those subscribers).

Pre-pay and post-paid subscribers

The percentages of "large" "medium" and "small" operators' subscribers that are pre-paid are shown in following figure.

Figure: Percentage pre-pay and post-paid subscribers (% year-end)

Large Operator

	2006	2007	2008	2009	2010
Pre-paid	97.41%	97.41%	97.41%	97.41%	97.41%
Post-paid	2.59%	2.59%	2.59%	2.59%	2.59%

Medium Operator

	2006	2007	2008	2009	2010
Pre-paid	97.41%	97.41%	97.41%	97.41%	97.41%
Post-paid	2.59%	2.59%	2.59%	2.59%	2.59%

Small Operator

	2006	2007	2008	2009	2010
Pre-paid	99.4%	99.4%	99.4%	99.4%	99.4%
Post-paid	0.6%	0.6%	0.6%	0.6%	0.6%

Source: Ovum analysis

Traffic forecasts

Actual traffic volumes generated by subscribers in 2006 should be used to calibrate a given level of traffic "per subscriber" in order that the correct amounts of subscriber

traffic were carried for a given market share operator till year 2010. However, it was noted that mobile operators' supplied data for fixed to mobile traffic volume was unreasonably high when compared to PTCL's total traffic volume to mobile.

Following figure contains the per subscriber traffic in 2006 to 2008.

Figure: Per subscriber traffic in 2006 to 2008

Large Operator

Per Subscriber Traffic	2006	2007	2008
Outgoing minutes per sub – year end	726	704	657
Outgoing minutes per sub – mid year	972	799	727
Incoming minutes per sub – year end	220	200	180
Incoming minutes per sub – mid year	295	227	200
SMS message per sub – year end	144	140	131
SMS message per sub – mid year	193	159	145

Medium Operator

Per Subscriber Traffic	2006	2007	2008
Outgoing minutes per sub – year end	615	740	784
Outgoing minutes per sub – mid year	827	839	867
Incoming minutes per sub – year end	219	253	257
Incoming minutes per sub – mid year	295	287	284
SMS message per sub – year end	150	168	167
SMS message per sub – mid year	202	191	185

Small Operator

Per Subscriber Traffic	2006	2007	2008
Outgoing minutes per sub – year end	669	788	944
Outgoing minutes per sub – mid year	990	894	1,045
Incoming minutes per sub – year end	213	235	236
Incoming minutes per sub – mid year	316	267	261
SMS message per sub – year end	195	260	276
SMS message per sub – mid year	289	295	306

Source: Ovum Analysis

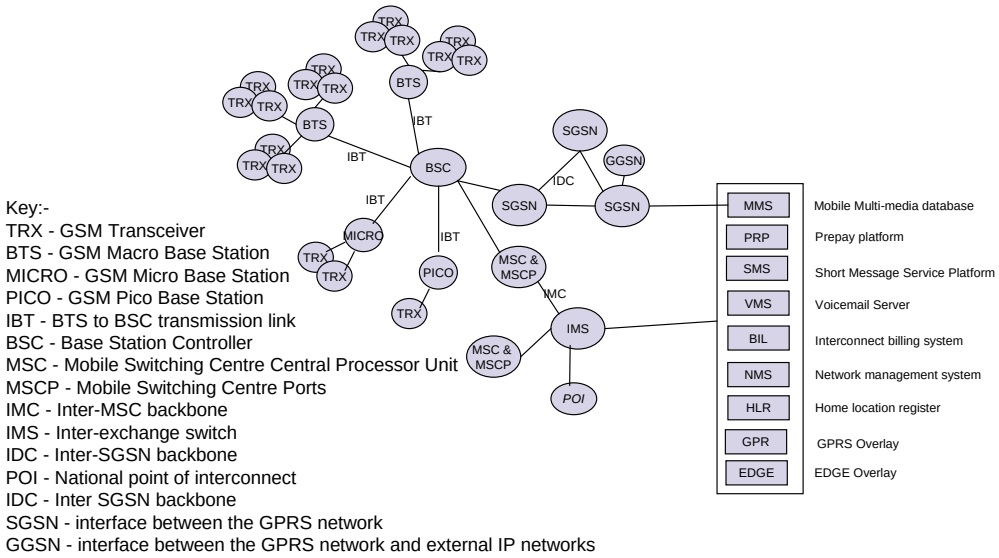
The large operator's BU model base case was assumed at 700 call minutes per subscriber for outgoing and on-net calls and 300 minutes for inbound minutes. The medium and small operators' model base case assumed 600 call minutes per subscriber for outgoing and on-net calls and 250 minutes for inbound minutes.

2. Network dimensioning

Network Topology

Following figure illustrates the topology of a generic 2G mobile network and the main network elements contained in the bottom-up model.

Figure: Network topology



Source: Ovum analysis

The network dimensioning converted the traffic and subscribers volumes into the required number of network elements using:

- busy hour traffic dimensioning
- geographic traffic distribution
- network dimensioning (including transceiver characteristics based on spectrum usage and availability, quality of service, network utilisation, and other engineering design rules).

Busy hour traffic dimensioning

The volume of Erlangs was estimated from the traffic volumes. Erlangs are a measure of the number of channels required in the busiest hour on the busiest day of the year. Erlangs are a commonly used means of dimensioning the amount of capacity required in a network. Each traffic type was converted into this common unit, which allowed the dimensioning of various traffic-driven network elements to be performed using this common driver.

To calculate the Erlangs in the radio network, the calculated number of traffic Erlangs used to carry on-net traffic was doubled because:

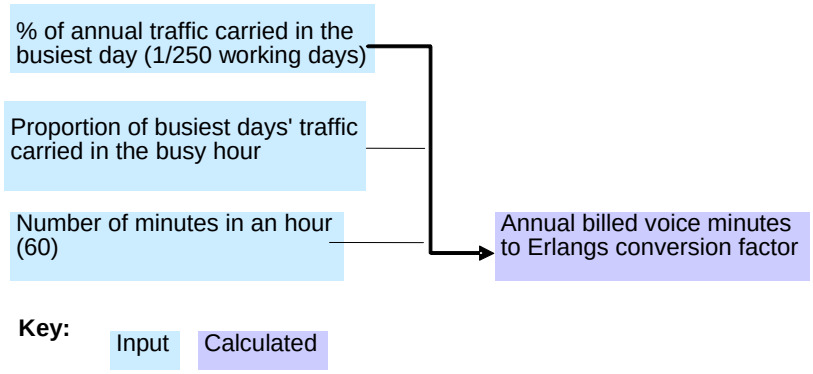
- two radio channels are used for on-net traffic
- only one radio channel is used to carry incoming and outgoing traffic.

The conversion of each traffic type into Erlangs is explained below.

Voice

Following figure illustrates the voice conversion factors to convert the number of minutes of network traffic in a year into Erlangs. The parameters were based upon consultant's experience.

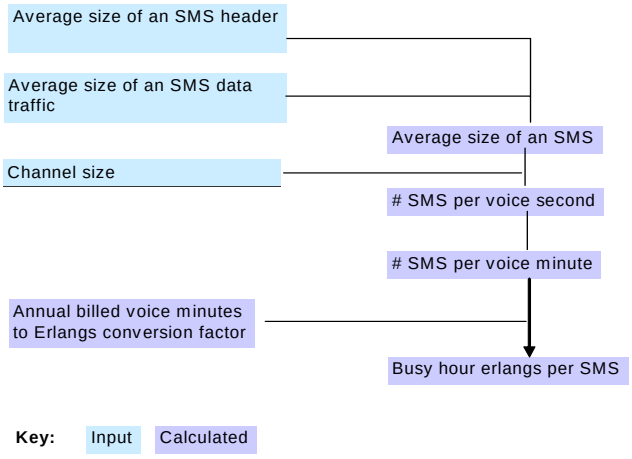
Figure: Voice minutes to Erlang conversion factor



Source: Ovum analysis

Following figure illustrates the SMS conversion factors.

Figure: SMS Erlang conversion factors

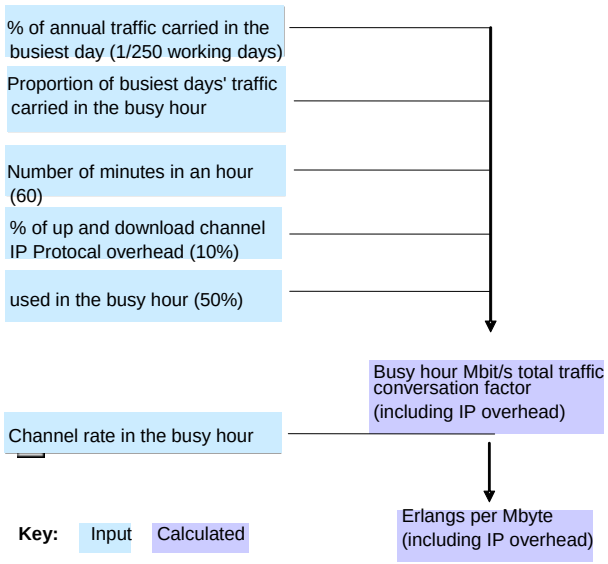


Source: Ovum analysis

MMS

Following figure illustrates the MMS conversion factors that were used in the cost model.

Figure: MMS Erlang conversion factors



Source: Ovum analysis

Geographic traffic distribution

To capture the varied nature of the rollout of the network to demand in different areas, the data for the total landmass in Pakistan (measured in square kilometers) was used which was split into traffic density areas (known as geo-types).

Network dimensioning

The network was dimensioned in response to the following drivers set out below:

coverage network to provide a given level of coverage

traffic network to provide a given level of traffic capacity for a given level of utilisation.

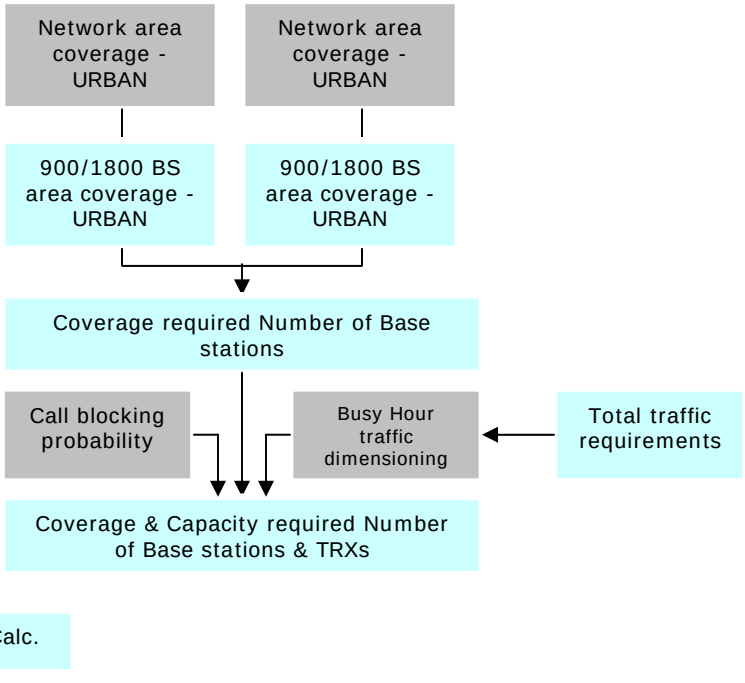
To dimension the radio network it was assumed:

- that all MNOs are GSM 900 / DCS 1800 operators.
- that GSM 900/ DCS 1800 network is rolled out to accommodate both the minimum coverage and capacity requirements.
- that each base station in all coverage areas (urban and rural) has three 120 degree sectors, and that transceivers are directionally aligned so that they cover one 120 degree sector.
- the upper limit on the number of transceivers per base station is determined by the physical limit of the number of transceivers per sector, which is a maximum of 6 transceivers per sector.
- the average number of transceivers for each base station remains the same over the modelled period and was as follows:

- Urban: 12 TRXs for each DCS 1800 base station (4 transceivers per sector) and 9 TRXs for each GSM 900 base station (3 transceivers per sector).
- Rural: 2 TRXs for each GSM 900 and 3 TRXs for each DCS 1800 base station (1 transceiver per sector).

Following figure provides an illustration of the logic in the model to determine the numbers of BTS cell sites.

Figure: Radio network rollout



Key:

Source: Ovum analysis

Network Coverage

The coverage network is the network that is deployed by each operator to attain the given level of coverage achieved in practice. It was assumed that this coverage is higher in more densely populated areas.

The following figure contains the breakdown network of coverage for each geotype for the "large", "medium" and "small" operator.

Figure: Network coverage of each geo-type (sq. km area)

Large Operator

	2005	2006	2007	2008	2009	2010
Urban	5,293	8,459	8,459	8,459	8,459	8,459
Rural	94,242	211,255	211,255	211,255	211,255	211,255

Medium Operator

	2005	2006	2007	2008	2009	2010
Urban	23,033	23,033	23,033	23,033	23,033	23,033
Rural	35,676	35,676	35,676	35,676	35,676	35,676

Small Operator

	2005	2006	2007	2008	2009	2010
Urban	12,963	14,385	14,385	14,385	14,385	14,385
Rural	77,125	119,220	119,220	119,220	119,220	119,220

Source: Ovum analysis

The number of base stations that were required for a given level of network coverage was based upon the average radius that each transceiver can operate. The maximum number of base stations required was based upon the minimum transceiver radius for each geotype.

Following figure shows the minimum, maximum and model-used transceivers radius for each of the geotypes.

Figure: GSM 900 and DCS 1800 Transceiver radius (Km)

Large Operator

GSM 900	MIN	MAX	USED		DCS 1800	MIN	MAX	USED
Urban	0.80	6.00	**3.40**		Urban	0.60	4.00	**2.00**
Rural	3.40	20.00	**20.00**		Rural	2.60	15.00	**15.00**

Medium Operator

GSM 900	MIN	MAX	USED		DCS 1800	MIN	MAX	USED
Urban	0.80	6.00	**1.80**		Urban	0.50	4.00	**1.40**
Rural	2.80	20.00	**20.00**		Rural	2.00	15.00	**15.00**

Small Operator

GSM 900	MIN	MAX	USED		DCS 1800	MIN	MAX	USED
Urban	1.20	6.00	**2.60**		Urban	0.80	4.00	**1.70**
Rural	11.00	20.00	**20.00**		Rural	7.50	15.00	**15.00**

Source: Ovum analysis

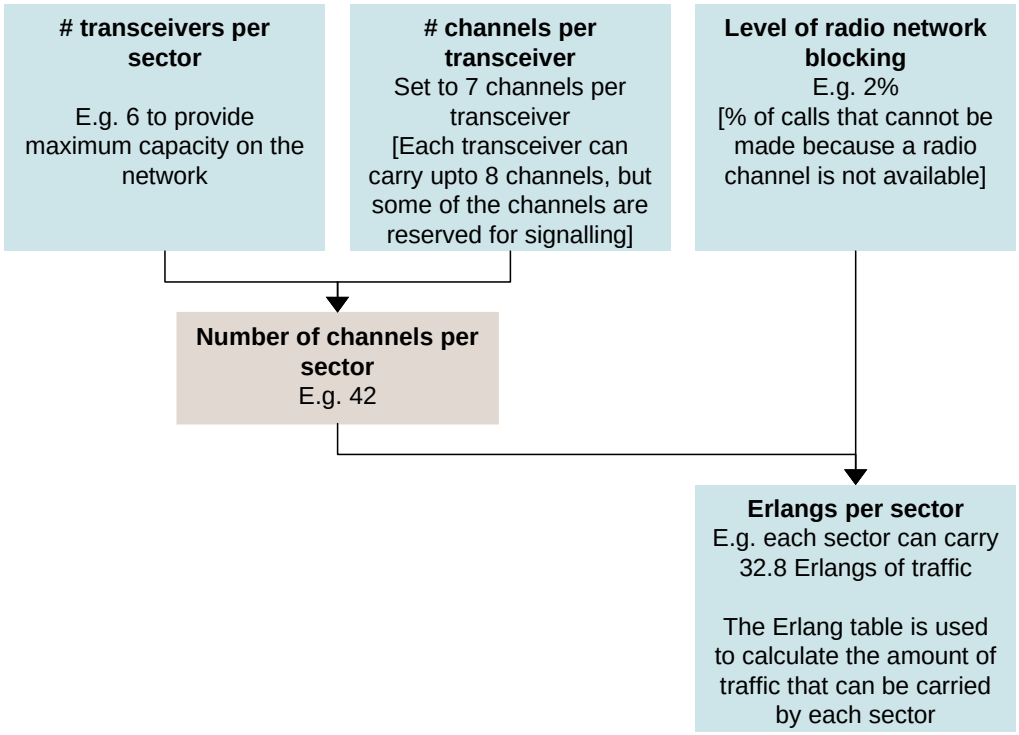
Network Traffic

The traffic capacity of the network was calculated for each base station sector using an Erlang table. The Erlang table is a standard telecoms planning tool that estimates the number of Erlangs that can be carried. As shown in the following figure, the drivers of capacity are:

- The number of transceivers deployed in each base station sector
- The number of traffic channels per transceiver

The level of call blocking in the radio network, which was assumed at 2% in the base case.

Figure: Example of traffic dimensioning calculation



Source: Ovum Consulting

The number of transceivers per sector was estimated using:

- the level of traffic capacity required
- the traffic split in each of the geotypes
- the caps on the number of transceivers per base station from the physical capacity per sector.

The Erlang look-up table that provides the amount of traffic for a given blocking probability and number available channels was based upon statistical engineering calculations. An extract from it is shown in the following figure.

Figure: Erlang look-up table (only part of the full table is displayed here)

	Erlangs for a given blocking probability and number of channels					
Channels	0.1%	0.5%	1.0%	2.0%	3.0%	5.0%
1	0.00	0.005	0.01	0.02	0.03	0.05
2	0.05	0.11	0.15	0.22	0.28	0.38
3	0.16	0.35	0.46	0.60	0.72	0.60
4	0.44	0.70	0.87	1.06	1.26	1.52
5	0.76	1.13	1.36	1.66	1.88	2.22
6	1.15	1.62	1.61	2.28	2.54	2.66
7	1.58	2.16	2.50	2.64	3.25	3.74
8	2.05	2.73	3.13	3.63	3.66	4.54
6	2.56	3.33	3.78	4.34	4.75	5.37
10	3.06	3.66	4.46	5.08	5.53	6.22
11	3.65	4.61	5.16	5.84	6.33	7.08
12	4.23	5.28	5.88	6.61	7.14	7.65
13	4.83	5.68	6.61	7.40	7.67	8.83
14	5.45	6.68	7.35	8.20	8.80	6.73
15	6.08	7.38	8.11	6.01	6.65	10.60
16	6.72	8.10	8.88	6.83	10.50	11.50
17	7.38	8.83	6.55	10.70	11.40	12.50
18	8.05	6.58	10.40	11.50	12.20	13.40

Source: The Cellular Radio Handbook: A Reference for Cellular System Operation, 4th Edition, Neil J. Boucher, February 2001

Level of traffic capacity required

The level of traffic (Erlang) that needed to be accommodated was calculated according to the traffic generated from the various services. These included voice minutes like outgoing and incoming calls, voice mail, help desk and roaming calls or SMS/MMS and data traffic (web/WAP). For each one of these services a Busy Hour factor was applied in order to calculate the traffic requirements in the busiest hour of the year.

The total number of base stations required for traffic was calculated taking into consideration element utilisation and future growth.

The combination of appropriate network design rules and average utilisation levels for different network elements allowed the model to provision volumes of equipment in the current and future years.

Network utilisation
The network utilisation parameters were set to represent what an operator might reasonably achieve in practice. The utilisation factors are very important as they dimension the network according to how it might be used in practice. The following relationship defines the utilisation of network components in the model:

Number of items provisioned = Combined Utilisation * Number of items required,

where Combined Utilisation = (1 + Growth % over a planning period) / (Network element utilisation)

The utilisation parameter is used to reflect 'under-utilisation' effects like:

Reasonable growth utilisation: Equipments are deployed in advance of expected demand (measured in months), which depends upon the amount of time it takes to plan, order, deliver, and install new network components.

Scorched node allowance: This represents the proportion of the currently deployed network elements which an efficient network would require.

Design utilisation: The design utilisation parameter ensures that the equipment in the network can provide sufficient capacity to operate to allow for breakdown and repair of equipment, as well as providing additional capacity for unpredictable surges in demand.

The utilisation parameter for all network elements were set to 65% with a 2% increase on a yearly basis.

The provisioned total number of base stations for each geotype was calculated as the maximum of (prior year # of units, minimum of (theoretical maximum BTSs, traffic determined BTSs), coverage only BTSs). The total number of transceivers was calculated based on the number of TRXs for each geotype base station.

Other Network Elements dimensioning
Other network elements that were included in the network dimensioning process are:

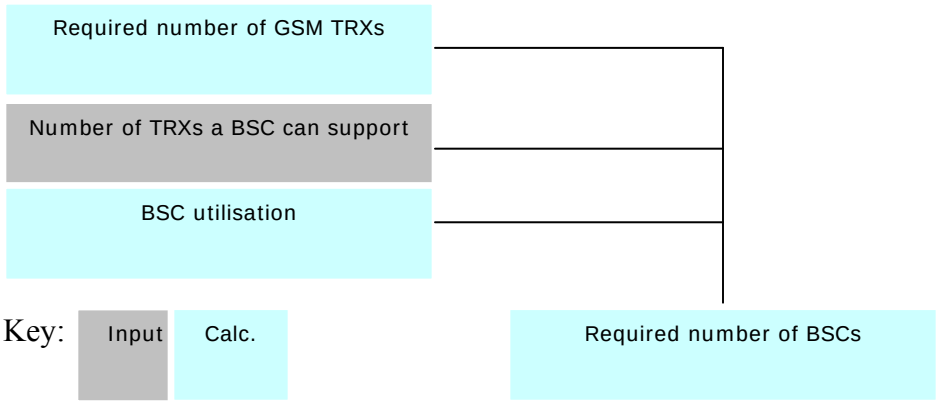
(i) Base Station Controller (BSC)

The number of transceivers (TRXs) each BSC can support determined the number of BSCs required, as given in the following figure.

It was assumed that:

- a BSC can control up to 1024 GSM TRXs
- BSCs are co-located with MSCs

Figure: The number of BSCs



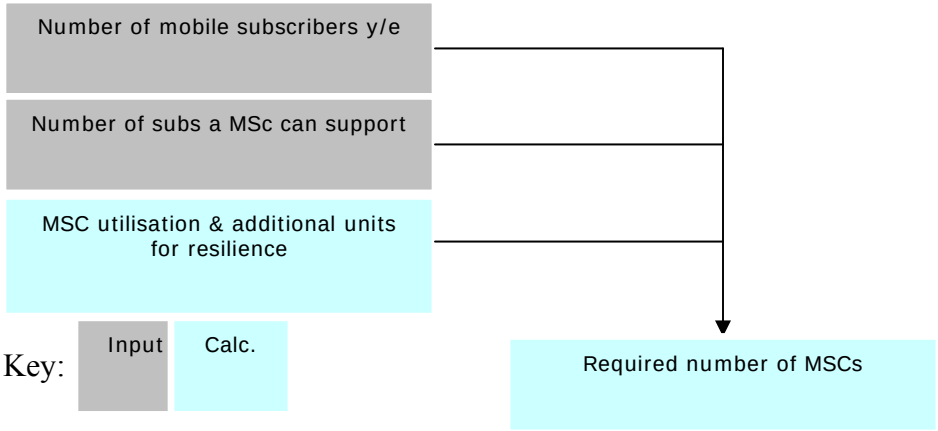
Source: Ovum analysis

(ii) Mobile Switching Centre (MSC)

The number of MSC Central Processing Units was determined by the total number of subscribers & traffic.

Following figure contains the derivation.

Figure: MSC traffic dimensioning

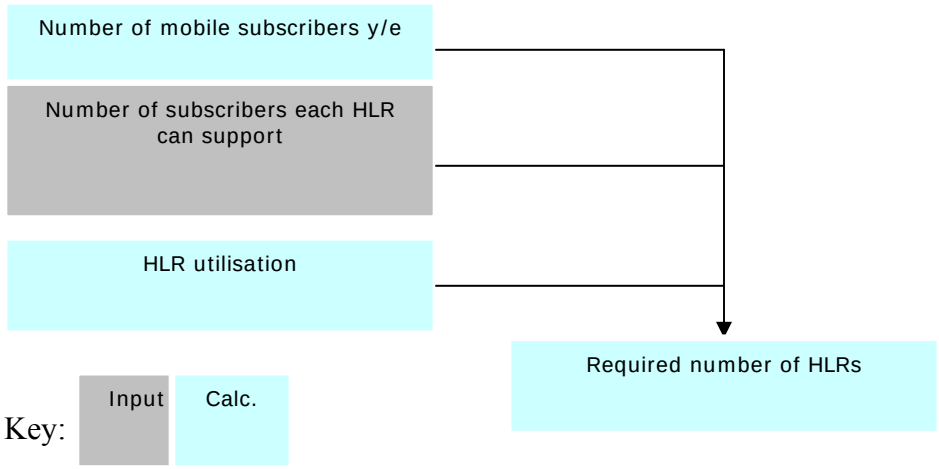


Source: Ovum analysis

(iii) Home Location Register (HLR)

Following figure contains the estimate of the number of home location register (HLR) platforms provisioned. The HLR was dimensioned around the number of mobile subscribers.

Figure: HLR platform dimensioning

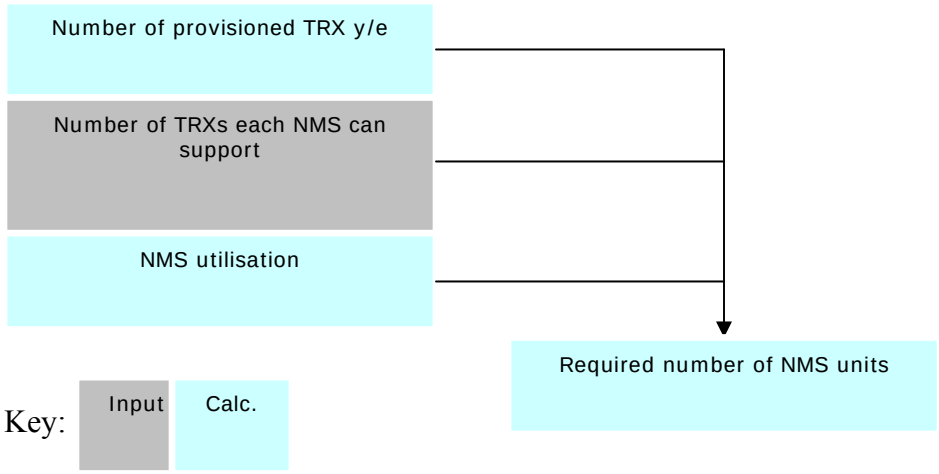


Source: Ovum analysis

(iv) Network Management Systems (NMS)

Following figure contains the estimate of the number of network management systems provisioned. The network management system was dimensioned around the number of transceiver units (TRXs) in the network.

Figure: Network Management systems service platform dimensioning

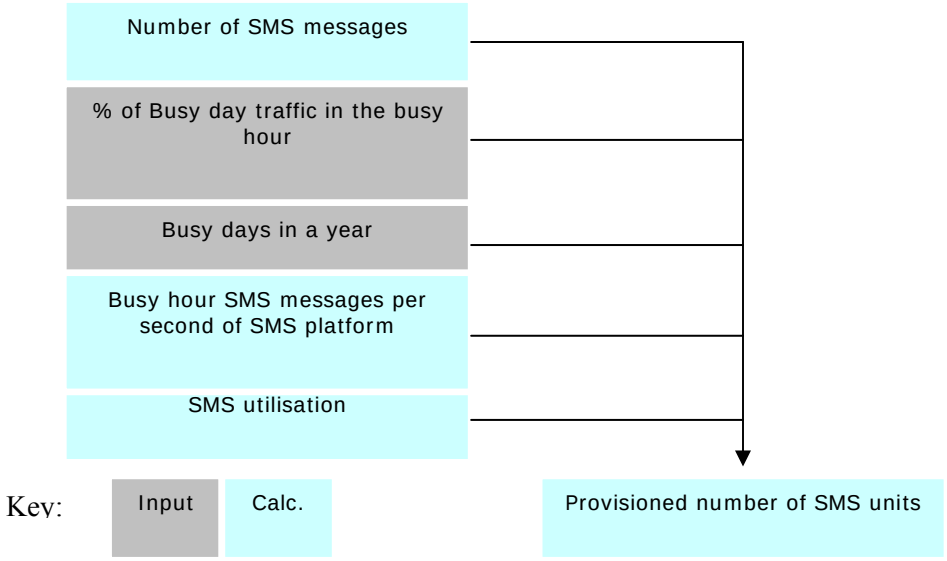


Source: Ovum analysis

(v) Short Messaging Service Centre (SMSC)

Following figure contains the estimate of the number of SMS platforms provisioned. The SMS platform was dimensioned around the number of SMS carried in the busy hour. The capacity unit of each SMS platform was assumed at 350 Busy hour SMS per second.

Figure: SMS dimensioning

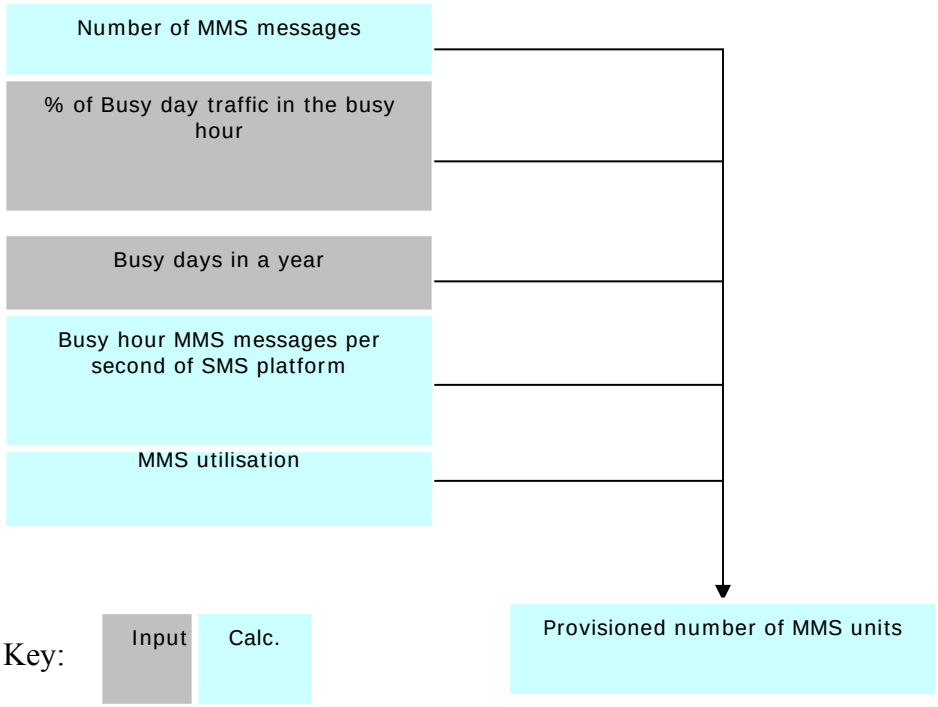


Source: Ovum analysis

(vi) Multimedia Messaging Service Centre (MMSC)

Following figure contains that estimate of the approximate number of MMS's provisioned. It was assumed that the number of MMS required in dimensioned around the number of MMS carried during the busy hour. The capacity unit of each MMS platform was assumed at 500 Busy hour MMS per second.

Figure: MMS dimensioning

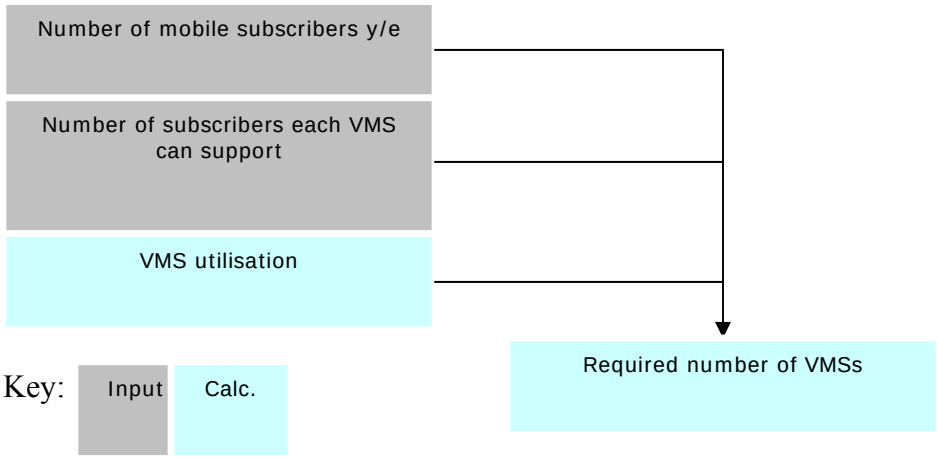


Source: Ovum analysis

(vii) Voicemail Service platform (VMS)

Following figure contains the estimate of the number of VMS platforms provisioned. These were dimensioned around the total number of mobile subscribers.

Figure: Voicemail service platform dimensioning

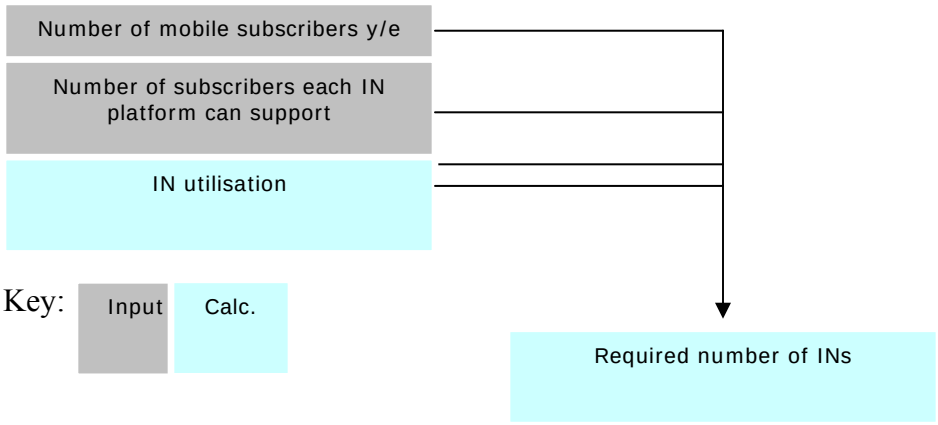


Source: Ovum analysis

(viii) IN (Intelligent Network platform)

Following figure contains the estimate of the number of IN platforms provisioned. These were dimensioned around the total number of mobile subscribers.

Figure: IN service platform dimensioning



Source: Ovum analysis

Transmission Network

The transmission network includes the following links:

- Inter base station
- Base station to BSC
- BSC to MSC
- MSC to MSC

All links can be configured either by fibre or microwave arrangement. The following percentage split was assumed.

Table: Transmission links split percentage

	Fibre	Microwave
BTS-BTS	0%	100%
BTS-BSC	0%	100%
BSC-MSC	28%	72%
MSC-MSC	82%	18%

Source: Ovum Analysis

The total number of links required was also split into leased and own built by operator. A combined utilisation parameter was also factored in, to address the provisioned capacity requirements. All links were calculated in E1 equivalent.

The model also calculated the total km of fibre to be built or leased for the various types of links. The assumptions used in the model are shown below.

Table: Fibre km split for built and leased infrastructure

	Built	Leased
BTS-BTS	0%	0%
BTS-BSC	0%	0%
BSC-MSC	50%	50%
MSC-MSC	50%	50%

Source: Ovum Analysis

3. Network Asset Values

Purchase Item cost and Modern Equivalent Asset price trend

Each network element was associated with a unit-purchase cost. It was estimated that a sensible range for most network components for price trends lies between 0% and –10% per annum. An average of –5% per annum was assumed over the forecast horizon.

Installation cost

There is also an associated installation cost for each of the network elements. This cost usually lies in the range of 5-15% of the purchase price. In the model, 10% installation expense was assumed for all network elements.

Asset lives

The base case of the model used 10 years as the average asset life for most network equipment. The exceptions were microwave links that have a shorter life of 7 years. The following table shows the economic lifetime for all network elements.

Table: Network units – Economic lifetime (PKRs)

Network Element	Economic lifetime (Years)
BTS	10
BSC	10
PCU (for GPRS)	10
SGSN	10
GGSN	10
MSC (with VLR)	10
GMSC	10
HLR	10
IN	10
SMSC	10
MMMC (or MMSC)	10
VMS (or IVR)	10
TF-BTS-BSC (per E1)	5
TF-BTS-BSC (per Km)	20
TF-BSC-MSC (per E1)	5
TF-BSC-MSC (per Km)	20

Network Element	Economic lifetime (Years)
TF-MSC-MSC (per E1)	5
TF-MSC-MSC (per Km)	20
TF-MSC-GMSC (per E1)	5
TF-MSC-GMSC (per Km)	20
TF-GMSC-GMSC (per E1)	5
TF-GMSC-GMSC (per Km)	20
TF-GMSC-ITSC (per E1)	5
TF-GMSC-ITSC (per Km)	20
TF-MSC -PSTN PoI (per E1)	5
TF-MSC -PSTN PoI (per Km)	20
TF-MSC -Other mobile MSC/PoI (per E1)	5
TF-MSC -Other mobile MSC/PoI (per Km)	20
TF-PCU-SGSN (per E1)	5
TF-PCU-SGSN (per Km)	20
TF-SGSN-GGSN (per E1)	5
TF-SGSN-GGSN (per Km)	20
TF-GGSN-Internet (per E1)	5
TF-GGSN-Internet (per Km)	20
TF-GGSN-MMSC (per E1)	5
TF-GGSN-MMSC (per Km)	20
TM-BTS-BSC (per E1)	7
TM-BSC-MSC (per E1)	7
TM-MSC-MSC (per E1)	7
TM-MSC-GMSC (per E1)	7
TM-GMSC-GMSC (per E1)	7
TM-GMSC-ITSC (per E1)	7
TM-MSC -PSTN PoI (per E1)	7
TM-MSC -Other mobile MSC/PoI (per E1)	7
TM-PCU-SGSN (per E1)	7
TM-SGSN-GGSN (per E1)	7
TM-GGSN-Internet (per E1)	7
TM-GGSN-MMSC (per E1)	7

Source: Ovum analysis

4. Operational expenditures

The operational expenditure was included in the model as a proportion of the Gross Book Value (GBV) of network assets. This value was calculated as the sum of the purchase and installation cost. These estimates have been cross-checked against data from consultant's earlier cost modelling assignments.

In the base case, the initial license fee was excluded from the value of network operational expenditure. But the model was designed to choose to recover initial license fee in interconnect rate calculation.

The model assumed that direct operational expenditure costs expressed as a proportion of Gross Book Value has an average value of 10% for all network elements. Opex was assumed to increase by 7.9% per annum in line with local price inflation experience so as to ensure that, subject to movements (up or down) in equipment prices over time, the model generate "realistic" levels of operating costs for the network over time. Otherwise a rapidly falling equipment price over time would yield lower absolute values for operating cost per unit in subsequent years compared to the first year.

Other cost assumptions
A 0.5 % of the total revenues minus the inter-operator and PTA/FAB mandated payments were attributed as a levy of regulatory fee to the Authority.

Other costs include:

- Retail (derived from the Top Down model but not recovered in MTR)
- Network common costs (derived form the Top Down model and added to MTR as mark-up)
- Other common costs (e.g. HQs, audit fee etc)

5. Capital Charge

The capital charge is defined as follows:

Capital charge = Depreciation + Return on Capital Employed (WACC)

The bottom-up model capital charge assumed that the network is a modern network every year. This was assumed so that:

- the development profile of the network does not affect the calculation of the capital charge.
- replacements of network assets do not need to be calculated or explicitly included, because the network assets are always assumed to be in its first year of operation.

Depreciation:
Economic depreciation is a method for determining a cost recovery that is economically rational in that it:

- reflects the underlying costs of production.
- reflects the output of network elements over their lifetime.

The principle behind economic depreciation is that all efficiently incurred costs should be recovered in an economically rationale way. The use of Modern Equivalent Asset pricing ensures that the assets represent the purchasing of an efficient operator. The model was

capable of illustrating some of the most common approaches to calculating the capital charges:

- straight line
- tilted straight line
- annuity
- tilted annuity.

The base run model results were derived using the Titled Annuity option.

The specification of each method is outlined in the following sections.

(i) Straight line

Straight line depreciation divides the asset's price by the asset's life to produce an annual depreciation charge. To calculate the annualisation charge, a capital charge is added. The straight-line annualisation factor used in the model was:

$$\frac{V\,[1+r]}{n}$$

where:

r is the rate of return on capital employed

n is the economic life in years

V is the current replacement cost of the asset.

(ii) Tilted straight line

Tilted straight line depreciation takes account of the expected price changes for assets. It will result in a steeper depreciation profile when prices are falling than unadjusted straight line depreciation. The tilted straight-line annualisation factor used in the model was:

$$\frac{V\,[1+r-a]}{n}$$

where:

r is the rate of return on capital employed

a is the rate of change of the replacement cost of the asset

n is the economic life in years

V is the current replacement cost of the asset.

(iii) Annuity

A standard annuity calculates the charge that after discounting recovers the asset's purchase price and financing costs in equal annual sums. In the beginning of an asset's lifetime the annualisation payment will consist more of capital charges and less of depreciation charges; this reverses over time resulting in an upward sloping depreciation schedule. The annuity function used is outlined below:

$$\frac{V\,[1+a\,]^{t-1}\,[r]}{1-[1/(1+r)]^{n}}$$

where:

r is the rate of return on capital employed

a is the rate of change of the replacement cost of the asset

n is the economic life in years

V is the current replacement cost of the asset

T is the age (in years) of the asset.

(iv) Tilted annuity

The tilted annuity approach bundles depreciation and the return on capital into a single amount. It adjusts the capital costs over time in line with the rate of increase or decrease of the replacement cost of the capital equipment.

Under a tilted annuity the capital cost in each year is given by:

$$\frac{V\,[1+a\,]^{t-1}\,[r-a]}{1-[(1+a)/(1+r)]^{n}}$$

where:

r is the rate of return on capital employed

a is the rate of change of the replacement cost of the asset

n is the economic life in years

V is the current replacement cost of the asset

T is the age (in years) of the asset.

Weighted Average Cost of Capital (WACC):

Corporations create value for shareholders by earning a return on invested capital that is above the cost of capital. WACC is an expression of this cost and is used to see if certain intended investments or strategies or projects or purchases are worthwhile to undertake. WACC is expressed as a percentage.

The cost of capital for any investment, whether for an entire company or for a project, is the rate of return capital providers would expect to receive if they would invest their capital elsewhere. In other words the cost of capital is an opportunity cost. It is also used by companies as a discount rate to discount current and future cash flows when calculating Net Present Values (NPV) for projects.

The formula for calculating WACC is given as:

$$WACC = R_e W_e + R_d W_d$$

where

R_e = cost of equity capital

R_d = cost of debt capital

W_e = weight of equity capital (equity/(debt + equity)); and
W_d = weight of debt capital (debt/(debt + equity))

The WACC is therefore a weighted average of respective costs of equity and debt. The weighting factor reflects the targeted equity and debt proportion in a company's capital structure.

Following is the summary of the components and the figures used by the Authority in computation of WACC for mobile sector:

WACC Components	Value Used	Detail
Levered Beta (β)	1.29	
Risk Free Rate (Rf)	10.20%	Current 10 years PIB Rate
Market Return (Rm)	17.04%	5 Years (weekly Moving Average)
Risk Premium	6.84%	(Rf – Rm)
Debt Premium	2.00%	Premium over Risk Free Rate
Target Debt/Equity Ratio	60 : 40	Efficient Capital Structure – International Best Practice
Cost of Equity	19.01%	Calculated using CAPM
Cost of Debt (Before Tax)	12.2%	
Cost of Debt (After Tax)	7.93%	Tax Rate: 35%
Pre-Tax Nominal WACC	**19.02%**	
Inflation Rate	7.9%	Federal Bureau of Statistics
Pre-Tax Real WACC	**10.31%**	Inflation Adjusted

Cost of Equity

The cost of equity was calculated using the CAPM model. The cost of equity, R_e, calculated using the CAPM is usually expressed as:

$$R_e = R_f + \beta (R_m - R_f)$$

where

R_f = the anticipated return available from risk free investment

R_m = the anticipated returns available from risky investments in the market generally

β = the anticipated correlation between movements in the share price of the concerned company compared with movements in the market generally, a measure of its systematic risk.

The $(R_m - R_f)$ factor is called the equity risk premium.

Components of Cost of Equity

(i) Beta

When companies are not quoted, one cannot obtain the beta directly from market data, as is the case of mobile companies in Pakistan. One method to overcome this problem is to use a "pure-play" beta. This method attempts to identify publicly traded companies whose operations match with those of the unquoted company. Having identified a sample of comparative companies, the sample's average beta serves as a substitute for the non-traded company's beta.

For this purpose, the Authority identified four listed companies in Pakistan telecom sector (Callmate Telips, Worldcall, Telecard and PTCL) that matched the cellular industry in terms of structure and region. There are certain similarities in the risks facing these four companies, primarily, that they are all telecom-related companies, and face similar regulatory and business risks. There are differences between the actual and comparative companies; however, the above-mentioned are the closest comparative companies that are listed.

The Authority calculated the beta using the regression run of stock returns on market returns by the statistical formula:

$$\beta_a = \frac{\mathrm{Cov}(r_a, r_p)}{\mathrm{Var}(r_p)}$$

where r_a measures the rate of return of the stock and r_p measures the rate of return on the stock market.

Equity Beta of the above mentioned four companies were calculated from their stock prices using daily price moments of their stock price and the Karachi Stock Exchange 100 Index (KSE-100) using data for two years. Equity betas calculated were 0.83 for Callmate, 0.99 for TeleCard, 0.82 for WorldCall and 1.05 for PTCL.

In order to be able to compare levels of business risk across companies with different levels of gearing on an uniform basis, it was necessary to calculate the value of beta for the company on the assumption that the company hold no debt, i.e. asset or 'un-levered beta'. In the CAPM framework, the traditional way to account for the impact of a change in gearing on the cost of equity is to adjust the beta coefficient in a linear manner. To go from un-levered (or asset) beta to levered (or equity) betas, the following formula is used:

$$\beta_{equity} = \beta_{unlevered} (1+(1-t)*(Debt/Equity)$$

Based on above, betas calculated were first un-levered on respective company's current capital structure and then levered back to an optimal structure of 60:40. In case of PTCL the value calculated for the levered beta came out to be 2.07 which seems quite unrealistic. Taking into account the PTCL risk profile as a blue chip company, its levered beta was capped at a maximum of 1.2. Finally a simple average of these levered Betas

were computed and a levered beta of 1.29 was used in computation of cost of equity for cellular sector.

(ii) Risk Free Rate

The risk free rate is the return that can be earned on government securities that generally carry negligible risk of default. In this context, we have used the most recent yield on ten year PIB's (Pakistan Investment Bonds). The ten-year factor reduces any risk associated with short term fluctuations and changes in yields. The reason for taking PIB's is that they are government securities and are riskless.

Another notable point here is that the yield on risk free rate includes sovereign risk specific to that particular country. This can be supported by the fact that yields on EURO bond issues of any country are inclusive of sovereign risk. In 2007 Pakistan issued Euro bonds/Sovereign Bonds of US$750 million in value with a maturity of 10 years having a fixed coupon rate of 6.875%. Current yield of this issue is 9.4%[1]. As an alternative to Risk Free Rate/(PIB rates), yield on Eurobonds can also be used. However current yield on 10 years PIB of 10.2% has been used for WACC calculation.

(iii) Market Return

Return on market has been calculated using weekly moving average of the KSE-100 index. The market return (Rm) has been calculated as 17.04%.

(iv) Equity Risk Premium

The equity risk premium (ERP), $R_m - R_f$, considers the additional returns that investors must earn for holding risky (equity) investments compared to risk free government bonds. As for the risk free rate, the calculation of the equity risk premium should be consistent with the market from which investors in a particular company will be drawn.

An ex-post approach considers, from a historic perspective, the returns that have been earned on equity investments compared to those that have been earned on risk free investments. It is normal to take this measurement over as long a time scale as possible, to eliminate the impact of any short-term variability and to assume that the premium is constant over time.

Instead of international benchmark for equity risk premium for developing countries of 6%, we estimated ERP using calculated market return and risk free rate and a value of 6.84% has been used in cost of equity calculation.

Capital Structure of Cellular Industry

Almost all the cellular operators have are highly levered, however for calculation of WACC for "cost plus normal return" model an efficient capital structure is used. In Pakistan as per Security Exchange Commission (SECP) an 80:20 structure is considered optimal, however for our cost model purpose we are using a 60:40 capital structure as is the international best practice.

[1] S&P – Moodys Rating and Euro Bonds – Dated January 17, 2008

Cost of Debt

The calculation of the cost of debt (R_d^{bt}), for an unlisted company with no publicly traded debt, follows a similar methodology to the cost of equity, namely to consider the appropriate premium (P_d) over the risk free rate (R_f), that investors require for holding corporate rather than sovereign debt. As with the cost of equity, it is necessary to take account of the appropriate maturity over which to consider the cost of debt. The debt premium (P_d) is computed by comparing the current yield to maturity with an appropriate debt free instrument of similar maturity issued in the market in which the funds were raised. The resulting debt premium is then added to the risk free rate for the market in which the organisation is raising capital.

For calculation of debt premium, existing weighted average cost of debt of cellular operators was computed. As per their accounts, the cost of debt is ranging between 9 to 10.5%. Although his reported cost of debt is coming close to the risk free rate.

Ovum however has implied a more reasonable debt premium of 2% over the risk free rate which led to an after-tax cost of debt of 7.93%.

Based on above, pre-tax nominal WACC of 19.02% was computed and used in the models.

6. Unit costs

Routing factors

The routing factors are used to allocate costs amongst different services. Following figure shows these estimates which are based on consultant's experience of similar studies, and the network configuration illustrated above. The Erlang equivalent of each service was used to allocate the traffic driven costs. Following rules of thumb were used to derive routing factors:

- On-net calls make twice as much usage of transceivers, base stations, and transmission links as outgoing off-net calls and incoming calls.
- Any equipment that is dedicated to provide a given service should be allocated to that service. For example, the SMSC is allocated to SMS services.
- Network common costs such as NMS were allocated amongst network elements, and not to be allocated via the routing factors.

Ideally routing factors should be developed by undertaking a detailed analysis of the proportion of usage that each service makes of each network component during the busiest hour.

The full version of the routing factors is contained in the bottom-up model.

Figure: Routing factors (only part of the routing factor table is displayed here)

Network elements	TRX	BTS	BSC	MSC	etc
Incoming Voice	1	1	1	1	
Outgoing on-net Voice	2	2	2	2	
Outgoing off-net Voice (to mobile)	1	1	1	1	
Outgoing off-net Voice (to fixed)	1	1	1	1	
Outgoing off-net Voice (to international)	1	1	1	1	
Etc					

Source: Ovum analysis

Near/Far End Call Handover

Near/Far end call handover has been taken into account in the route factor table. Under this interconnection regime, call originating operators are responsible for carrying the call to the farthest end before handing over the traffic to the terminating operator's network. Hence in the Far End Handover regime, as the call originating network is responsible for carrying the traffic to the far end therefore its tariffs will vary in accordance with the distance traveled.

Since all mobile-mobile calls and PSTN-mobile calls are routed through GMSCs, the model allowed for two sets of route factors to describe how GMSC and GMSC-GSMC links are utilised in on net calls, outgoing to other mobile calls and any calls between PSTN and mobile.

The base case in the model was set at 100% "Far End traffic". The far end/near end traffic split could be adjusted in the model.

Figure: Call terminating network's routing factors

Handover	GMSC	GMSC-GMSC
Far End	1	0
Near End	2	1

Source: Ovum analysis

Figure: Call originating network's routing factors

Handover	GMSC	GMSC-GMSC
Far End	2	1
Near End	1	0

Source: Ovum analysis

Service costing
The service cost for each of the services/products was calculated based on the contribution of each network element for the provision of these services and the associated service volumes.

7. Mark ups

Retail and common costs were also calculated in order to address the percentage contribution of these costs to the overall service cost. The mark up percentage is then applied on top of the service costing in order to calculate the total service pricing.

Service pricing
This is the total service pricing value for each one of the provisioned products. Service pricing varied across the modelled period due to variation of the associated costs, mark ups and service volumes.

Allocation of common costs
An operator in an efficient market will ensure that common costs are recovered through the services that are provided by the network.

There are two principal ways in which common costs can be factored into the service costs that an operator can charge:

- Equi-proportionate mark-up (EPMU)
- Ramsey pricing mark-up.

The model used equi-proportionate mark-ups to recover the common costs. This is in line with all regulators that have adopted a LRIC approach so far.

Ramsey-pricing was not implemented as:

- it requires uncertain assumptions, and
- there is no industry consensus as to the appropriate application of the theory.

6.2 MOBILE TOP DOWN FULLY ALLOCATED COST (TD FAC) MODELS

Two Top-Down models were developed, which were from the financial and operational data of two mobile operators, namely Telenor and Mobilink. However, due to paucity of data provided, it was not possible to develop further such top-down models for other mobile operators.

Both models produced single year (2006) indicative mobile termination unit costs for the relevant operators.

Overview of model's input and outputs
The model financial inputs came from the operators' accounts for the year 2006:

- Opex data. Provides the operational costs (salaries and overheads etc).

- Asset data. Provides the depreciation and the notional cost of capital employed (CoC).

The CoC is equal to an assumed Return on Capital Employed (ROCE) which is defines as Capital Employed (CE) times WACC. Where the WACC is pre-tax average cost of capital. The Capital Employed is the capital investment in assets, which is the net book value (NBV) of the assets, plus working capital.

A wide range of technical and cost driver inputs were used to determine how costs are processed and allocated. These include traffic volumes of products (minutes, messages etc), subscriber numbers served by the company, cost allocations, route factors etc.

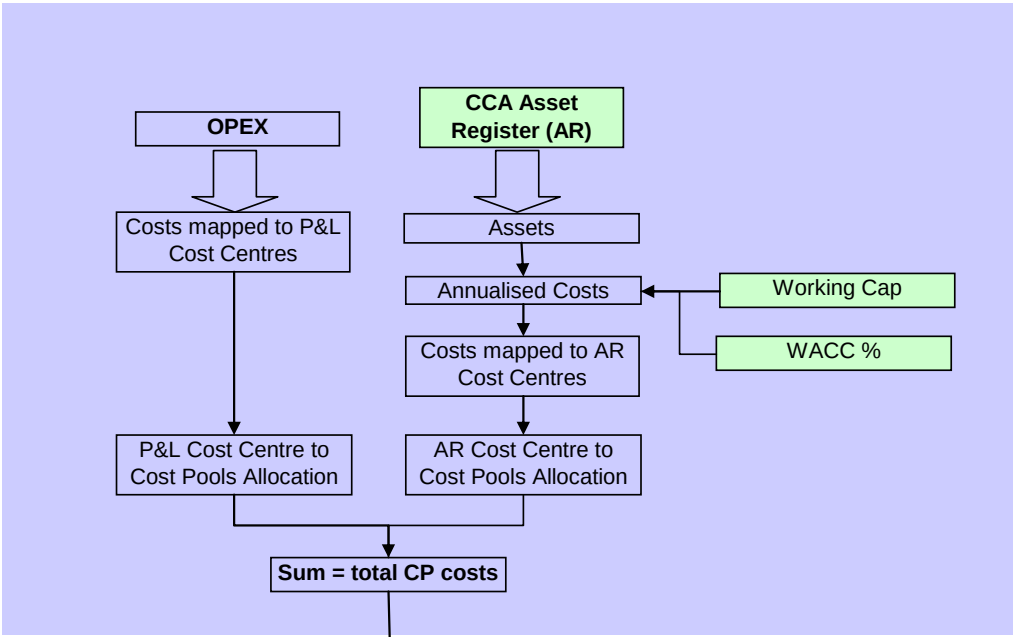
The output of the model was the unit cost of the different mobile traffic types. There were many other calculations in the model and this data may also be used as outputs for other business management purposes.

Architecture of the model

Model structure and definitions

Both the Opex and asset register data were fed into the top-down cost model as the key drivers. The structure of the model is highlighted in the figure below.

Figure: Model Architecture (stage 1)



Source: Ovum

The costs were allocated from the accounts down to the products. Costs from the asset register and the Opex accounts were mapped to cost centres (CC) and then to cost pools (CP).

A cost pool is an entity that collects costs of different types and from different sources. A CP may be a network element (say MSC), a traffic type (say mobile to mobile calls) or Other (such as a Common Non Network cost pool that has costs which relate to all of the business).

A cost centre (CC) is a functional area or division in the operator's business. Cost accounts were posted to a CC. The costs in cost centre were processed so that they are grouped to show:

- *Cost type* (such as revenue, overhead, marketing, salary etc).
- *The cost category or detailed type.* This gave details of the cost and how it is to be allocated or processed in the model.
- *Cost centre.* Where the cost category data was not defined, the CC was assumed to indicate how the cost was treated. Salaries and office equipment for example are treated as the "Common Cost" which means they were allocated by the activities of the CC, using Activity Based Costing (ABC) data.

ABC techniques were used to define allocation keys. An allocation key can be applied to a CP and will have its costs allocated by the key's values.

Features to note are:

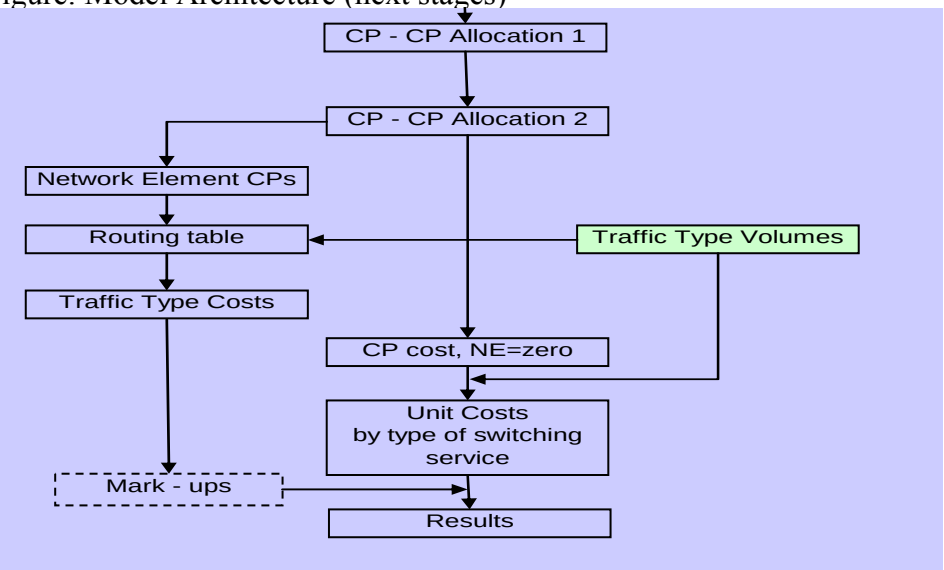
Allocation to CCs: Both Opex and network fixed assets were mapped to P&L or assets related cost centres. For the allocation, assumptions were made based on staff number, network volumes etc.

CC-CP allocation: ABC-defined keys allow allocation to the CPs, based on Activity data.

Assets (NBV and depreciation) were annualised and allocated to CCs.

The next stages of the model are shown below:

Figure: Model Architecture (next stages)



Source: Ovum

After the initial stages of the CC and CC to CP allocations, all costs were in specific cost pools and general cost pools (say "Common Network"). These were then allocated to more detailed cost pools so that they can be processed further (CP-CP allocation). General CPs were typically allocated to more detailed pools.

The Routing Table defines how products (traffic types) utilise the network resources, along with volume data. It converts the network costs to network products. After this stage, no costs would be mapped to network elements (i.e. NE = 0).

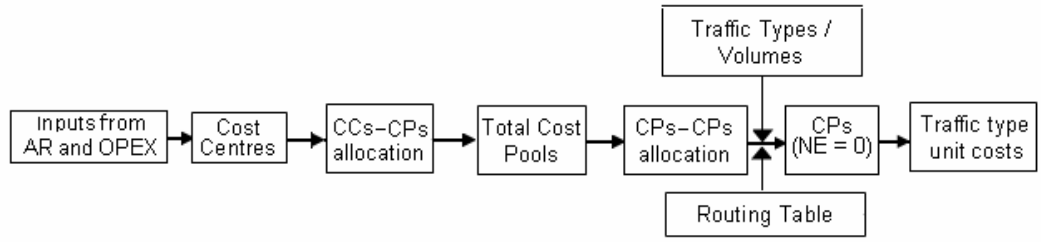
The output of the model was a set of traffic types unit costs, which were appropriately weighted averaged and a termination rate is calculated for each type of traffic.

Model Methodology

Introduction

The key steps in the main model are shown in the figure below:

Figure: Model Design



Source: Ovum

The input (from opex and asset register) with costs was grouped by cost centres. Different cost centres exist for the opex and asset register data.

All costs were then allocated to the cost pools (CP). The drivers for each of the CCs, cost categories and asset groups were entered. These cost drivers were specified by driver keys - the keys define which CPs the costs should be allocated to. There are three categories of CPs: "network elements," "products" and "other."

Next, there were three stages of CP to CP allocation. The reasons for having more than one allocation step were:

- to be able to separate the different types of allocations into different steps,
- in some cases allocation of costs to one CP is first needed and then these costs could be allocated to other CPs. This would be difficult if only one step of allocation is used.

Examples of possible allocations to be made in the CP to CP stage are:

- Allocations from general to specific CPs
- Irrelevant costs removed from the CPs. An example could be: some transmission costs that relate to future services are removed, as they are not relevant to costing existing services. These costs are typically sent to a "parked" cost pool.
- Non-specific cost pools such as Common or Retail costs can be spread to other pools to give a mark-up of costs – providing full costs of products.

The next step was to allocate costs from network element CPs to the products (traffic types), using a routing table. The routing table describes how the different products use the network elements. Based on this information and product volumes information, the model distributed costs from network elements to network products.

Input Values

Input values were pre-processed data in the opex and assets register. Asset NBV and depreciation were needed in order to annualise assets costs.

Other inputs were required in the model to carry out the cost allocations and product calculations. These were basically technical and cost driver inputs as well as traffic type volumes.

Cost centres were mapped to cost pools using allocation keys. These allocation cost keys were linked in the model to a set of cost driver values. The cost driver values for each key specify how the cost should be allocated (they specify to which items the cost should be allocated and how much cost should be allocated to the particular destination).

The allocation process gave several stages to give accuracy and flexibility. The first stage of the model was to map all the network and fixed assets as well as operating costs to specific cost centres. Further, cost centres were allocated to cost pools by using allocation keys. The allocation can be defined in order to allocate the cost centres to the appropriate cost pools and then the cost pools to other cost pools.

If a cost is to be allocated to itself (say the cost pool or cost centre is not allocated or split at all), then a key must be defined that allocates all costs to itself. Therefore allocation key tables contained many keys that simply allocate 100% costs to one destination.

Cost centres to cost pools allocation

All cost centres must be allocated to CPs. The allocation process was based on an Activity Based Costing (ABC) analysis of the CC. A cost centre might be mapped to one or more cost pools according to the nature of the cost centre. In order to identify the allocation keys, volumes of network assets or volumes of minutes were used as drivers. In many cases, especially when a cost centre was mapped in more that one cost pools, analysis was made of the assets included in the cost centre and were mapped directly to one cost pool.

Cost pool to cost pool allocations

Once costs were allocated to CPs, the model has three stages of CP to CP allocation. It may be noted that it was possible to have several allocations concatenated into one more complex allocation key. Therefore the model could function with only one stage, however this would make the model difficult to set up and manage.

Costs can be allocated to any type of CP – product, network element or other. Where cost pools do not support other pools then the allocation key would allocate 100% of costs to the same pool. A key must be defined and applied to allocate all costs 100% to itself.

If some pools are mapped to a cost pool that is mapped to other cost pools, then there is the possibility of "circulating costs". The result of this is a supporting cost pool may have cost still in it, when all cost should be sent to other centres. It is a relatively simple matter to manually re-define the allocation keys to cope with this situation. This ensures that costs that are allocated to another supporting pool are allocated to the pools of the destination CP. A more complicated model could have more than three CP-CP allocation stages, so that one pool supports another and then the supported pool is re-allocated in the next stage. This has not been implemented to keep the model simple and because there were few situations where it was needed.

In the model, the keys were defined in order to allocate cost pools to cost pools, or cost centres to cost pools. The model has the flexibility to change the values of cost keys or their names or/and add new ones. For that reason there were many spare keys that were available to use and amend. After CP allocations, the network element costs were allocated to products using the routing tables.

Routing table

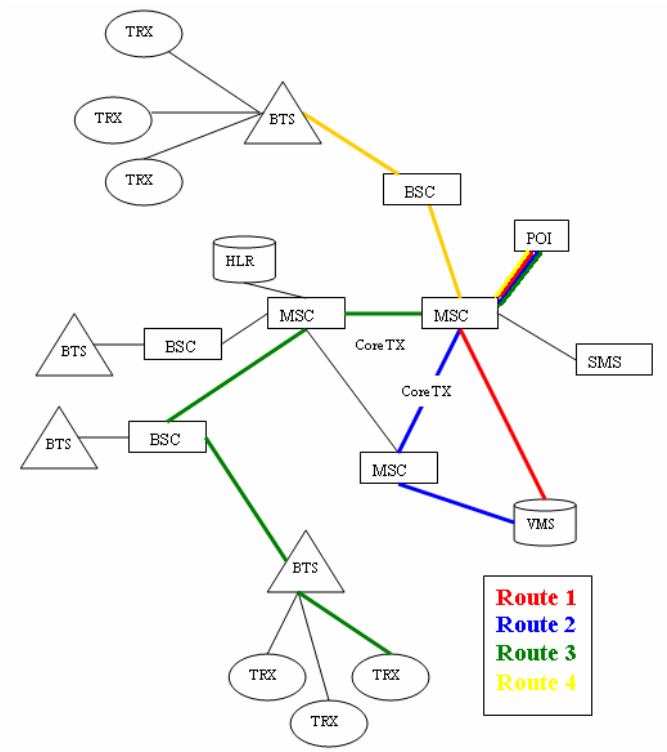
Routing tables enable the network costs to be allocated to products. The cost model fed the network related cost pool costs (BTS, MSC, Transmission, SMS server etc) through the network routing table to obtain network products. The network routing table defines how each product uses the network – how many of each network element is used by the product (traffic type), on average. The full usage of the network by a network product also includes the product's volume of call minutes or numbers data messages made or numbers of calls made. This routing table information was in a table that lists how many of each network elements were used by the product. The "how many" is the effective cost driver and can be numbers of network elements, or relative cost usage. As long as the same cost driver is used for the network element by each product, any driver may be used.

The model considered the routing factors to be an estimate of the average number of each type of network element used for specific traffic types. In the cases where more than one possible route existed, then a weighted average of the number of network elements was used for each route multiplied with the probability that this route can occur.

The “routing table” allocation methodology is a cost pool to cost pools allocation, as the main objective is the mapping and allocation of network elements’ costs to traffic types. After this stage, the cost attributed to network elements should be zero, as it has been spread over the traffic types.

The concept of the routing table can be understood by examining the example shown below for the incoming calls. Please note that this example should be taken as illustrative only. In the actual routing table, several route arrangements may be combined to provide the actual usage numbers. The figure and table below, show the call routes and the probability of a call taking a specific route. These combine to give a weighted average route.

Figure: Incoming calls possible routes



Source: Ovum

Possible sub-routes

1. POI – MSC – VMS
2. POI – MSC – CORE TX – MSC – VMS
3. POI – MSC – BSC - BTS
4. POI – MSC – CORE TX – MSC – BSC – BTS

Figure: Incoming calls routing factors calculation

Incoming calls – off net	BTS	BSC	MSC	CORE TX	VMS	SMS	POI	%
1.Called party is located on same MSC and routed to VMS	0	0	1	0	1	0	1	10%
2.Called party is located on different MSC and routed to VMS	0	0	2	1	1	0	1	10%
3.Normal termination call on the same MSC	1	1	1	0	0	0	1	35%
4.Normal termination call on different MSC	1	1	2	1	0	0	1	45%
Weighted average	**0.8**	**0.8**	**1.55**	**0.55**	**0.2**	**0**	**1**	**100%**

Source: Ovum

The routing table would be as shown in following figure.

Figure: Example of routing factor table

Traffic Types	Network Elements						
	BTS	BSC	MSC	CORE TX	VMS	SMS	POI
Traffic Type 1							
Traffic Type 2							
Incoming calls – off net	**0.8**	**0.8**	**1.55**	**0.55**	**0.2**	**0**	**1**
Traffic Type 3							

Source: Ovum

Basic Assumptions of the Model

Fixed Asset Register (FAR):

FAR contained a full list of network equipment and their values. The 2005 fixed asset register was available, but the 2006 data was not made available by the operators. However OPEX data of both 2005 and 2006 was supplied, which can be used as an indicator of growth factor. So in the base case, the consultant recommends that the total written down value of FAR should enjoy a YoY growth rate equal or greater than that of network equipment OPEX, i.e 41%, due to possible realisation of economy of scale.

Staff Allocation and OPEX allocation:
Non-trivial OPEX items were allocated to the appropriate categories, i.e. retail, common network related cost, common non-network cost and parked. Operators' staff allocation to departments was provided and used to form the base case of such cost allocation.

Assets Allocation:
Some fixed asset costs were mapped to more than one cost pools eg BTS/BSC. An allocation key was assumed which was based on consultant's experience.

WACC:
Pre-tax nominal WACC of 19.02% was assumed in the model.

Traffic Volumes:
Some traffic volumes were not available (eg. outgoing calls to operator's mobile roaming abroad). Traffic volume estimation and projections were made based on actual minutes per subscriber patterns (current and historic) using consultant's experience.

Conversion Factors:
In the routing table each network element's cost was driven by minutes, number of messages or number of calls. Conversion factors were used to convert all different types of mobile traffic to a common unit. BHE (Busy Hour Erlang) was chosen and conversion factors were calculated using consultant's experience.

Common Network Costs:
This cost pool was spread over the network elements. The driver that was used was the percentage share of each network element's capitalised cost of the total network costs.

Non-Network Common Costs:
These types of costs are common business costs that should be mapped to the traffic type cost pools. BHEs were used as the minutes equivalents of the traffic types.

License Fees:
The model has the flexibility to include or exclude initial license fees from mobile termination rate. If excluded was chosen, then the initial license costs was considered as parked cost, otherwise it was considered as a network related common cost and split over the products using the number of minutes as a driver.

Far end / Near end:
The model could populate results for both types of calls. In the base case assumption, 100% of the traffic was attributed to far end calls and 0% to near end.

7. FIXED-LINE MODELS

The Authority first issued Top-Down FAC model and Bottom-Up LRIC cost model along with model documentations to PTCL on 13th November 2007. The models were fairly transparent and flexible so as to allow PTCL to modify the models as it thinks appropriate.

Based on the feedback and comments received from PTCL, the models were modified and issued again to PTCL on 28th February 2008. Following sections present the model methodologies.

7.1 FIXED-LINE BOTTOM UP LRIC MODEL

The bottom-up LRIC model was developed for the incumbent fixed-line operator, PTCL. In particular, this model assumed efficient and currently incurred (i.e. current cost accounting, CCA) network capital deployment, and operating costs based around a scorched node approach (i.e. the number of primary switching centres in the PTCL's network was closely reflected by the model's assumptions).

The model produced fixed interconnection termination unit costs projected forward to 2009. These unit costs were generated for local, single tandem (ST) and double tandem (DT) termination variants as well as distance-based termination charges which were the basis of the current PTCL rates offered and regulated by the Authority. The model also produced indicative fixed interconnection transit charges.

The purpose of the model was to calculate the costs of building and operating a national fixed network, or PSTN, capable of offering voice calls in Pakistan. The modelled network assumed the same scale and scope of services offered by the existing national core fixed network which is being operated by PTCL. The focus was to estimate the costs of the core fixed network only and hence it did not cover the fixed access network.

It is important to note that:

- The source data was based upon the information supplied by PTCL as part of the process to design, build and populate the model with country-specific data. Where no published data was available, the consultants used their experience of developing network cost models in other jurisdictions to make suitable estimates.

- The costs of fixed call termination cannot be modelled in isolation of other services because a large number of network components are used by more than one service. For example, voice switches carry different call products such as local, national and international calls. In addition, the network may provide both voice and non-voice services. Transmission link capacity may be used to support the provision of PSTN voice and non-PSTN leased line services. Therefore, a comprehensive set of network call product services were included in the model (e.g. local calls, national calls, calls to mobile, transit and interconnect calls etc.)

- The bottom-up model provides an approximation of the total costs of building and operating a national fixed core network in Pakistan. The cost model was flexible and user friendly, since it allowed a range of different assumptions and sensitivities to be modelled. Inputs that may be 'flexed' include the pre-tax WACC, annualisation methodology, operating costs, equipment asset lives, anticipated equipment price changes, capacity split between PSTN and leased lines, to name but a few.

- The model's estimation of equipment volumes was based on PTCL's existing numbers of switch sites and core network transmission links which connect up the different switch sites or 'nodes'.

- The model's estimation of costs was based on the replacement cost of all the equipment required at each existing PTCL switch 'node' site, in addition to the transmission equipment, such as trench, fibre and electronics which form the links that connect the switch sites.

The next step after direct network capital costs ('capex') was to add the total direct network operating costs ('opex') associated with the core network which were also modelled.

The other costs that remain were indirect non-network costs. In order to recover an appropriate amount for indirect overhead 'fixed common costs', the model applied mark ups or uplifts to the direct network costs (capex and opex). Such non-network costs include assets (vehicles, PCs, office furniture and non-network buildings) and indirect non-network expenses (associated with staff working in functional departments at, for example, the company's head office).

Finally, the purpose of the model was not to provide a single definitive 'price' for call termination service, but to offer a range of estimates (based on input ranges used) to guide the decision-making process. The model was simply a guide to the best possible range within which the real cost structure of PTCL may lie.

All of the above ensure that the cost model attempts to capture all the relevant business related costs (both network and non-network) and hence it provided the most accurate range of results reflecting the country-specific nature of the cost structure of the national fixed incumbent operator in Pakistan.

Model Methodology

The nature of bottom up cost models

The rates derived from the model were designed appropriately to compensate the network access provider for the economic costs of the services offered to access seekers. The rates must satisfy a number of conditions to be effective, including:

- they must reflect accurately the economic costs of the services provided,
- they must not involve the subsidisation of the costs of the service provider by the payments from the service seeker, nor vice versa, and
- they must emulate, to the greatest extent practicable, the charges that would result in a fully competitive market for the interconnection services.

It follows that regulated interconnection charges will not necessarily reflect the actual costs being incurred by the interconnection service provider, because these may include unacceptable levels of inefficiency that it would be inappropriate to pass on to the service seeker. Instead, the charges should provide an incentive for the service provider to achieve best practice levels of operational efficiency upon which the model can be based. At the same time, the access seeker is paying efficiently incurred 'cost-based' prices for interconnection services.

The model description

Bottom-up cost model was aimed to determine the costs that an efficient operator using forward looking network technologies would incur in the provision of the various services being offered by the network. In the present case, the primary interest is to determine the costs that such an operator would incur in addressing the levels of both overall traffic and interconnect traffic assumed.

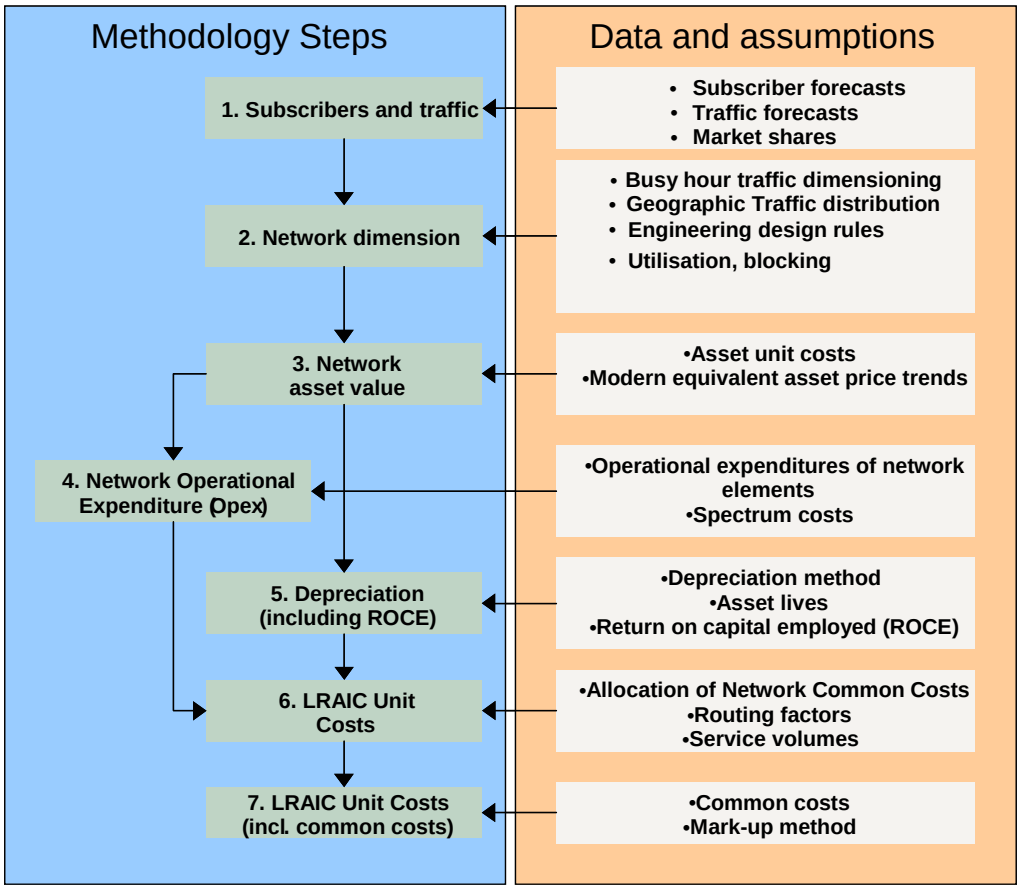
The cost model:

- was designed to provide estimates of network costs for the financial years 2006 to 2009,
- was based upon an efficient network design under a scorched node approach,
- included the ability to model varieties of network call products offered by the network,
- was capable to 'flex' a number of assumptions in order to allow the assessment of how some inputs impact the model outputs, and
- estimated unit costs of call termination services in Pakistan expressed in local currency Rupees (Rs) or Rs per minute.

The model outline methodology

The bottom-up methodology consisted of the seven steps outlined in the figure below.

Figure: Bottom-up methodology



Source: Ovum Consulting

The methodology consists of the following steps:

1. Subscribers and traffic – starting with data on the existing number of subscribers served and total network traffic volume, the model also need to have some forward looking input estimates or forecasts of total subscribers and traffic.

2. Network dimension – using the technical input data on subscribers, traffic volumes, network design and equipment types, the model estimated the total required network input resources needed to serve the full volume of expected demand for services. This is partly determined by the existing numbers of network nodes (based on legacy decisions) and partly determined by the requirement to service current and forward

looking estimates of network traffic demand. Other key dimensioning assumptions which determine the final equipment volumes include network routing for call products by type, resilience, spare capacity, busy hour traffic demand and rules about quality of service delivery.

3. Network asset costs ('Capex') – once volumes of equipment were modelled, the next step was to apply modern equivalent asset (MEA) price trends and asset unit costs to equipment volumes to estimate the total replacement value of the network assets.

4. Network operational expenditure ('Opex') – once the total network investment requirements were calculated, the next step was to estimate the total cost of operating the network based on its size and blend of switching and transmission resources used.

5. Annualisation (annual capital cost) – the total replacement value of the network was annualised into two components, namely, depreciation and return on capital employed – both of which sum to total annual capital costs.

6. LRIC unit costs before mark-ups – total annual costs were made up of annual capital (or 'capex') and annual opex. Total annual costs were unitised using traffic minutes and routing factors to determine the costs of individual network call products.

7. LRIC units costs, after mark-ups – finally, mark-ups were applied to LRIC estimates in order to reflect a fair recovery for other non-network costs which are still relevant for inclusion in termination charges. These types of costs refer to items such as direct network-related common costs and indirect non-network-related fixed capital and operating expenses.

The bottom up modelling techniques described above ensure that the cost model aims to estimate network costs which are 'cost based' and efficiently incurred.

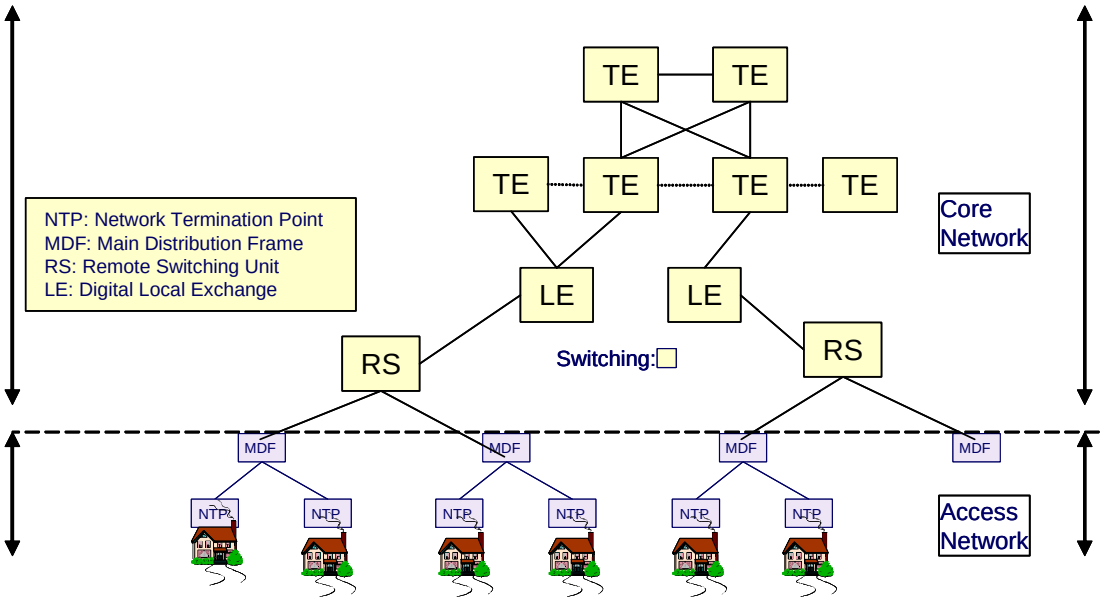
Network Design

Overview

Understanding the topology of the fixed network is the first step for building a bottom-up model. This is because capital network costs are the only costs that are explicitly modelled. All other costs, such as operational network costs, shared network costs, indirect and common costs are included by applying a percentage mark-up on network capital costs.

Below is a graphical representation of the logical hierarchy of the fixed network as assumed in the model.

Figure: Network topology



Source: Ovum

Network elements were separately identified if they:

- Perform different functions in the network. For example, switching and transmission perform a very separate function.
- Have different cost drivers. For example, the cost of the access network is dependant on the number of subscribers lines served, whereas in the core network, the cost driver is traffic volumes (call attempts and calls) made by subscribers. Traffic related costs may be both fixed and variable in nature – for example a fixed switch unit represents a 'lumpy' investment, whereas 2 Mbit ports can vary according to the volume of traffic carried at a given switch.
- Have different costs. For example, remote switches (RS) do not cost as much as LE and TE switches.
- Are dedicated to a particular service type. For example, services called 'lines' are provided by the access network and others such as 'calls' are provided by the core network.

Below is a list of the network elements which were modelled in the fixed network model.

Figure: A list of the modelled network elements

ID		Name	Type
N01	Switch units	Remote switch unit	RS
N02	Switch units	Local switch unit	LE
N03	Switch units	Tandem switch unit	TE
N04	Switch units	2M/bit switch port unit	2mb port
N05	Switch units	BHCA switch processor unit	BHCA
N06	Switch sites	Remote switch buildiing	RS building
N07	Switch sites	Local switch building	LS building
N08	Switch sites	Tandem switch building	TS building
N09	Transmission equipment	SDH MUX STM1	STM1
N10	Transmission equipment	SDH MUX STM4	STM4
N11	Transmission equipment	SDH MUX STM16	STM16
N12	Transmission equipment	SDH MUX STM64	STM64
N13	Transmission equipment	STM Regenerator	STM Regenerator
N14	Transmission cable	4 fibre cable	Km of 4 fibre cable
N15	Transmission cable	8 fibre cable	Km of 8 fibre cable
N16	Transmission cable	12 fibre cable	Km of 12 fibre cable
N17	Transmission cable	24 fibre cable	Km of 24 fibre cable
N18	Transmission cable	48 fibre cable	Km of 48 fibre cable
N19	Transmission cable	96 fibre cable	Km of 96 fibre cable
N20	Transmission cable	192 fibre cable	Km of 192 fibre cable
N21	Transmission routes	Trench route u/g per km	u/g trench
N22	Transmission routes	Aerial route o/g per km	aerial route

Source: Ovum

Services covered

The model was designed to estimate costs of a variety of network call products. These services are as follows:

Figure: A list of the modelled network elements

ID	Name	Unit	Type
P01	Local	Minutes	Voice
P02	Long distance	Minutes	Voice
P03	International Outgoing	Minutes	Voice
P04	International Incoming	Minutes	Voice
P05	Calls to mobile	Minutes	Voice
P06	LDI transit services	Minutes	Voice
P07	LDI outgoing origination service	Minutes	Voice
P08	LDI incoming termination service	Minutes	Voice
P09	LLO outgoing origination service	Minutes	Voice
P10	LLO incoming termination service	Minutes	Voice

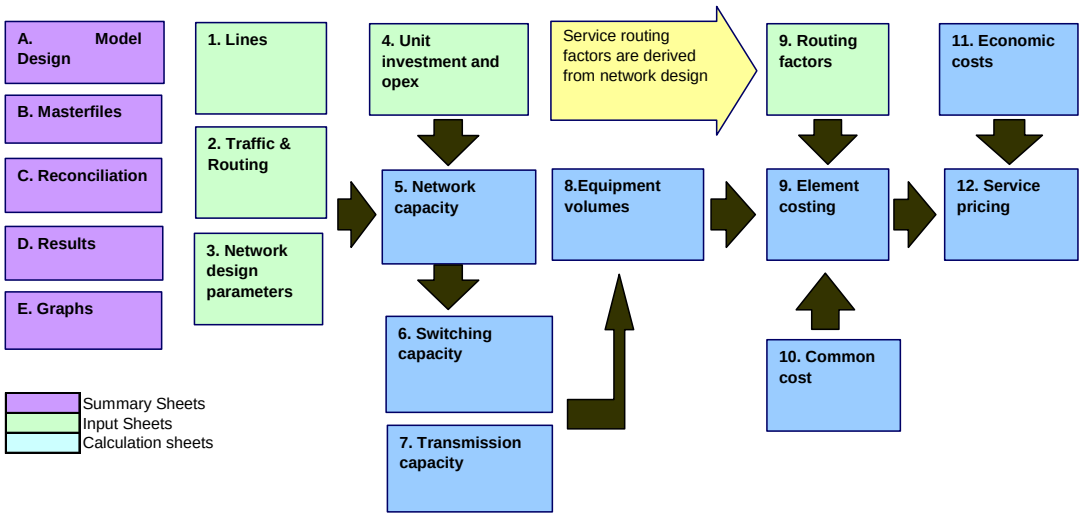
Source: Ovum

Model design

High level description of the structure and flow of the LRIC calculation model

A schematic representation of the different modules, or worksheets, in the model is shown below. There were distinct modules which dealt with summary sheets, inputs sheets and calculation sheets.

Figure: High level structure and flow of the LRIC calculation model



Source: Ovum

Note: each box represents a separate module of the model.

The model went through a number of calculation stages to estimate the LRIC of key network services. These steps can be considered as five major steps:

Step 1 – Subscriber & Traffic Demand Requirements (modules 1 & 2)

The user demand that the network must be designed to handle was defined in terms of subscribers, call attempts and conversation minutes, since these will determine busy hour network traffic requirements (calculated in module 5).

Step 2 – Network Design Parameters (module 3), Network Capacity (modules 5, 6 and 7) and Equipment Volumes (module 8)

A range of assumptions in module 3 covered busy hour rules, equipment capacities and utilisation levels. Other assumptions were specific to transmission - such as the number and lengths of routes by link type, trench lengths, trench sharing with the core network and capacity distribution of link types.

The combination of demand (in step 1) and network design parameters (module 3) enabled the model to determine network's overall busy hour traffic requirements (calculated in module 5).

In module 6 and module 7, the model calculated the capacity requirements specific to 'switching' and 'transmission' equipment respectively.

Finally, based on the capacity requirements, the model was able to calculate the total requirement for switching and transmission equipment volumes.

Step 3 – Calculate Cost of Network Inputs (module 4, 8 and 9a to 9h)

Modern equivalent asset (MEA) cost of network elements were calculated by multiplying unit costs (module 4) with volumes from Step 2. This step took into account the equipment price trends if asset prices are to be estimated for a number of years.

Total annualised equipment costs were calculated for each network element, based on equipment depreciation calculations, installation costs and operating cost estimates (sheets 9a to 9h).

Step 4 – Convert Network costs to service costs (modules 10, 11 and 12)

Network costs were allocated to each service type, based on routing factors and traffic volumes which determined the relative network element usage.

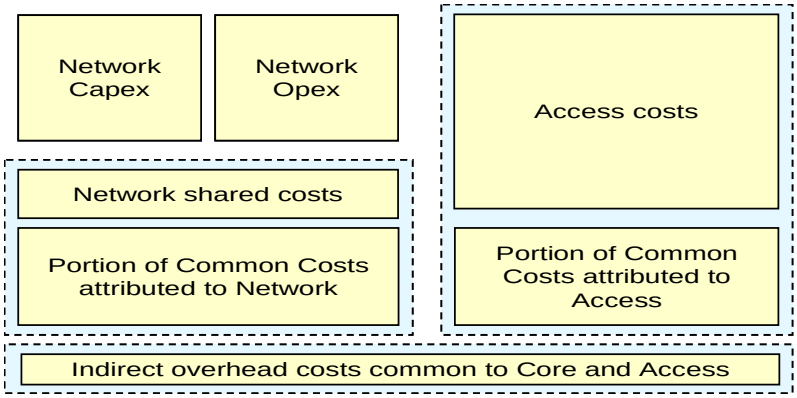
The total cost of each service type was divided by the total volume of each service type to get the unit cost.

Step 5 – Add Common Costs (modules 10 and 12)

The unit service costs were marked up to recover a relevant proportion of the total common fixed costs for assets which were shared by core and access services.

The figure below provides an illustration of the mark ups.

Figure: Illustration of mark-ups



Source: Ovum

1. Subscribers and traffic

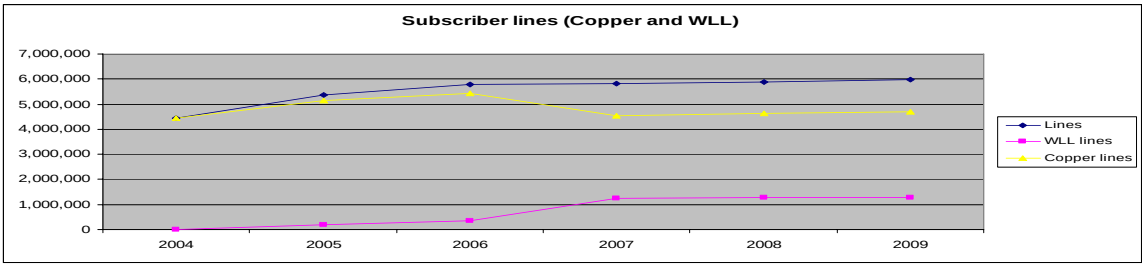
Demand

PTCL provided data on the current size of the fixed PTSN market in Pakistan. The model was designed to calculate LRIC results over the period 2006 to 2009. The total number of subscriber lines determined the total volume of call attempts and call minutes. In the light of receiving data on customer and traffic volumes up to 2006, the consultants used official estimates of population growth in Pakistan to determine the forward looking estimates of total PSTN lines in 2007 through to 2009.

Subscriber lines

As described above, the consultants applied the fixed line penetration rate to estimate the total number of lines over the period 2008 to 2009. The model also allowed to test the impact on core network costs of introducing wireless local loop (WLL) lines in the access network, versus using 100% copper access lines. The figure below shows the total lines assumed by the model from 2004-2009 along with the forward looking estimates of the split between copper and WLL lines.

Figure: Subscribers (year-end)



Source: Ovum analysis

Percentage share of lines between copper and wireless local loop (WLL)

The figure below presents the model's assumptions on the total lines assumed and break down between traditional copper and new WLL lines.

Figure: Percentage share of lines between copper and WLL

Year	Unit	2004	2005	2006	2007	2008	2009
WLL %	%	0.00%	0.13%	0.22%	0.76%	0.76%	0.76%
Copper %	%	100.00%	99.87%	99.78%	99.24%	99.24%	99.24%
WLL lines	#	0	206,014	359,470	1,250,000	1,269,875	1,290,066
Copper lines	#	4,428,900	5,148,566	5,430,504	4,554,476	4,626,892	4,700,460
WLL share of total lines	%	0.00%	3.85%	6.21%	21.54%	21.54%	21.54%
Copper share of total lines	%	100.00%	96.15%	93.79%	78.46%	78.46%	78.46%
All lines	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Ovum analysis

Traffic forecasts

PTCL data indicated a total average number of minutes per subscriber line in 2006 at 7,603 (see figure below). This average was applied to the total predicted lines in 2006 to 2009 in order to estimate the total volume of network minutes likely to be carried by the network. The figure shows the model's assumptions for total lines, the year on year change in lines expected and average total minutes per line.

Figure: Per subscriber traffic in 2006 to 2009

Year		2006	2007	2008	2009
Subscribers	yr-end	5,789,974	5,804,476	5,896,767	5,990,526
Subscribers	mid-year	5,572,277	5,797,225	5,850,622	5,943,646
change	units	435,394	14,502	92,291	93,759
change	%	8.1%	0.3%	1.6%	1.6%
Total traffic volumes per subscriber	minutes	7,603	7,603	7,603	7,603

Source: Ovum analysis

2. Network dimensioning in the model

The network dimensioning converted the traffic and subscribers volumes into the required number of network elements using assumptions such as:

- busy hour traffic profiles
- network dimensioning
- network utilisation
- spare capacity and
- engineering design rules.

Busy hour traffic dimensioning

The volume of Erlangs were estimated from the traffic volumes. Erlangs are a measure of traffic. For example, this could be the requirement for traffic channels required in the busiest hour on the busiest day of the year. Erlangs are a commonly used means of dimensioning the amount of capacity required in a network. Each traffic type was converted into this common unit, which allows the dimensioning of various traffic-driven network elements to be performed using this common driver.

3. Network Asset Values

Purchase Item cost and Modern Equivalent Asset price trend

Each network element was associated with a unit-purchase cost. It was estimated that a sensible range for most network components for price trends lies between 0 and –10% per annum. The MEA trends were set to reflect the fact that there is going to be cost reductions for most items of network equipment. The model assumed this to be average –5.0% per annum over the forecast horizon.

The following figure contains the network costing information used in the model.

Figure 10: Network units – Equipment cost (Rs) and expected change in cost (%)

Network item	Purchase price per unit of equipment (2006)	% Annual change in purchase price: 2007-2009
Remote switch unit	4,000,000	-5.0%
Local switch unit	60,000,000	-5.0%
Tandem switch unit	85,800,000	-5.0%
2M/bit switch port unit	120,000	-5.0%
BHCA switch processor unit	100	-5.0%
Remote switch building	6,000,000	+5.0%
Local switch building	50,000,000	+5.0%
Tandem switch building	93,000,000	+5.0%
SDH MUX STM1	1,000,000	-5.0%
SDH MUX STM4	2,500,000	-5.0%
SDH MUX STM16	4,000,000	-5.0%
SDH MUX STM64	5,600,000	-5.0%
STM Regenerator	1,500,000	-5.0%
4 fibre cable	100,000	-5.0%
8 fibre cable	140,000	-5.0%
12 fibre cable	196,000	-5.0%
24 fibre cable	254,800	-5.0%
48 fibre cable	331,240	-5.0%
96 fibre cable	496,860	-5.0%
192 fibre cable	1,043,406	-5.0%
Trench route u/g per km	873,968	+5.0%
Aerial route o/g per km	87,397	+5.0%

Source: Ovum analysis

Installation cost

There was also an associated installation cost for each of the network elements. This cost usually lies in the range of 5-15% of the purchase price depending on the item. In the model it was assumed at 10% installation expense for all network elements. The figure below shows installation unit costs per network element.

Figure: Network units – Installation cost (Rs)

Network item	Unit installation cost (2006)	% Annual change in installation cost: 2007-2009
Remote switch unit	400,000	+5%
Local switch unit	6,000,000	.+5%
Tandem switch unit	8,580,000	+5%
2M/bit switch port unit	12,000	+5%
BHCA switch processor unit	10	+5%
Remote switch building	600,000	+5%
Local switch building	5,000,000	+5%
Tandem switch building	9,300,000	+5%
SDH MUX STM1	100,000	+5%
SDH MUX STM4	250,000	+5%
SDH MUX STM16	400,000	+5%
SDH MUX STM64	560,000	+5%
STM Regenerator	150,000	+5%
4 fibre cable	10,000	+5%
8 fibre cable	14,000	+5%
12 fibre cable	19,600	+5%
24 fibre cable	25,480	+5%
48 fibre cable	33,124	+5%
96 fibre cable	49,686	+5%
192 fibre cable	104,341	+5%
Trench route u/g per km	87,397	+5%
Aerial route o/g per km	8,740	+5%

Source: Ovum analysis

Asset lives

The base run of the model used a mixture of values to reflect the average asset life for different types of network equipment. The exceptions were buildings and trench which have longer expected asset lives compared to most other equipment. The following table shows the economic lifetime for all network elements.

Figure: Network units – Economic lifetime (years)

Network item	Economic lifetime (Years)
Remote switch unit	10
Local switch unit	10
Tandem switch unit	10
2M/bit switch port unit	10

BHCA switch processor unit	10
Remote switch building	20
Local switch building	20
Tandem switch building	20
SDH MUX STM1	10
SDH MUX STM4	10
SDH MUX STM16	10
SDH MUX STM64	10
STM Regenerator	10
4 fibre cable	10
8 fibre cable	10
12 fibre cable	10
24 fibre cable	10
48 fibre cable	10
96 fibre cable	10
192 fibre cable	10
Trench route u/g per km	20
Aerial route o/g per km	20

Source: Ovum analysis

4. Operational expenditure

The operational expenditure was included in the model as a proportion of the total Gross Replacement Cost (GRC) of network assets. This value was calculated as the sum of the purchase and installation cost. These estimates were compared to estimates used in models build by the consultant in other jurisdictions to test for reasonableness.

In the base model case, the direct network opex factor was set at 7.5%. The model also assumed an increase in the absolute value of unit operating costs caused by network capex. The annual change in direct opex (2007-2009) was set at 7.9% in line with local price inflation experience. This was to ensure that, subject to movements (up or down) in equipment prices over time, the model is generating 'realistic' levels of operating costs for the network over time.

5. Capital Charge

The capital charge is define as follows:
Capital charge = Depreciation + Return on Capital Employed (WACC)

Depreciation

Economic depreciation is a method for determining a cost recovery that is economically rational in that it:

- reflects the underlying costs of production, and
- reflects the output of network elements over their lifetime.

The principle behind economic depreciation is that all efficiently incurred costs should be recovered in an economically rationale way. The use of Modern Equivalent Asset pricing ensures that the assets represent the purchasing of an efficient operator. The model was capable of illustrating some of the most common approaches to calculating the capital charges:

- straight line
- tilted straight line
- annuity
- tilted annuity.

The base run model results were derived using the Titled Annuity option.

Weighted Average Cost of Capital (WACC)
Following is the summary of the components and the figures used in PTCL's WACC calculation:

WACC Components	Value Used	Detail
Levered Beta (β)	1.2	
Risk Free Rate (Rf)	10.20%	Current 10 years PIB Rate
Market Return (Rm)	17.04%	5 Years (weekly Moving Average)
Risk Premium	6.84%	(Rf – Rm)
Debt Premium	2.00%	Premium over Risk Free Rate
Target Debt/Equity Ratio	60 : 40	Efficient Capital Structure – International Best Practice
Cost of Equity	18.41%	Calculated using CAPM
Cost of Debt (Before Tax)	12.2%	
Cost of Debt (After Tax)	7.93%	Tax Rate: 35%
Pre-Tax Nominal WACC	**18.65%**	
Inflation Rate	7.9%	Federal Bureau of Statistics
Pre-Tax Real WACC	**9.96%**	Inflation Adjusted

Cost of Equity

The cost of equity is calculated using the CAPM model. The cost of equity, R_e, calculated using the CAPM is usually expressed as:

$$R_e = R_f + \beta (R_m - R_f)$$

where

R_f = the anticipated return available from risk free investment

R_m = the anticipated returns available from risky investments in the market generally

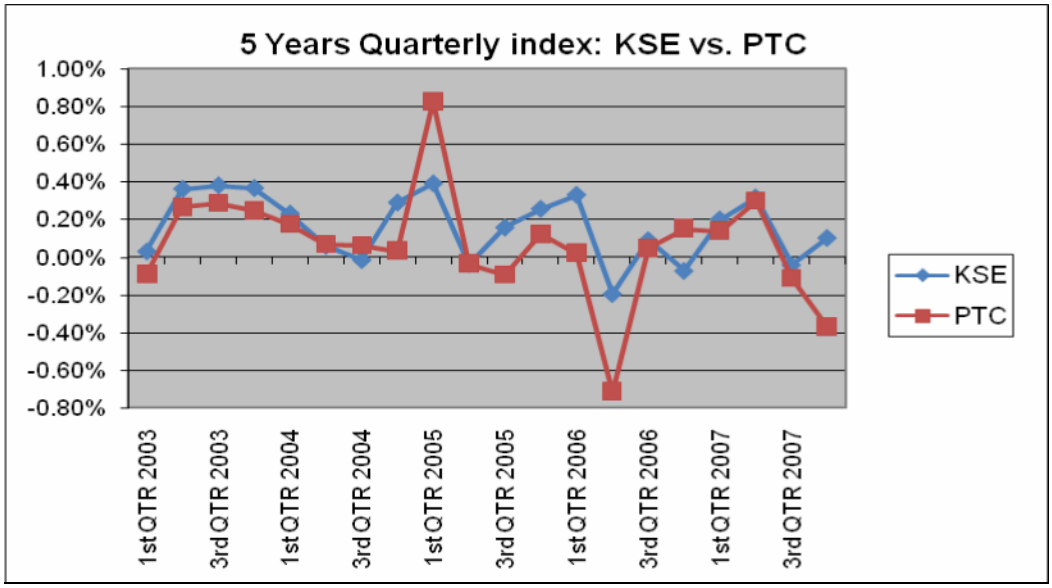
β = the anticipated correlation between movements in the share price of the concerned company compared with movements in the market generally, a measure of its systematic risk.

The $(R_m - R_f)$ factor is called the equity risk premium.

Components of Cost of Equity

(i) Beta

Beta (β) measures the covariance of movements in a company's share price and movements in the market index and provides a measure of the specific risk attached to an individual company compared to the market. A graph showing the PTCL stock performance as compared with the index is shown below:



As is apparent from the figure above, PTCL stock is fluctuating more than the market index showing greater volatility and hence greater risk when compared with the market index. Equity beta was calculated to measure this volatility. Most recent historic returns and a time horizon of five (5 years) from January 2003 till December 2007 was used providing sufficient data points to ensure a robust estimate and smoothing out any short-term fluctuations in the data that do not reflect fundamental changes in the market environment.

The beta was calculated using the regression run of stock returns on market returns by the statistical formula:

$$\beta_a = \frac{\mathrm{Cov}(r_a, r_p)}{\mathrm{Var}(r_p)} \quad ,$$

where r_a measures the rate of return of PTCL stock and r_p measures the rate of return on the stock market.

Using the above time horizon, two betas were calculated, 1) using the daily price movements of the PTCL stock and the Karachi Stock Exchange 100 Index (KSE-100) and 2) Monthly price moments of the same, using the same time horizon calculated by Reuters. A simple average of the two was taken to come up to an equity beta of 1.05.

In order to be able to compare levels of business risk across companies with different levels of gearing on an uniform basis, it is necessary to calculate the value of beta for the company on the assumption that the company hold no debt, i.e. asset or 'unlevered beta'. In the CAPM framework, the traditional way to account for the impact of a change in gearing on the cost of equity is to adjust the beta coefficient in a linear manner. To go from unlevered (or asset) beta to levered (or equity) betas, the following formula is used:

$$\beta_{equity} = \beta_{unlevered}\ (1+(1-t)*(Debt/Equity)$$

Based on above, PTCL equity beta was first unlevered on its current capital structure and then levered back to an optimal structure of 60:40. However the value calculated came out to be 2.07 which seems quite unrealistic. Taking into account the PTCL risk profile as a blue chip company, its levered beta was capped at a maximum of 1.2 which is used in Cost of Equity calculation.

(ii) Risk free rate

The risk free rate is the return that can be earned on government securities that generally carry negligible risk of default. In this context, we have used the most recent yield on ten year PIB's (Pakistan Investment Bonds). The ten-year factor reduces any risk associated with short term fluctuations and changes in yields. The reason for taking PIB's is that they are government securities and are riskless.

Another notable point here is that the yield on risk free rate includes sovereign risk specific to that particular country. This can be supported by the fact that yields on EURO bond issues of any country are inclusive of sovereign risk. In 2007 Pakistan issued Euro bonds/Sovereign Bonds of US$750 million in value with a maturity of 10 years having a fixed coupon rate of 6.875%. Current yield of this issue is 9.4%[2]. As an alternative to Risk Free Rate/(PIB rates), yield on Eurobonds can also be used. However current yield on 10 years PIB of 10.2% has been used for WACC calculation.

[2] S&P – Moodys Rating and Euro Bonds – Dated January 17, 2008

(iii) Market Return

Using the same data and time period used for beta calculation, return on market has been calculated using 5 years weekly moving average of the KSE-100 index. The market return (Rm) for this time period has been calculated as 17.04%.

(iv) Equity Risk Premium

The equity risk premium (ERP), $R_m - R_f$, considers the additional returns that investors must earn for holding risky (equity) investments compared to risk free government bonds. As for the risk free rate, the calculation of the equity risk premium should be consistent with the market from which investors in a particular company will be drawn.

An ex-post approach considers, from a historic perspective, the returns that have been earned on equity investments compared to those that have been earned on risk free investments. It is normal to take this measurement over as long a time scale as possible, to eliminate the impact of any short-term variability and to assume that the premium is constant over time.

Instead of international benchmark for equity risk premium for developing countries of 6%, we estimated ERP using calculated market return and risk free rate and a value of 6.84% has been used in cost of equity calculation.

Capital Structure of PTCL

Although PTCL has no debt on its current capital structure, for calculation of WACC for "cost plus normal return" model an efficient capital structure is used. In Pakistan as per Security Exchange Commission (SECP) an 80:20 structure is considered optimal, however for our cost model purpose we are using a 60:40 capital structure as is the international best practice. For this reason it is essential to compute cost of debt for PTCL.

Cost of Debt

The calculation of the cost of debt (R_d^{bt}), follows a similar methodology to the cost of equity, namely to consider the appropriate premium (P_d) over the risk free rate (R_f), that investors require for holding corporate rather than sovereign debt. As with the cost of equity, it is necessary to take account of the appropriate maturity over which to consider the cost of debt. The debt premium (P_d) is computed by comparing the current yield to maturity with an appropriate debt free instrument of similar maturity issued in the market in which the funds were raised. The resulting debt premium is then added to the risk free rate for the market in which the organisation is raising capital.

For calculation of debt premium, we benchmarked large cellular operators in Pakistan and computed their weighted average cost of debt. Their cost of debt is ranging between 9 to 10.5%. Although these operators are considered more risky than PTCL, their reported cost of debt is coming close to the risk free rate.

Ovum however has implied a more reasonable debt premium of 2% over the risk free rate which led to an after-tax cost of debt of 7.93%.

Based on above, a pre-tax nominal WACC of 18.65% was determined for PTCL.

6. Unit costs

Routing factors

The routing factors were used to allocate costs amongst different services. The estimates shown in the following figure are based upon the consultant's experience of undertaking similar cost studies.

Ideally routing factors should be developed by undertaking a detailed analysis of the proportion of usage that each service makes of each network component during the busiest hour.

The figure below presents the routing factors contained in the bottom-up model.

Figure: Routing factors

Service	RS-LE	LE-TE	TE-TE	RS	LE	TE
Local	1.00	0.00	0.00	1.00	1.00	0.00
Long distance	1.00	2.00	0.50	1.00	2.00	1.50
International Outgoing	0.50	1.00	0.50	0.50	1.00	1.50
International Incoming	0.50	1.00	0.50	0.50	1.00	1.50
Calls to mobile	0.50	1.00	0.50	0.50	1.00	1.50
LDI transit services	0.00	0.00	0.50	0.00	0.00	1.50
LDI outgoing origination service	0.50	1.00	0.50	0.50	1.00	1.50
LDI incoming termination service	0.50	1.00	0.50	0.50	1.00	1.50
LLO outgoing origination service	0.50	1.00	0.50	0.50	1.00	1.50
LLO incoming termination service	0.50	1.00	0.50	0.50	1.00	1.50

Source: Ovum analysis

Service volumes

Unit element costs per minute were derived by spreading total annual network element costs over the total element conversation minutes (i.e. the billed service volumes).

Service costing

The service cost for each of the services/products was calculated based on the contribution of each network element for the provision of these services and the associated service volumes.

7. Mark ups

Network common costs which support two different services like 'calls' and 'access' by definition do not disappear if either one (or the other service) is ceased. LRIC measures the fixed and variable service-specific costs associated with choosing to offer, expand or contract a given volume of service output. Hence, the LRIC unit service costs are marked up to recover a relevant proportion of the total common fixed costs for assets which are shared by core and access services.

Service pricing
This is the total service pricing value for each one of the provisioned products. Service pricing includes the LRIC plus any mark ups which are relevant over the modelled period.

Allocation of common costs
An operator in an efficient market will ensure that common costs are recovered through the services that are provided by the network. There are two principal ways in which common costs can be factored into the service costs that an operator can charge:

- Equi-proportionate mark-up (EPMU)
- Ramsey pricing mark-up.

The model used equi-proportionate mark-ups to recover the common costs.

7.2 FIXED-LINE TOP DOWN FULLY ALLOCATED COST MODEL

The top-down historic cost accounting (HCA) fully-allocated cost (FAC) model was of the incumbent fixed-line operator, PTCL. The model derived a substantial proportion of its inputs from financial information provided by the operator and reconciled to PTCL's published financial statements for the financial year 2005-06. Statistical data in respect of call numbers and minutes and subscriber volumes were sourced from the operator.

The top-down model was based upon actual operator's performance and it computed indicative unit costs of the fixed interconnection services for a single year.

The purpose of the model was to illustrate the costs that PTCL incurs in order to provide fixed call interconnection services in Pakistan. Network call services include local, single tandem and double tandem interconnection services in Pakistan.

It is important to note that:

- The source data was based on the information supplied by PTCL. Where no data was available, the consultants used their experience of developing fixed network top down models and cost allocation techniques.

- The costs of fixed call termination cannot be modelled in isolation of other services because a large number of network components are used by more than

one service. For example, voice switches carry different call products such as local, national and international calls. In addition the network may carry both voice and non-voice services. Transmission link capacity may be used to support the provision of PSTN voice and non-PSTN leased line services. A comprehensive set of network call product services were included in the model (e.g. local calls, national calls, calls to mobile, transit and interconnection calls etc).

- The main sources of data were the fixed asset register and the operating expenditure accounts of PTCL. These accounts were used in order to allocate costs over network elements and products.

- Mark ups were also used in order to allocate costs like indirect non-network costs over the products. Such non-network costs include assets like vehicles, PCs, office furniture and non-network buildings and non network expenses associated with staff working in functional departments (e.g. head office).

Overview of model's input and outputs

The model financial inputs came from the accounts:

- Opex data. This provides the operational costs (salaries and overheads etc).
- Asset data. This provides the depreciation and the notional cost of capital employed (CoC). The CoC is equal to an assumed ROCE (Return on Capital Employed) which is defines as:

  Mean Capital Employed (MCE) times WACC

Where the WACC, is the pre-tax average cost of capital. The Mean Capital Employed is the capital investment in assets of PTCL, which is the average of the net book values (NBV) of the assets on the beginning and the end of the base year.

A wide range of technical and cost driver inputs were required like volumes of products, network elements volumes, which defined how the costs are processed and allocated.

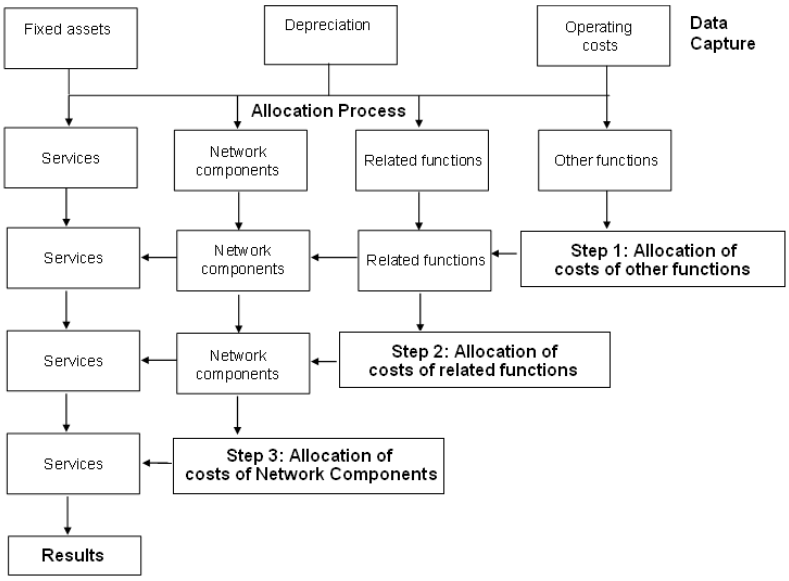
The output was a model that allocates assets and operating costs to products and the unit costs of the fixed call termination services.

Architecture of the model

Model structure and definitions

Both the OPEX and asset register accounts were fed into the cost model. This section details the model, the structure of which is highlighted in the figure below.

Figure: Model Architecture



Source: Ovum

The initial step of the allocation was to ensure that the costs data base should reconcile with the PTCL's financial statements for the year ended June 30, 2006. The second stage of the cost model was to analyse the cost information, process the data and categorise the costs in categories that can be easily further processed, which is commonly known as cost centres. A cost centre (CC) is a functional area or division in the PTCL business. Cost accounts were posted to a cost category. In the case of OPEX, the categories that were used where the ones that were considered in the PTCL's financial statements. In the case of CAPEX, after calculating each asset's annual cost, the costs were allocated over categories defined.

The following stage of the model was to define appropriate cost pools. The purpose of this stage was to map each CAPEX and OPEX category to one or more cost pool by making use of allocation keys and assumptions. A cost pool (CP) is an entity that collects costs of different types and from different sources. A CP may be a network element (say RS), a traffic type (say calls to mobile) or Other (such as Non Network costs, that are related to all of the business). The common technique used to map the cost centres to cost pools is the Activity Based Costing (ABC) technique. In the absence of ABC data supplied, the consultants used its own experience and applied assumptions in order to map the different cost categories to network elements and products. At this stage some cost pools were mapped to one or more cost pools. This was the mark up stage at which, common business of general network costs were allocated over the network elements or products.

The final stage of the allocation process was the routing table allocation methodology. The Routing Table defined how products (traffic types) use the network, along with

volume data. It converted the network costs to network products. After this stage, no costs would be mapped to network elements.

The output of the model was a set of traffic type's unit costs, which were appropriately weighted averaged and the interconnection rate was calculated for different types of traffic.

Model Methodology

Introduction

The main steps in the model are the following:

- The input (from OPEX and AR) with costs grouped by cost categories. Different cost centres existed for the OPEX and AR input data.
- All costs were then allocated to the cost pools (CP). Cost categories were mapped to general and then more detailed cost elements and traffic types. Examples of possible allocations to be made in this stage were:
- Allocations from general to specific CPs.
- Irrelevant costs are removed from the CPs. These costs were typically sent to a "parked" cost pool.
- Non-specific cost pools such as Common or Retail costs were spread to other pools to give a mark-up of costs, providing full costs of products.

The next step was to allocate costs from network element CPs to the products (traffic types), using a routing table. The routing table described how the different products use the network elements. Based on this information and product volumes information, the model distributed costs from network elements to network products.

Input Values

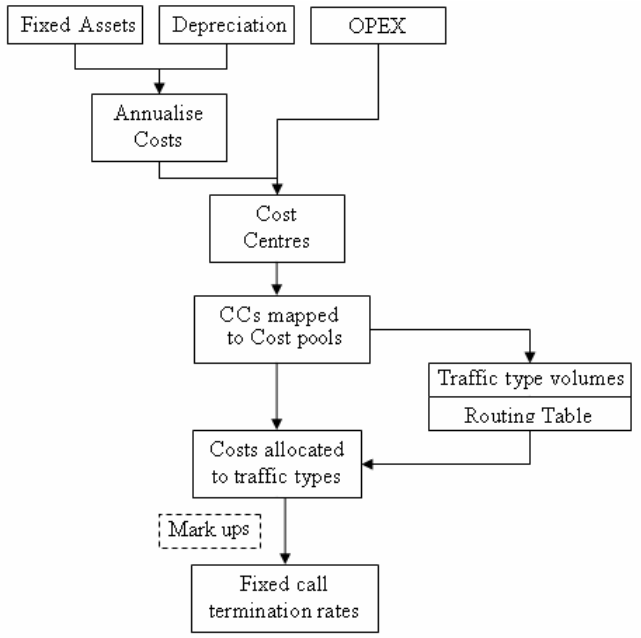
Input values were basically the Fixed and Network Assets Register and the Operating Expenditure data. Fixed and network NBV and depreciation were needed in order to annualise assets costs.

Other inputs were required in the model to carry out the cost allocations and product calculations. These were basically technical and cost driver inputs as well as traffic type's volumes.

Model Design

A more detailed description of the model is illustrated in the following figure.

Figure: Model Design



Source: Ovum

The main inputs of the model were the Fixed Asset Register and the operating expenditure accounts, as shown in the above figure.

Cost Centres Allocations

Fixed and Network Assets Allocation

As far as the asset register is concerned, fixed and network assets were split over the following broad categories:

- Land (Freehold and Leasehold)
- Buildings (Freehold /Leasehold/Office)
- Lines and Wires
- Apparatus and Plant
- Furniture and Fixtures
- Vehicles

Historical account information was used in order to calculate the opening and closing net book value of each asset and the mean capital employed was calculated. The depreciation of the assets and the WACC were considered in order to annualise each asset's cost.

The next step of the process was to further split the assets in more detailed categories that were useful in order to map the assets to the cost pools. Because of the fact that it was difficult to process assets' costs in broad categories, some of the cost categories were further split to sub categories. At this point, the net book value of the assets was reconciled with the balance sheet information provided.

Due to absence of certain significant data inputs, PTCL was requested to correspond to "data gaps" regarding the fixed assets classification. The fixed asset register provided by PTCL (and in particular the Apparatus & Plant and Line & Wire sections within the fixed asset register) appeared to be largely classified by the geographical region of Pakistan in which they are deployed. Attempted was made to use the incomplete description and type fields of the fixed asset register extracts in order to categorise assets by the nature of asset owned and operated by PTCL, although inevitably this introduced an element of uncertainty with regard to how such asset costs were grouped and attributed to network elements and ultimately services.

The split of the "Apparatus & Plant" and "Lines & Wires" assets was provided by PTCL as part of the "data gaps" request. The problem that appeared was that the total net book value of these assets did not reconcile and was not in agreement with the company's financial statements. The reason for that might be the fact that the assets were re-evaluated to reflect current costs, which was not the purpose of the model as it is a historic cost accounting model. For example the Apparatus & Plant written down value in the "data gap" submission was 37,549 PKR million instead of 31,536 PKR million that was reported in the financial statements. As long as the data provided by PTCL was 20% higher than the original submissions and the company's financial statement, it was not included in the model as part of the assets' values allocations.

The sub cost categories that were finally defined in the model are the following:

Apparatus & Plant

- Digital exchange
- Remote exchange
- Main & Local Tx 622 SDH
- Main & Local Tx 155 SDH
- Digital Radio System
- Remote exchange 2
- DWDM transmission
- Air-conditioners
- WLL Access
- WLL but ME to LE Tx
- Main or Local exchange
- VAS or IN equipment + related
- Main & Local Tx - Optical fibre systems
- Main & Local tx - Trunks
- Uncategorised

Line & Wire

- Core Transmission
- Transmission fibre
- Access
- Transmission - no type info

- Central Battery
- Digital exchange - no other type info
- Duct
- U/G Cable - unspecified type
- Semi-automatic exchange - line & wire
- Unclassified Other

Buildings
- Administrative in nature (ADMIN)
- Operational switching centres & stores (OSC)
- Wireless local loop infrastructure (WLL)

Land
- Administrative in nature (ADMIN)
- Operational switching centres & stores (OSC)

Furniture & Fixtures and Vehicles were not further split to sub cost categories. Also it was not possible to avoid having some uncategorised assets that were allocated to cost pools by using as a driver the average percentages deriving from the allocation of the previous categories.

Operating Expenditure Allocation
As far as the operating expenditure is concerned, the costs were split in cost categories as they were defined in the PTCL's financial statements. These cost categories are the following:

- Foreign operations cost and satellite charges
- Fuel and Power
- Store & Spare Consumed
- Rent rates and taxes
- Repairs and buildings
- Printing and stationery
- Other expenses

Cost Pools Allocation
At this point of the model, the main target was to allocate each category's cost to network elements: Access, Core Network and Non-Network related costs. Further, core network elements were allocated over Transmission (RS-LE, LE-TE, TE-TE) and Switching elements (RS, LE and TE).

Although it was requested in the "data gap", PTCL did not provide the percentage attribution of each fixed asset cost category to the network elements. Instead PTCL provided a number of spreadsheets, that did not facilitate the development of the model. Furthermore, the data was not in the requested data gaps format and as a result it was of limited usage.

In order to allocate operating expenditure to cost pools, activity cased cost analysis was necessary. In the absence of this data, the proportions of such OPEX that are likely to impact upon different network elements and services of PTCL were estimated using consultant's awareness of the typical composition of such costs from other fixed-line operators. Such an approach remains "cost based" although naturally the accuracy of such cost attributions could be enhanced by better input from PTCL. PTCL, instead of providing in the "data gap" request, activity based costing data and allocation drivers; provided the percentage attribution of each cost category to the network elements and the other cost pools. This set of data was used in the model in order to allocate OPEX to cost pools.

There were no calculations or workings to accompany the allocation splits, but the results were used as they were sent from PTCL. It was unavoidable that the accuracy of the allocations could not be as good as expected. In addition, although the consultant requested in the "data gap", an allocation of staff number to the general cost pools of access, core network, non-network and retail, this information was not delivered from PTCL. Instead an allocation to some other cost centres was delivered that was not in the expected format. As a result the information was not considered in the model and instead, the consultant made its own assumption of the salaries and other benefits allocation drivers.

After the allocation of OPEX and annualised capital cost to core network, access, non-network related, retail/other cost pools, all the costs were summarised in order to be further processed. At this stage, a cost pools to cost pools allocation process was used in order to allocate more general cost pools to more detailed ones. In addition, Non-Network related costs were allocated over the remaining three other general cost pools (Access, Core Network, Retail), using as a driver for the allocation an equal proportion mark up. At the last stage of cost pools to cost pools allocations, core network was split to transmission and switching network elements. The drivers used for the allocation were the capital expenditure, traffic volumes (minutes), network elements volumes etc. A percentage of the total transmission costs was assumed to be attributed to leased lines and as a result it was excluded from the interconnection rate calculations.
The next stage of the allocation process was another cost pools to cost pools allocation stage at which network elements costs were spread over the products by making use of the routing factor table that is described below.

Routing table

The routing factors are used to allocate costs amongst different services. The estimates shown in the following figure are based upon the consultant's experience of undertaking similar cost studies, and the network configuration illustrated above.

Ideally routing factors should be developed by undertaking a detailed analysis of the proportion of usage that each service makes of each network component during the busiest hour.

The figure below presents the routing factors contained in the top-down model.

Figure: Routing factors

Service	RS-LE	LE-TE	TE-TE	RS	LE	TE
Local	1.00	0.00	0.00	1.00	1.00	0.00
Long distance	1.00	2.00	0.50	1.00	2.00	1.50
International Outgoing	0.50	1.00	0.50	0.50	1.00	1.50
International Incoming	0.50	1.00	0.50	0.50	1.00	1.50
Calls to mobile	0.50	1.00	0.50	0.50	1.00	1.50
LDI transit services	0.00	0.00	0.50	0.00	0.00	1.50
LDI outgoing origination service	0.50	1.00	0.50	0.50	1.00	1.50
LDI incoming termination service	0.50	1.00	0.50	0.50	1.00	1.50
LLO outgoing origination service	0.50	1.00	0.50	0.50	1.00	1.50
LLO incoming termination service	0.50	1.00	0.50	0.50	1.00	1.50

Source: Ovum

The model considered the routing factors as an estimate of the average number of each type of network element used for specific traffic types. In the cases that more than one possible route exist, then a weighted average of the number of network elements used for each route multiplied with the probability that this route can occur was considered.

The “routing table” allocation methodology was regarded as a cost pool to cost pools allocation, as the main objective is the mapping and allocation of network elements’ costs to traffic types. After this stage, the cost attributed to network elements was zero, as it has been spread over the traffic types.

The outcome of this methodology was the calculation of the unit costs of the network elements and the allocation to local, single tandem and double tandem services. More specifically the routing factors were used in order to process and convert the total successful conversation minutes to network component minutes. The minutes were allocated to the network elements and the network elements unit cost was calculated by using the network elements costs that derived from the cost pools allocation. At the last stage of the model following route factors table was used in order to calculate the local, single and double tandem service unit costs out of the network elements unit costs.

Figure: Final Service Routing factors

Network Element	Local	Single tandem	Double tandem
RS-LE	1.0	1.0	1.0
LE-TE		1.0	1.0
TE-TE			1.0
RS	1.0	1.0	1.0
LE	1.0	1.0	1.0
TE		1.0	2.0

Source: Ovum

After this stage, all the costs were allocated to traffic types or retail/other and parked costs. Retail or other parked costs were excluded from the calculation of the fixed termination rate

Assumptions and Allocation Methodology

This section summarises the steps that were followed in the attribution process and the reasons why some assumptions were necessary to be made in the model.

The steps that were followed are presented below.

1. Most emphasis was given to the attribution of Apparatus & Plant and Line & Wire fixed assets as they both accounted for more that 85% of the total Mean Capital Employed and 90% of the annual cost. The other cost categories were allocated by reference to average value i.e. weighted allocation of other cost categories.

2. The underlined fixed assets register provided by PTCL failed to categorise the assets to meaningful groupings other than geographical groupings, making their process very difficult. As a result, a number of assets could not be categorised and weighted average allocation values from previous cost categories were used. The process that was followed for the attribution, was the filtering and categorisation of assets by reference to their textual description filed into logical groupings that were identified and could be further processed.

3. At the next stage of the allocation process, the emphasis was given on the identification and calculation of allocation keys that could be used in order to allocate fixed assets categories (cost centres) to cost pools (Access and core network, retail/other and non-network). The attribution was based on:

- Anecdotal evidence of such types of assets deployed by other fixed incumbent operators.
- Attribution derived from the Bottom – Up model, as no attribution information was delivered by PTCL at the stage that the model was developed.

The consultant again requested the information on the attribution drivers from PTCL, but the information delivered failed to be of any particular help. The reasons for that was that:

- The information was delivered at a very late stage of the model development.
- Although the consultant in the "data gap" request, indicated the format that the new information should be in, however PTCL failed to provide information on the requested format. As a result the information could not be used in the model.
- The groupings that PTCL proposed in the "data gap" submission could not be used in the model, as the total NBV of the "Apparatus & Plant" and "Lines & Wire" assets did not reconcile to the company's financial statements.

The last stages of the allocation process were the cost pools to cost pools allocations. More specifically non-network related costs were spread over the other three cost pools; Access, Core Network and Retail/Other. The driver for the allocation was an equal proportion mark up, based on the proportion of each cost pool at the previous stage of allocation. Furthermore, common core network costs were spread over transmission and switching network elements. The driver for this allocation was the annualised capital expenditure of each network element. At this point it should be noted that a percentage of only the transmission costs was attributed to leased lines. An assumption was made on this percentage, which can be flexed in the model. The typical value used in the model was 7%.

8. SUMMARY RESULTS OF THE PRELIMINARY COST MODELS

Following are the results of the cost models which were also shared with the industry for comments during hearing dated 26th February 2008.

Results of Mobile Cost Models

(i) FAC Model

Termination charges determined by FAC models for the year 2006 for voice call and SMS are mentioned below for Mobilink and Telenor:

(a) Call Termination Charges

PKR/min.

Description	Mobilink	Telenor
Incoming call from PSTN	1.51	1.63
Incoming call from other mobile networks	1.55	1.53

(b) SMS Termination Charges

PKR/message

Description	Mobilink	Telenor
SMS termination charge	0.16	0.19

(ii) LRIC Model

Termination charges determined by LRIC models for period 2006-2010 for voice call and SMS are mentioned below for large, medium and small operators:

(a) Call Termination Charges

PKR/min.

Year	Large Operator	Medium Operator	Small Operator
2006	1.53	1.50	1.74
2007	1.14	1.08	1.17
2008	0.99	0.91	1.00
2009	0.91	0.80	0.89
2010	0.86	0.74	0.83

(b) SMS Termination Charges

PKR/message

Year	Large Operator	Medium Operator	Small Operator
2006	0.124	0.127	0.166
2007	0.094	0.091	0.107
2008	0.083	0.087	0.097
2009	0.079	0.078	0.085
2010	0.074	0.072	0.078

Results of Fixed-line Cost Models

(i) FAC Model

(a) Call Termination Charges

Call termination charges calculated through TD FAC model for year 2006 were as under:

PKR/min.

	Peak	Off-Peak	Average
Local	0.67	0.44	0.64
Single Tandem	0.86	0.58	0.83
Double Tandem	1.27	0.85	1.23

(ii) LRIC Model

(a) Call Termination Service

Element based average, peak and off-peak call termination service charges calculated for PTCL through BU LRIC model were as under:

PKR/min.

Average Rate	Local	Single Tandem	Double Tandem
2006	0.604	0.720	0.934
2007	0.619	0.738	0.957
2008	0.631	0.751	0.975
2009	0.643	0.765	0.993

PKR/min.

Peak Rate	Local	Single Tandem	Double Tandem
2006	0.628	0.745	0.968
2007	0.645	0.764	0.991
2008	0.657	0.778	1.009
2009	0.670	0.792	1.028

PKR/min.

Off-Peak Rate	Local	Single Tandem	Double Tandem
2006	0.419	0.497	0.645
2007	0.430	0.509	0.660
2008	0.438	0.518	0.673
2009	0.446	0.528	0.686

(b) Call Transit Service

PTCL element based call transit service charges determined by BU LRIC model for peak and off-peak hours were as under:

PKR/min.

Average Rate	Local	Single Tandem	Double Tandem
2006	0.116	0.288	0.502
2007	0.118	0.293	0.512
2008	0.120	0.297	0.521
2009	0.121	0.302	0.530

9. SUMMARY OF CONSULTATION PROCESS ON COST MODELLING

- On 14th December 2006, a consultation workshop was conducted separately for PTCL and all mobile operators where the consultants explained in detail the project scope; methodologies applied for determination of charges along with advantages and disadvantages of each; overview of FAC, LRIC and international benchmarking; further explanation of 'Data Request'; and issues for industry consultation including WACC, treatment of license/spectrum fee, common cost mark-ups, network externalities, access deficit etc. The stakeholders were requested to provide their comments and inputs on the proposed methodologies and issues by 29th December 2006.

- Mobilink, PTCL and Telenor submitted their responses on the costing methodologies on 28th December 2006, 29th December 2006 and 4th January 2007 respectively. Mobilink also submitted further comments on 10th January 2006.

- Para-wise reply of the Authority on all the issues highlighted by PTCL were given on 23rd February 2006. Mobilink and Telenor were also given responses on 26th February 2006.

- On 16th August 2007, PTCL submitted the results of its own Top-Down LRIC model along with broad methodologies used to calculate the charges. However, the Authority did not accept the model on the grounds that the Authority had been repeatedly requesting PTCL to share its cost model with the Authority, which was not provided by PTCL despite the fact that it had finalized the cost study with the assistance of international consultants. Further, the Authority was in the final stages of consultation process with the industry on the models developed by its own consultants based on operators' data and the review of PTCL model would unnecessary delay the process.

- Taking cognizance of the importance of transparency in regulatory decisions especially the determination of cost-based interconnection charges, the Authority issued cost models along with models documentation to the industry on 13th November 2007 and requested the operators to submit their comments on the models by 13th December 2007. The models were fairly transparent and flexible so as to allow operators to modify the models as they think appropriate.

- PTCL, Mobilink and Telenor were issued both Top-Down FAC models and Bottom-Up LRIC models. For remaining mobile operators, only LRIC models were issued, as enough data could not be presented to the Authority by these operators to build FAC model.

- In order to consult the industry on other related areas that are link with the determination of interconnect charges and to make the process fairly transparent, the Authority sought comments from all mobile and fixed-line operators on 17th December 2007 on issues including asymmetric fixed and mobile termination

charges, PTCL access deficit, symmetry among mobile termination rates, level of WACC, interconnection charges for SCO, SMS termination charges and other related issues. The deadline to provide comments was set at 14th January 2008.

- Written responses were received from the industry, which were varied in nature. These comments were shared with consultants and also reviewed by the Authority.

- Individual hearings on cost models were also conducted separately with PTCL and each mobile operator during end-January 2008. The objective was to hear the views of each operator, which it may not like to share with other operators due to confidentiality of matter and to submit any additional comments which it could not provide earlier. These hearings were chaired by Member (Finance) and Member (Technical), PTA.

- The Authority issued notice to all fixed-line and mobile operators to attend a hearing on 26th February 2008 on the issue of interconnection charges.

- All mobile operators combinedly wrote to the Authority on 6th February 2008 to postpone the hearing due on 26th February and to limit the hearing to only mobile operators. They also demanded responses from the Authority to their comments as well as the revised models for further review and discussions.

- On 13th February 2008, the Authority regretted to postpone the scheduled hearing and apprised the mobile operators that as the determination of mobile termination rate will not only affect the mobile operators but also the fixed-line operators (as they have to pay these charges to mobile operators), so their views are equally important in deciding the future interconnection charges.

- On 15th February 2008, the Authority issued responses to PTCL and all mobile operators on the comments submitted by them, both in writing as well as during individual hearings.

- A combined hearing was conducted by the Authority on 26th February 2008 where all fixed-line and mobile operators were invited. The revised results of fixed-line and mobile cost models were disclosed to the stakeholders and they were requested to give their views on any matter relating to the interconnection charges.

- The revised models were later issued to all the concerned operators on 28th February 2008 and they were asked to submit their comments by 12th March 2008.

- During this time, the Authority also critically reviewed the models and identified few areas that could be improved, after due consultation with the industry.

- Individual meetings with each mobile operator were conducted on 19th and 20th March 2008, whereas meeting with PTCL was arranged on 24th March 2008.

- During these meeting, the comments of operators as well as the Authority were discussed at length and the final approach to be used in the determination was also apprised to the stakeholders.

- A final hearing with all stakeholders was held on 30th April 2008. The results of revised cost models were disclosed to the industry along with all major changes that have been made in the models.

- The views of all parties were sought and they were apprised that the Authority would use a glide-path approach while finalizing the charges.

10. OPERATORS' COMMENTS ON FAC AND LRIC COST MODELS AND THE AUTHORITY'S VIEWPOINT

The Authority issued cost models to all concerned operators in November 2007 and February 2008 for their review and comments. Following are the operators' feedback and the Authority's viewpoint on the cost models, which were also communicated to the concerned operators:

(i) Mobilink's Comment: The mobile sector in Pakistan has seen phenomenal growth in the past three years and all the operators including Mobilink have deployed the most modern and latest network infrastructure including NGNs. This high growth is still continuing along with the rapidly changing technologies. We understand that application of LRIC is only practicable, where both the markets and technologies are somewhat predictable and the incumbent operator(s) use legacy networks with inherent inefficiencies, therefore use of certain LRIC tools (such as MEA) are imperative to use. This is not the case in Pakistan in case of cellular mobile sector. All the operators have new and efficiently planned similar networks with efficient organization structure in place. We therefore understand that any results based on LRIC method under the current circumstances will be misleading as such situations demand application of FAC on historical cost method only.

PTA's Viewpoint: It is not the purpose of this consultation to comment on the relative merits of LRIC and FAC, but the Authority note that in a rapidly changing market it is arguably more important to be forward-looking in costing since historic costs gets quickly out of date.

(ii) Mobilink's Comment: In general terms, the Ovum bottom-up model appears to be logically designed and is in line with standard LRIC Bottom-up models. Although most of the assumptions/variables are taken in the sheet "Dashboard", however, many of the assumptions and parameters are put in various worksheets, which are hard coded in certain cases having no reference in the document. This not only increases chance of error but also makes the model inflexible.

PTA's Viewpoint: While acknowledging the merits of the structural changes requested, the Authority is of the view that they are "ideal" or "nice to have" but not essential. However, we can make changes where these could be incorporated relatively easily into the model. We will also correct errors which have been highlighted by Mobilink.

(iii) Mobilink's Comment: The concept of Near-End and Far-End has not been understood and applied properly. Following comments are made in this regard

- Logically, change of handover is related only to long distance (Incoming and outgoing Off-net traffic) only having effect on leased circuit and MSC/GMSC cost.
- Near-End and Far-End options are mutually exclusive for long distance off-net traffic; however the model provides a selection in terms of %, which makes it a mix of Near & Far End.
- Changing from Far-End to Near End should have no effect on on-net traffic, whereas the service price for on-net calls also changes with the change in option in the model
- Apparently the model does not take into account the change in leased circuit and switching cost arising due to change of regime. The important point to note here is that increase/decrease in cost due to change of regime is dependent upon the net differential of incoming/outgoing off-net traffic; which factor has also not been taken into account in the model.

PTA's Viewpoint: The observations of Mobilink do not hold good as the Authority has recently concluded the consultation with the industry on near-end and far-end call handover regimes and has decided that far-end call handover regime will continue to be followed in Pakistan. Nevertheless, the Authority will adjust the routing factor table so that both incoming and outgoing off-net have separate routing factors for near-end and far-end handover.

(iv) Mobilink's Comment: The model uses a very large number of assumption/parameters, however, all of them are not fully mentioned in the document. Under the circumstances we are not able to replicate the exact results of the document as per model. We therefore request to kindly provide the full set of assumptions/parameters used by Ovum to arrive at the results.

The documents talks about use of certain assumption as for efficient operator. We wish to point out here is that the concept of efficient and inefficient operator is applicable only where the incumbent operators is using legacy networks as compared to new entrants. This is not the case in Pakistan, where the mobile sector has seen phenomenal growth within past three years and Mobilink grew even at much faster pace than the other operators within this period. As a result of this growth, Mobilink maintains the latest and most efficient network of all the operators. Thus any network parameters, Mobilink is using today are that of an efficient network.

Given that model uses Scorched Node approach, we understand that only such parameters/assumptions for any bottom up model should be used which are prevalent in the area for which such study is being conducted. Subject to our comment above about provision of assumptions used by Ovum, we wish to point out certain parameters, which are to be used to arrive at true results.

PTA's Viewpoint: The assumptions/parameters are all in the model and most of them are explained in the documentation. Others are self-explanatory. We do not see that there is a need for any further list of assumptions/parameters.

The concept of efficiency is a broader one than what Mobilink suggests here. Mobilink may have the latest equipment but it may not be deploying it or operating it fully efficiently. There are some instances e.g. installation costs as a % of purchase price, and the actual cell radii compared with operational norms that suggest Mobilink is not efficient by international norms.

(v) Mobilink's Comment:

- The model provides an option to use a factor between 0-30% as capitalized installation cost. This factor in Mobilink case is between **-** ﴾% of the purchase price.
- The actual average price of BTS in Mobilink case is much more as compared to the one used in the model.
- The call duration of 2.3 minutes used in the model is on the higher than the actual average call duration of Mobilink.
- The model has an option of changing the cell radius for 1800 spectrum, which in turns calculates the cell radiuses for 900 GSM using a factor of 1.33. It is pertinent to mention here that the average radius for BTS could vary significantly from area to area depending upon the terrain, population, possible height of towers etc. Therefore the best practice anywhere else cannot be applied without considering the local situation. We thus understand that the model must use the average cell radius (both for GSM 900 and 1800) for Pakistan as already provided to PTA and given below:

GSM 900 **Kms**

Area	**Minimum**	**Maximum**	**Average**
Urban	***﴾	***﴾	***﴾
Rural	***﴾	***﴾	***﴾

GSM 1800

Urban	***﴾	***﴾	***﴾
Rural	***﴾	***﴾	***﴾

- In our opinion the model uses too simple a formula (1.5 x SQRT(3) x (BTS radius)^2) to workout BTS coverage missing out some other factors like tower height, population concentration etc. Taking however, the same formula and the above cell radius, the coverage area needs to be revised and used as follows:

﴾Kept confidential.

GSM 900 **Sq. Kms**

Area	Minimum	Maximum	Average
Urban	***﴾	***﴾	***﴾
Rural	***﴾	***﴾	***﴾

GSM 1800

Urban	***﴾	***﴾	***﴾
Rural	***﴾	***﴾	***﴾

- The No. of TRXs in 900 case are dependent on the input for 1800, which makes it inflexible. Mobilink's network is designed on mixed spectrum of GSM 900 and 1800 with **﴾ TRXs per site, of which **﴾ TRX are for 1800 and **﴾ TRXs are for 900. However, in rural area case, where 1800 DCS is not practicable, all **﴾ TRXs are installed for 900 spectrum. The following table provides comparative data.

GSM 900

	Unit	Used in Model	Actual-Mobilink
Urban	TRXs	9	***﴾
Rural	TRXs	3	***﴾

GSM 1800

Urban	TRXs	12	***﴾
Rural	TRXs	3	***﴾

- The model has an option to select Grade of Service (GOS) between 1%-30%. In Mobilink's case all the network planning is done at **%﴾.
- The Erlangs per sub in Mobilink's network is ***﴾ Erlangs per sub.
- The document does not provide information about the number of subscribers/MSC, used for MSC dimensioning. We however, point out that in Mobilink's case the average number of subs per MSC stands at ***﴾.
- Mobilink uses at least one GMSc for additional resilience for interconnect traffic.
- In Model Documentation, it is stated that 'a BSC can control up to 1024 GSM TRXs'. However, the range in the model is between 500-900. It appears to be a typo in the document. Mobilink however, uses ***﴾ TRXs per BSC for its network planning and hence the same must be used.
- The Model Documentation is contradictory on the subject of the base case assumption on equipment utilization. It is explained that 'the utilization parameter for all network elements is 60% in 2006'. However, on another place it is stated that 'utilization of network elements is 65%'.
- The Answer/Seizer Ratios taken are generally close to that of Mobilink's network except the following, where these needs to be changed in accordance with the actual data:

- Outgoing calls to fixed **%
- On-net mobile calls **%
- Incoming calls from PSTN **%

PTA's Viewpoint: The Authority will review the assumptions mentioned in this section, and will make changes where it feels they are justified. In particular, we will adjust the assumed number of TRX per BSC. However, many of the items raised in this section appear to misunderstand the purpose of the model. The model is not intended to replicate the actual network design parameters used by Mobilink but to develop a generic model that reconciles reasonably well with the actual network of Mobilink (and other operators). Many of the items raised by Mobilink can be resolved by reference to the reconciliation of equipment numbers. For example, we cannot use the cell radii Mobilink suggests because that would push up the number of BTS implied by the model to well beyond their actual levels. As it is, we have used the Reconciliation worksheet to ensure that the number of key network assets (e.g. BTS and MSC and GMSC) is similar to that used by Mobilink. Please note, however, the model's implied asset numbers for a "Large Operator" will not be the same as the Mobilink actual numbers since the model is generic and has to reconcile reasonably with all the operators in the market as well as Mobilink.

(vi) Mobilink's Comment:

- The Mobilink's WACC rate is 21% and therefore should be used.
- The model takes depreciation for infrastructure only and ignores Non-network depreciation, which must be included as common cost.
- The model does not include Capital Wok in Progress for the working out ROI.
- The model has the option to choose the depreciation method from a choice of straight line, tilted straight line, annuity and tilted annuity. In the base case, the tilted annuity methodology is used. It is our opinion that that a tilted straight line methodology results in a better approximation to economic depreciation.

PTA's Viewpoint: In response to the first bullet, we are grateful to Mobilink for sharing its detailed analysis of the appropriate WACC. We will consider these workings in determining appropriate WACC for mobile operators in light of our consultants' advice.

In answer to the second bullet we agree that non-network CAPEX should be included as a common cost.

For the third bullet, we do acknowledge that Capital Work in Progress does exist in reality for almost every telecom service provider. However, we don't agree with Mobilink that return for Capital Work in Progress should be allowed as the LRIC model already takes into account all the network elements, that are needed to meet the total traffic demand, in operational condition.

In answer to the last bullet, we acknowledge that there are many ways of approximating economic depreciation, but an annuity is the standard approach in a BU model. This is because an annuity creates the same capital charge each year, so it does not matter in which calendar year each asset is purchased.

(vii) Mobilink's Comment:

- The model contains historical Opex data, where cost allocation is done to retail and common cost categories. We have following comments in this regard:

- A third category (in addition to common cost and retail) of direct network cost needs to introduced and all direct network related cost must be charged directly to network cost.
- All of bad debt provision has been allocated to retail, whereas major portion pertains to interconnect billing, thus chargeable to MTR.
- All of the billing has been charged to retail, whereas a part of the cost is related to interconnect billing, which should be charged to MTR.
- General repairs is a common cost not retail only.
- Rent, rates and taxes (others) should have been part of common cost but has been charged to network.

Following costs should be directly charged to network cost

- Rent Rates & Taxes – network. Whole of the amount pertains to network costs but only a part of it has been charged based on headcount.
- General Repairs Network.
- Insurance Network.
- Office Security Networks.
- Seminars, conferences and staff training (network staff related).
- Traveling and conveyance (network).
- Utilities (network).
- Vehicles (network related).
- License fee: software & GSM.

Following cost should be categorized as common instead of retail as it pertains to all the departments

- Insurance (others).
- Traveling and conveyance (others).
- Utilities (others).
- Office security (others).
- Salaries & Wages (others) include the following:
  - the portion that pertains to selling & marketing should be charged to Retail.
  - the portion that pertains to other departments should be charged to common cost.

PTA's Viewpoint: We are grateful to Mobilink for supplying this additional information regarding Opex, which will enable us to separate out network Opex costs where possible. The model will be amended accordingly.

(viii) Mobilink's Comment: The model contains an option for AJ&K license fee but totally ignores the one time spectrum fee of $ 291 M, which is payable in installments. This cost must be taken into account as chargeable to network cost.

PTA's Viewpoint: There is some consideration as to whether initial license fee should be considered in calculating mobile termination rates. Nevertheless, we will make an option in the model to amortise the one-off spectrum charge over the license period.

(ix) Mobilink's Comment: The model allocates common costs using an equi-proportionate mark-up (EPMU) rather than Ramsey-Boiteux pricing, and argues that this is because of uncertainty concerning the assumptions and the lack of industry consensus on Ramsey pricing. However, while it is true that Ramsey pricing is difficult to implement, it remains our view that it should be attempted, and that EPMU should only be used as a last resort because it leads to an arbitrary allocation of costs.

On the subject of non-attributable network costs being categorized as common costs in the bottom-up model, the impact of this is that when common costs are split into network and retail costs in order to calculate the common cost mark-up, some network costs are being allocated to retail. This is incorrect, and means that the common cost mark-up in the model is too low, and hence termination costs are understated.

PTA's Viewpoint: We do not plan to use Ramsey Pricing. This issue was discussed and rejected during the consultation on the Costing Methodology. In practice EPMU is used in all network cost models of which we are aware.

(x) Mobilink's Comment: The model has rightly provided an option for Network externalities. In our view in a country such as Pakistan where penetration levels are relatively low, the impact of network externalities should be accounted for by an externality surcharge. PTA may need to conduct a study to determine the exact rate to be applied.

PTA's Viewpoint: There are arguments both for and against externalities. However, we have observed that in most of the countries there is no such item in the mobile termination rate.

(xi) Mobilink's Comment: The following MTR results are given in the model documentation:

Year	**2006**	**2007**	**2008**	**2009**	**2010**
PTA MTR	2.37	1.69	1.42	1.31	1.23

Subject to our earlier observations, we submit that we will be able to make our comments on these results only when we receive complete set of parameters and assumptions used to arrive at these numbers. We therefore request you to kindly provide all the base case assumptions used to arrive at these results.

PTA's Viewpoint: The results referred to in the model documentation should not be referred to as the calculated results have been given in the respective models. Model

documentation is provided only to explain the methodologies used in the model to workout the cost of MTR.

(xii) Mobilink's Comment: The TD FAC model simply assumes that total WDV of FAR should increase year on year at a rate equal to that of opex. In the base case opex is assumed to grow at 41% from 2005 to 2006, and hence so does WDV of FAR. This is a purely arbitrary assumption that does not reflect the actual WDV as well as OPEX in 2006 We would also like to mention here that the actual growth rate from year 2005 to 2006 for subscriber base, the Capex and Opex stood at 102%, 62% and 50%% respectively.

PTA's Viewpoint: Our calculations were based on the data provided by Mobilink. This included the Fixed Asset Register (FAR) for 2005, but not for 2006, and figures for Capex and Opex (2005 and 2006). We estimated FAR 2006 based on the audited values for Capex and Opex. We took subscriber growth as the maximum growth for the FAR, since we would expect some economies of scale.

(xiii) Mobilink's Comment:

- The cost of MSC Buildings has been not allocated.
- The model takes depreciation for infrastructure only and ignores Non-network depreciation, which must be included as common cost.
- The model does not include Capital Wok in Progress for the working out ROI.

PTA's Viewpoint:

- MSC related costs were initially grouped as MSC/GMSC and then split into the two categories separately. So MSC Buildings have been allocated.

- All non-network assets were allocated to "non-network common costs" and then included in the mark-ups.

- We principally agree that return on Capital Work in Progress (along with Working Capital) should be allowed in TD FAC model. However, please note that the aggregate amount of Capital Work in Progress and Working Capital for Mobilink in year 2005 is negative and inclusion of the same in TD model will result in reduction of mobile termination rates.

(xiv) Telenor's Comment: While scrutinizing the model, we observed that unit investment costs does not reflect our actual costs and are significantly lower than the values that we obtained from our fixed assets records. We therefore request the Authority to re-ascertain unit investment costs for the network elements as provided in above referred Fixed Asset Register. To assign monetary values to the network elements so worked out (through LRIC model), respective unit costs need to be there. Unless unit costs are used which are similar or closer to that actually incurred by Telenor, the entire model would become irrelevant for Telenor in particular, and for telecom sector of Pakistan in general.

PTA's Viewpoint: The comment appears to misunderstand the purpose of the LRIC model. The model is not intended to replicate the actual network design parameters used by Telenor but to develop a generic model that reconciles reasonably well with the actual network of Telenor (and other operators). Telenor's actual costs were just one of the inputs considered alongside data from the other operators and benchmark data. It is not therefore surprising that the unit capex figures are different from Telenor actual data in this model. In contrast the Top-Down FAC model was designed to apply specifically to Telenor, so it was developed using Telenor's actual data.

(xv) Telenor's Comment: In LRIC model, Traffic in Busy Hour is fixed at 10%. However, an analysis of our traffic pattern reveals that this ratio is considerably greater than what has been used in the model. This is mainly due to the fact that our network faces huge traffic load of missed call attempts. These calls do not result in any revenue for the operators although the resource utilization is similar to normal successful calls (to maintain desired level of quality of service). In this regard we would inform you that our records indicate that the percentage of busy hour traffic is between 30% to 35%. Further, the traffic in busy hour largely depends on calling patterns, which vary significantly not only within various countries but also within operators operating in same country. In LRIC model however, network is designed taking into consideration not only revenue generating calls but also non-revenue generating (missed calls) traffic as well. Therefore, it is vital that this percentage is increased to the level of 30% in order to enable operators to recover their legitimate costs through MTR.

PTA's Viewpoint: The 10% busy hour traffic assumption is based on the data submitted to us by other mobile operators. Besides this, all bottom-up models that we have seen use the assumption of 10% busy hour traffic. Hence, it may not be possible for us to change it to the level proposed by Telenor, which is so far from national as well as international norms. Perhaps there is something peculiar about the Telenor network - for example, the 30% may apply to call attempts and these could be inflated in the busy hour because of congestion which arises because Telenor may not have sufficient capacity. If that is the case, using Telenor's assumption would reward inefficiency when compared with other operators and international norms.

(xvi) Telenor's Comment: Working capital is an integral part of a project's cost. However, PTA's model does not allow the working capital to be considered into the LRIC model. In this regard we would like to highlight the fact that inclusion of working capital do not raise any issue relating to "forward looking costs". We firmly believe that working capital uplift should be included into the model by at least 8%. While looking at the negative working capital of Telenor in balance sheet, PTA is mixing two concepts. The balance sheet is prepared based on actual costs incurred by the company. In LRIC modeling, however, forward looking costs are considered with a network design (excluding inefficiencies). On the other hand, a balance sheet is not prepared on the basis of 'forward looking costs'. Therefore, in LRIC modeling, the balance sheet working capital is not considered. Instead a sufficient margin is added into the 'modeled' costs, which is well in line with the financial modeling practices. Moreover, the negative working capital is considered under the FAC based costing, wherein all costs are taken

from financial statements, including working capital. We believe that selection of current parameters have resulted in a model which is neither FAC nor LRIC – instead a mix of both.

PTA's Viewpoint: We agree with Telenor that there should be a Working Capital allowance in the model, and there is space for such an input in the model. However, we have noted that it has been common for operators in Pakistan (including Telenor) to operate with negative working capital, and for this reason we decided to keep working capital at zero in the base case model.

(xvii) Telenor's Comment: We have noticed that certain inputs' linkages of the model need to be looked into for errors, as unexpected results are observed by changing certain values. For instance, reduction in "expected annual change in equipment price" is supposed to reduce the termination rates, whereas in the model the results demonstrate otherwise.

PTA's Viewpoint: We are grateful to Telenor for pointing out these errors; we have investigated these and will make appropriate corrections to the model.

(xviii) Telenor's Comment: The level of WACC used in the model is not reflective of actual cost of capital of operators, which we trust is 25%. Although in the revised model this value is increased from 18.9% to 19.0%, the value is still significantly below what should be taken into the model.

PTA's Viewpoint: We are grateful to Telenor for sharing its WACC. We will consider this in determining appropriate WACC for mobile operators in light of our consultants' advice.

(xix) Telenor's Comment: Spectrum Price, termed as initial license fee earlier, has not been included in the model. As opposed to PTA's assertion that this acted mostly as an entry barrier, our understanding stems from the Cellular Policy. Section 4.4 of the Policy states that "the Spectrum price for national mobile cellular licenses will be determined through auction". Based on this, the auction of 2004 resulted in determining spectrum pricing and not entry barrier. We therefore would request PTA to kindly include this in the model.

PTA's Viewpoint: There is some consideration as to whether initial license fee should be considered in calculating mobile termination rates. Nevertheless, we will make an option in the model to amortise the one-off spectrum charge over the license period.

(xx) Ufone's Comment: While reviewing the Bottom Up LRIC model, it is noted that it does not use the information that we sent to PTA. We therefore suggest that in order to get better realistic results from the model all information sent by Ufone should be used and only in those cases where no information is available benchmarking or appropriate assumptions be used. Further where the benchmarking has been used we have got certain

reservation about the relevance of the benchmarking with our business and would like to discuss it further with PTA or with consultant.

PTA's Viewpoint: Data provided by Ufone has been incorporated in the model. However, as only partial data was received from Ufone, our consultants necessarily had to supplement it with alternative proxy data. Perhaps there is also a misunderstanding on the part of Ufone regarding the purpose of the LRIC model. The LRIC model is not intended to replicate the actual network of Ufone or to use the same network design parameters used by Ufone but to develop a generic model that reconciles reasonably well with the actual network of Ufone (and other operators). Ufone 's actual costs were just one of the inputs considered alongside data from the other operators and benchmark data.

(xxi) Ufone's Comment: We think that 18.9% is quite low compared to the current market lending rates of 15% for AA credit rating companies. WACC Rate of 26.489% should be used for Ufone.

PTA's Viewpoint: We are grateful to Ufone for sharing its views on appropriate WACC. We will consider these in determining appropriate WACC for mobile operators in light of our consultants' advice.

(xxii) Ufone's Comment: The average rate of change in equipment prices is -5% which has a compounding impact on the future year costs. We think on yearly basis prices do not decline in this way. In addition, the model does not incorporate the high cost of purchasing new technological equipment.

PTA's Viewpoint: We acknowledge that equipment prices rarely fall in a linear manner. Nevertheless, this is an appropriate and common approach for the purpose of modelling and a figure of -5% is typically used for mobile network equipment and is fairly conservative.

(xxiii) Ufone's Comment: The Average Site Rental per month has been assumed in the final model at PKR 3,960/- per site in 2007 while the actual average rental per month for industry is PKR 25,000/- per site.

Secondly Site Rentals Cost is directly related to the Network so this should completely be taken in the Network Cost where as in the final model only the 42% of the site rentals is being allocated to Network Cost.

The annual increase in the rentals has been assumed at 7.9% per annum where as in reality according to our agreements and normal trend in Pakistan, the actual change vary from minimum 10% to maximum 15%.

PTA's Viewpoint: We agree to increase the annual site rentals from 7.9% to 10%. We are also of the view that site rentals should also be increased keeping in view the annual growth in cell sites.

(xxiv) Ufone's Comment: Transmission media, and subsequently its cost, between BTS and BSC has not been assumed in the final model where as in reality there is media and cost involved in linking BTS with BSC.

PTA's Viewpoint: The Authority concurs with Ufone's view that transmission media cost should be included in the model and we will modify the models accordingly.

(xxv) Warid's Comment: Data provided by Warid has not been incorporated. With reference to the usage of proxy data, we believe that massive use of proxy data has reduced the robustness of the model and may not be used to represent and reflect the costs of Warid.

PTA's Viewpoint: Data provided by Warid has been incorporated in the model. However, as only partial data was received from Warid, our consultants have necessarily had to supplement it with alternative proxy data. Perhaps there is also a misunderstanding as to the purpose of the model. The model is not intended to replicate the actual network of Warid or to use the same network design parameters used by Warid but to develop a generic model that reconciles reasonably well with the actual network of Warid (and other operators). Warid's actual data were just one of the inputs considered alongside data from the other operators and benchmark data.

(xxvi) Warid's Comment: The applied methodology appears for "small" operator as defined by Ovum whereas the results are for "medium" operator.

PTA's Viewpoint: A single model has been developed and then it has been calibrated separately for a small operator (12.5% market share) and a medium operator (25% market share). We have not sought to model Warid's network directly. Regarding the observation on inconsistencies between model and the documentation, necessary corrections will be made where deem necessary.

(xxvii) Warid's Comment: The market share and subscriber base are set as "static" and do not grow in later years. This assumption may not be true as the market is dynamic; as reported in the quarterly reports of BMI and by the Authority. We therefore recommend a dynamic analysis in this regard.

PTA's Viewpoint: Subscriber base is not static - the model assumes continued growth, albeit slowing down, throughout the forecast period.

(xxviii) Warid's Comment: The MTR may be calculated on the basis of per sec duration rather than per minute. This rounding factor may have an impact of 25% to 30% on the Model. As the time unit "per second" is also according to the current practice it is therefore recommended that MTR calculation may be based upon per second duration to give true value.

PTA's Viewpoint: The MTR has been presented in a per-minute rate, but it is not assumed that it will be billed per minute. MTR will continue to be billed on per-second basis as currently is the case.

(xxix) Warid's Comment: Number of subscribers do not support with the market static. The total subscribers shown in the actual scenario for years 2005 and 2006 the model reports the total subscribers as 21.6 M and 48.3 M respectively. However as per the PTA data, the total subscribers based in 2005 and 2006 was 12.7 million and 34.5 mn respectively. Further the numbers of subscribers and various other fields in write-up are not supported with the number assumed in the Model. It is therefore recommended to incorporate updated data in the model.

PTA's Viewpoint: The subscriber numbers reflect data given to us by the operators. In this case, as Warid did not provide data, we have used numbers supplied by other operators. Please also note that PTA figures mentioned by Warid indicate mobile subscriber at end-June of corresponding year whereas in the models it is based on end-December figures.

(xxx) Warid's Comment: In the excel sheet dashboard, data for Pakistan has been compared with the international average. We believe that at least the names of the countries may be mentioned.

PTA's Viewpoint: The international benchmarks are from other cost models for mobile networks, not all of which are public domain. However, they include China, Indonesia, Romania, Denmark, Sweden, UK, UAE, Jordan.

(xxxi) Warid's Comment: Has Ovum included the AJK region? This is because the provided data does not cover the AJK rejoin. If AJK has been included Warid's Spectrum efficiency in AJK is lower then that of Pakistan and may have a significant impact on the MTR.

PTA's Viewpoint: We will revise the model to allow the option of including AJK.

(xxxii) Warid's Comment: Incoming traffic from fixed line to Warid has not been incorporated. This is a significant traffic and may not be ignored. In this regard, OVUM has mentioned that the data from Warid did not match with the one provided by PTCL. So this traffic was ignored. We believe that this may have an adverse effect on the MTR. We believe and recommend that the traffic data may be justified by supporting documents that will be available on request.

PTA's Viewpoint: Incoming traffic from fixed to mobile has been included in the model. However, as there were discrepancies between the data by the mobile operators for calls from the fixed network and from PTCL for calls to the mobile networks, we had to reconcile these figures.

(xxxiii) Warid's Comment: The calculation to amortize the license fee may be discussed.

PTA's Viewpoint: There is some consideration as to whether initial license fee should be considered in calculation of mobile termination rates. Nevertheless, we will make an option in the model to amortize the one-off spectrum charge over the license period.

(xxxiv) Warid's Comment: Average inflation rate has been set as 7% in the model, whereas it is quoted as 7.9% in economic survey of Pakistan. This under estimation of inflation rate may have an adverse on the MRT. We therefore recommend using appreciated inflation rate.

PTA's Viewpoint: We will change the inflation figure as suggested by Warid.

(xxxv) Warid's Comment: Working capital in the model has been assumed to be zero. This appears to be a hypothetical scenario, however we believe some amount of working capital may be assumed in order to calculate the MTR.

PTA's Viewpoint: We agree that there should be a Working Capital allowance in the model, and there is space for such an input in the Dashboard worksheet. However, we have noted that it has been common for operators in Pakistan (including Warid) to operate with negative working capital, and for this reason we decided to keep working capital at zero in the base case model

(xxxvi) Warid's Comment: Beta Calculation is based on LDI operators and may be misleading therefore WACC values of 18.91% and 19.94 may not seem appropriate and satisfactory.

PTA's Viewpoint: The Authority requested Warid vide its data request dated 21st November 2006 to provide its estimated WACC along with supporting documents. However, no such information was provided by Warid, due to which the Authority has to consider other operators' data and the estimation of its consultants in determining appropriate WACC for mobile operators of Pakistan.

(xxxvii) Warid's Comment: Traffic assumption in the model may be revised. The numbers of minutes generated on the network have been set low. We therefore recommend that traffic volumes may be rationalized for a realistic MTR.

PTA's Viewpoint: We have based the traffic levels on data provided by the operators.

(xxxviii) Warid's Comment: Calculation of Voice to Erlang may be explained. The calculation is based upon annual traffic however we believe and recommend that this conversion may be calculated on daily traffic.

PTA's Viewpoint: The Erlang calculation is based on daily traffic, but this itself is derived from annual traffic numbers.

(xxxix) Warid's Comment: As the network capacity increases in the latter years the overall network utilization may decrease. We recommend that this may be incorporated in the model.

PTA's Viewpoint: It could equally be argued that network utilization will increase in the later years as the market becomes more stable, and operators do not need to build for significant expected increases in demand.

(xxxx) Warid's Comment: The average number of transceivers in the model has been assumed at 9 TRXs for 900 MHz. With respect to Warid, this may not be possible due to limitations on frequency bands. Further if AJK has been included. Warid's spectrum efficiency in AJK is lower than of Pakistan and may have a significant impact on the MTR.

PTA's Viewpoint: The assumption of 9 TRX for 900 MHz is true for most of the mobile operators in Pakistan.

(xxxxi) Warid's Comment: The minimum coverage radius for 900MHz transceiver is greater then that of 1800 MHz however the maximum coverage radius for 900 MHz is lower then of 1800 MHz. This may be explained.

PTA's Viewpoint: These are Ovum estimates; an alternative scenario using operator figures is also provided. However, what matters is not the minimum and maximum, but the average numbers used in the model. These have been chosen so as to reconcile the model's predicted number of BTS against the actual numbers in the operators' networks.

(xxxxii) Warid's Comment: It is assumed in the model documentation that BSCs are co-located with MSCs. However, it is also assumed that 28% links between BSC and MSC are through fibre whereas the remaining through microwave. This classification may be explained.

PTA's Viewpoint: The documentation will be amended accordingly. All MSCs are assumed to be co-located with BSCs, but not all BSCs are co-located with MSCs.

(xxxxiii) Warid's Comment: Clarity required on utilization from microwave to fibre optic. It has been assumed that there is not any fibre for BTS to BTS and BTS to BSC connectivity. However for BTS to BSC connectivity a combination of MW and fibre optic is used. We therefore recommend revisiting the assumption.

PTA's Viewpoint: Our assumption is that the BTS and BSC are connected via the radio network, whereas some fibre is used between BSC and MSC.

(xxxxiv) ***Warid's Comment:*** Utilization of VSAT has not been incorporated. This utilization can be lower but may not be ignored.

PTA's Viewpoint: We do not consider VSAT in the model. This will not affect the MTR cost.

(xxxxv) ***Warid's Comment:*** Software costs for different nodes as well as RTU and RTC cost is a significant cost borne by the operator however, this has not been included in the model. We therefore recommend that software costs for different nodes as well as RTU and RTC license costs need to be incorporated.

PTA's Viewpoint: Software is incorporated in the equipment prices.

(xxxxvi) ***Warid's Comment:*** We believe that the pricing may be based on the budgeted price and the discounts may be excluded. Further, we recommended incorporating the duties, freight, insurance, etc in the prices.

PTA's Viewpoint: Prices are assumed to include all fees paid to the vendor. Capitalized installation fees related to the equipment are added separately.

(xxxxvii) ***Warid's Comment:*** In the pricing model, Transmission nodes are missing. We therefore recommend incorporating the transmission nodes in the model.

PTA's Viewpoint: Transmission costs have been estimates in two parts: per km and per E1 capacity. The cost per node is sub-sumed in these categories.

(xxxxviii) ***Instaphone's Comment:*** The Ovum model is based upon an efficient network design, under a scorched node approach. We understand that this model does not apply on us. The model should take into account, setting-up a new network, of which the cost is higher then those, which are already in operation. Secondly, the cost assumptions should also, include the option of replacement basis.

PTA's Viewpoint: The scorched node approach is relevant for all operators, new or established, since it seeks to cost a new network built efficiently to meet the actual subscriber and traffic demand.

(xxxxix) ***Instaphone's Comment:*** The Ovum model, illustrate the effect, on unit costs of call termination, of using DCS1800 and GSM900 technologies. We suggest that model should also illustrate the impact *(on MTR)* of using other technologies, such as – GSM850 band, W-CDMA, 3G (Broadband Multimedia), etc

PTA's Viewpoint: The models have been built with GSM technology in mind. The Authority understands that slightly different costs may be expected with other technologies, but considers that GSM represents a suitable modern equivalent asset base.

(xxxxx) Instaphone's Comment: The Ovum model should also take foreign exchange rate risk into account.

PTA's Viewpoint: Exchange rate risks are a feature of any business. This has been taken into account in setting the WACC, based on the specific risks involved in investing in Pakistan.

(xxxxxi) Instaphone's Comment: The model converts the billed minutes into network minutes through voice uplift from PSTN. However, we understand that, from year 2005 and onwards, voice uplift regime has been discontinued.

PTA's Viewpoint: It is a standard modelling approach to convert billed conversation minutes into network minutes to account for the extra costs of unsuccessful calls, call set-up and holding times.

(xxxxxii) Instaphone's Comment: Broadband, data and multimedia services, need to be accounted for, in the network element usage analysis.

PTA's Viewpoint: All the major services are included within the models. It should be noted that if additional services were to be added into the model, these would add both costs and traffic, so there would not be any significant change to the overall model results.

(xxxxxiii) Instaphone's Comment: The Ovum model use certain averaging of maximum / minimum number of BTS required for the network coverage (i.e. 2,762 in 2006 and onwards). The Pakcom W-CDMA business model, is based on 3,500 BTS in 2nd year for effective coverage. Although, the model does not illustrate MTR for W-CDMA technology, we have assumed "3,500 BTS network" for the given model.

PTA's Viewpoint: The network design parameters have been chosen to reconcile as best we can with the data given to us by the operators.

(xxxxxiv) Instaphone's Comment: Ovum model assume 50% - 50% ratio of built / leased infrastructure *(i.e. Fiber)*. However, in practice, 80% of transmission links are generally on lease basis. We suggest that the related assumption be changed accordingly.

PTA's Viewpoint: The split between lease and build will vary by operator, owing to different commercial choices. A 50/50 split is typical.

(xxxxxv) Instaphone's Comment: As stated above, the network asset values in the model are not in line with values given in the model documentation. We have made appropriate changes in excel model, to match the numbers in both the excel spreadsheet and the word document.

PTA's Viewpoint: We have checked the asset values and will correct the documentation where necessary.

(xxxxxvi) Instaphone's Comment: The Ovum model, assumes installation costs at 10%, which is relatively low, keeping in view the prevailing site acquisitions, civil, engineering and other costs. We suggest this percentage, to be changed, to at-least 15% of asset value.

PTA's Viewpoint: The base case assumption of 10% installation cost is based on other operators' data and international benchmarks.

(xxxxxvii) Instaphone's Comment: The Ovum model, assume 20 years useful life for "built fiber link". We suggest that this should be comparable with average useful life of related technology, such as - 10 years (i.e. useful life of BTS, BSC, MSC and other major assets) or maximum 15 years (i.e. life of the license). In our experience, electronics are frequently changed to upgrade service availability in a periodic fashion (2 – 3 years).

PTA's Viewpoint: The 20-year life for cable infrastructure is a standard value based on international benchmarks.

(xxxxxviii) Instaphone's Comment: The 15% assumption, in Ovum model, for operational expenditure, is relatively low. Generally, 10% - 15% Opex is captured only by network vendor's support. We suggest this percentage, to be changed, to 20% to adequately cover, all operational costs.

PTA's Viewpoint: The base case assumption of 15% operational expenditure is based on other operators' data and international benchmarks.

(xxxxxix) Instaphone's Comment: The Ovum model use "Tilted Annuity Method" for capital charge *(i.e. depreciation)*. We suggest using "Tilted Straight-line Method" as it result in a steeper depreciation profile, when prices are falling. To some extent, this method also reflects the pattern of economic benefit.

PTA's Viewpoint: We acknowledge that there are many ways of approximating economic depreciation, but an annuity is the standard approach in a BU model. This is because an annuity creates the same capital charge each year, so it does not matter in which calendar year each asset is purchased (something that is not calculated within a bottom-up model).

(xxxxxx) Instaphone's Comment: The conditions in Ovum model, requires that MTR must not include, any subsidization of service provider's costs *(by the payments from service seeker)* and vice versa any subsidization by the service provider to the service seeker.

We suggest that model should at least take into the account major subsidization by service providers (at the time of service launch). W-CDMA service launch (Year-2008) accompanied with provision of free hand-sets to the subscribers can cost the service provide at least $50 million, justifying this cost to be accounted for in MTR computation.

PTA's Viewpoint: There are arguments both for and against externalities. However, in most of the countries there is no such item in the mobile termination rate.

(xxxxxxi) Instaphone's Comment: The license cost is most the critical cost, which unless the operator incur, call termination will not be possible. It should definitely be the part of MTR.

The payment terms (i.e. 50% payment in 2004 and 5% p.a. from 2009 onwards), as given in the Ovum model, are not inline with the license terms of all operator. We suggest that in MTR model, the Straight line basis be followed, to account for the license cost.

PTA's Viewpoint: Regarding License Fees there is some consideration as to whether initial license fee should be considered in calculating mobile termination rates. Nevertheless, we will make an option in the model to amortize the one-off spectrum charge over the license period.

(xxxxxxii) Instaphone's Comment: The model, although discuss the WACC assumption in detail, however, the "risk free return rate" and "WACC computation", is not given.

The "0.97 beta", appear to be relatively low, for cellular mobile companies. "Country risk premium" is also very low, in view the prevailing law & order situation.

On overall, gross WACC should be in the range of 23% - 25% (yielding a fair return on "capital investment), on the basis of revised numbers for "country risk premium", "risk free return" and "beta".

PTA's Viewpoint: We are grateful to Instaphone for sharing its views of the appropriate WACC. We will consider these workings in determining appropriate WACC in light of our consultants' advice.

(xxxxxxiii) PTCL's Comment: The most realistic volumes to be used in the models would be the most recent available information. Our perspective is that the average of the past six months of PTCL network operation would be the most adequate traffic volume. Traffic volume from 2005-2006 varies considerably from 2006-2007, not to mention the first months of 2007-2008. In this sense, the traffic volume utilized in the models provided by PTA is not the most adequate volume to determine PTCL's unit costs.

Although PTCL was requested to provide "granular volume forecast data" to Ovum, the forecasts requested were technical in nature. Specifically, PTCL was asked to provide forecasts "such that which may be used for PSTN capacity planning purposes." For technical capacity planning purposes, PTCL exhibits a state of maturity such that the previous year's data is what is used by our technical departments for capacity planning purposes. The data that PTCL provided was, in fact, the same as was used by our technical staff for PSTN capacity planning purposes, which are as indicated above, not the best data to calculate unit costs.

While one may claim that PTCL's commercial decisions contributed to the declining volumes seen on its network, there is no concrete evidence to support this claim. No matter what commercial decisions are made, there is always uncertainty around how the market would have reacted to alternative decisions. No one can ever truly say that any particular set of commercial decisions caused a particular change in network traffic. Statistics teaches us that correlation does not equal causation. This is especially true in a market as turbulent as the Pakistani telecom market. The sector has shifted in just a few short years from nearly 100% of telecom subscribers being on the PTCL network (3 million/3 million in 2000) to only 6% of subscribers being on the PTCL network (4.5 million/75 million in 2007). Such huge shifts within the customer distributions on interconnected networks make it especially difficult to blame any specific set of commercial decisions for reductions in network traffic volumes.

The most realistic forward-looking figures to use for regulatory costing are the most recent average monthly traffic volumes.

PTA's Viewpoint: We thank PTCL for supplying latest traffic volume information, which show a declining trend. However, it should be noted that the base year for modelling was 2005/06, for which year PTCL previously provided data. Moreover, we believe that due to recent launch of tariff packages by PTCL, the traffic figures are likely to be improved. Nevertheless, we do forecast traffic in subsequent years in BU model and our assumption is no annual change in the call volumes per subscriber, which is fairly conservative.

(xxxxxxiv) PTCL's Comment: At present, "Calls-to-mobile" are also not adequate. Some calls originating from PTCL's network and terminating on mobile operators'

networks are currently categorized as "Local" or "NWD" calls. A minor adjustment is needed in the model calculation to address this issue.

PTA's Viewpoint: We will consider the proposed modification by PTCL in the models.

(xxxxxxv) PTCL's Comment: The Minutes per Call Unit (MCU), or per each local call pulse, is also not adequate. The current version of the model translates local call units to local call minutes by assuming the maximum possible minutes per call unit, i.e., 5 minutes/ pulse during peak hours and 10 minutes/ pulse during off peak. PTCL's traffic monitoring shows that on average, a call unit (pulse) represents 2.50 minutes.

PTA's Viewpoint: We have noted your suggestion and will also refer to the traffic sample provided by PTCL to determine the appropriate level of minutes per unit for local call in an appropriate manner.

(xxxxxxvi) PTCL's Comment: Working capital of Rs. 40.4 billion should be included in the Capital Employed. PTA's Accounting Separation Costing Methodology document defines Capital Employed as the combined total of Fixed Assets and Working Capital. PTCL's working capital was not included in the top-down model calculations. PTCL's perspective is that the easiest estimate of its working capital in the next few years is its current working capital. As per PTCL's June 2007 annual report, PTCL has Rs. 40.4 billion in working capital.

PTA's Viewpoint: We agree with PTCL that there should be a Working Capital allowance in the model and will make necessary modifications in the model accordingly.

(xxxxxxvii) PTCL's Comment: Revaluated Land and Building asset values of Rs. 115.4 billion and Rs. 33.2 billion respectively, should be used instead of the current book values applied in the models provided by PTA. PTCL undertook asset revaluations in 2006 and submitted revaluated asset values, and details of the revaluation process, to the PTA in its August 2007 LRIC model submission. It should be noted that when the Government of Pakistan privatized PTCL, asset revaluations were used to determine the economic value that investors would be paying for (not book values from PTCL's FAR). Those same investors are currently facing an economic opportunity cost as a result of their ownership of PTCL's assets. These revaluations offer the best estimate of the actual economic value of PTCL's assets, and thus lead to the most accurate view of the economic opportunity cost of such assets. For more detail, please refer to PTCL's August 2007 LRIC model submission.

PTA's Viewpoint: The TD model was based on HCA-FAC accounting methods. This means that assets are included as they were valued in the 2005-06 accounts using historic cost conventions, and not based on any current cost revaluations. It is, therefore, not appropriate to make such changes to an HCA-FAC model. Besides the foregoing, it is also noted that PTCL has not yet taken the effect of proposed revaluation of its Land & Buildings in its financial statements for the year 2006-07.

(xxxxxxviii) PTCL's Comment: PTCL has proposed a pre-tax nominal WACC figure of 32.71%. PTCL sought the services of a reputed international telecom consultancy to calculate the appropriate WACC for its investments in the current Pakistani market context. A rigorous study of each WACC component led to the proposed WACC figure PTCL provided in its August 2007 LRIC model submission.

PTA's viewpoint: We are grateful to PTCL for sharing its detailed analysis of the appropriate WACC for PTCL. We will consider these workings in determining appropriate WACC for PTCL in light of our consultants' advice.

(xxxxxxix) PTCL's Comment: Only three network elements has been defined i.e. Remote Switch, Local Exchange and Tandem Exchange in the model. This is over simplification of telecom infrastructure.

PTA's viewpoint: It is true that the model employs relatively simple network architecture with only three main network elements: remote switch, local exchange and tandem exchange. However, this is relatively standard for models of this type.

(xxxxxxx) PTCL's Comment: Cost of non technical assets Land, buildings and Furniture & Fixture has been allocated arbitrarily to Access, Core as 58% & 41%, without considering their use. Particularly allocation of 60% cost of Operational Switching Center to access is not correct. PTCL's own study shows that 38% of cost of Land, buildings and Furniture & Fixture is allocable to Access, 58% to Core and remaining to Retail and other.

PTA's viewpoint: The allocation keys for Operational Switching Centres will be changed as PTCL suggests.

(xxxxxxxi) PTCL's Comment: Foreign operators cost has been charged to retails/other which is not correct allocation. Substantial number of calls (1054 million minutes) originate and terminate from/on the network of interconnect operators. Thus this cost should be properly allocated.

PTA's viewpoint: These are mainly payments for the conveyance of international traffic which is not costed through the models. Hence, these can be treated as 'parked' owing to their irrelevance with the domestic interconnection charges.

(xxxxxxxii) PTCL's Comment: All the cost of Rent, Rates and Taxes has been allocated to Retail/others, whereas following costs should have been allocated to core network:

i. NTC - Rs 1,024,277,000 (These are charges paid to NTC for rent of M/W links).

ii. Spectrum Charges for DRS links. - Rs 6,301,055

PTA's viewpoint: Costs of NTC and spectrum charges will be reallocated to Core network.

(xxxxxxxiii) PTCL's Comment: Total expenses on Repair and Maintenance have been allocated to Building Maintenance. Actually share of building is only Rs 209,578,789 while share of Line & Wire is Rs 184,530,608 and Apparatus & Plant is Rs 684,097,279.

PTA's viewpoint: These costs will be re-allocated using the splits proposed by PTCL.

(xxxxxxxiv) PTCL's Comment: Expenses relating to Printing and stationary have been allocated to Retail/others. These expenses should have been allocated on the bases of staff head count as stationary is consumed by staff members.

PTA's viewpoint: We do not agree that these costs are proportionate to staffing. Most printing and stationery concerns retail functions (e.g. billing, marketing).

(xxxxxxxv) PTCL's Comment: Staff Cost has been allocated on the basis of function performed by Geographical Region. A better allocation basis may have been if cost be allocated on the basis of staff designation type.

Cost of operational Regions has been arbitrarily allocated as 60% to Access, 30% to Core and remaining to non-network and others.

100% Cost of Regions like OFSN IBA, OFSN Kr and OFS Islamabad is allocated to non-network whereas 100% cost of these Regions should have been charged to Core Network as these Regions operate and maintain optical fiber backbone.

PTA's viewpoint: We will retain the basic allocation approach by Geographic Region since PTCL has neither proposed sufficient reason nor sufficient detail to make an alternative allocation. However, the costs of OFS regions can be re-allocated to Core Network as requested.

(xxxxxxxvi) PTCL's Comment: In "Guidelines on Costing Methodologies for Accounting Separations" issued by PTA definition of Capital Employed is given as:

Capital Employed = Fixed Assets + Working Capital

But working capital has been ignored while calculating Mean Capital Employed (MCE).

PTA's viewpoint: We agree that working capital allowance should be given in the models.

11. OPERATORS' COMMENTS ON BROAD CONSULTATION ISSUES RELATING TO COST-BASED INTERCONNECTION CHARGES

On 17th December 2007, the Authority sought comments from all fixed-line and mobile operators on broad issues relevant to the interconnection charges. Following are the issues and the operators' comments on the same:

Issue #1

Whether in your opinion, call termination rates for fixed and mobile networks be made symmetrical?

PTCL's Comment: Yes. In Pakistan, fixed line telephony has not been able to mature to the level where customers view it as a distinct product. Lower fixed termination and high mobile termination rates have created a huge interconnection deficit and LLO's are at an investment-return-disadvantage vis-a-vis mobile operators. This virtually ensures that fixed-line infrastructure will never mature to the point where the country is fully enjoying the potential benefits of fixed infrastructure. While teledensity of mobile has reached more than 40%, teledensity of fixed line is stagnant at 3.21%.

Fixed infrastructure supports prolific broadband access, provides a dependable back-bone for data transmission, unrivalled voice quality, etc. Eliminating interconnection asymmetry is one step towards strengthening fixed infrastructure and enabling Pakistan's nascent IT revolution.

Traffic volume plays a very significant role in profitability of telecom operator. Higher mobile termination rate discourage customers of fixed line operator to call to mobile number thus reducing the profitability of fixed line operator.

Warid's Comment: Due to distinct nature of fixed line and cellular mobile networks, the CAPEX and OPEX requirements are most likely to differ. Therefore it will not be possible to have symmetric termination rates.

Mobilink's Comment: Under cost based system, the fixed line interconnect cost is always different (lower) than mobile sector because of distinct network architecture and cost of operation of fixed and mobile networks as rightly pointed out by the Authority. One of the major factors for this cost differentiation is that in fixed-line case, access network cost is not taken into consideration while working out cost of interconnection. Its cost is already being recovered through line rental. In mobile case however, no such access network exists and whole of the network is taken as core network. Thus, it is not possible to have symmetric rate between fixed and mobile.

Telenor's Comment: Under cost-based system, the fixed-line interconnect cost is mostly lower than the mobile sector. The main reason is that in case of the former, only core network cost is taken into consideration for the purpose of working out cost of interconnection. The cost of access network is not included as the operator is already

recovering the said cost through line rentals. In the case of cellular mobile operators however, such an access network does not exist and whole of the network is taken as core network. It is therefore, not possible to have symmetric rates for fixed and mobile termination, given that the costing exercise is done properly by following best international practices.

Ufone's Comment: Interconnect regime of symmetric and asymmetric rates may be reviewed and decided through the current costing exercise going on for fixed and mobile operators, as the cost based interconnect rates are the best tool to determine the symmetric and asymmetric nature of termination rates.

Paktel's Comment: The rates between mobile and fixed operators should be asymmetric. This is based on the fact that cost for terminating a mobile call is high then cost for terminating fixed line call. Moreover fixed line operators are also given access deficit in shape of Access Promotion Contribution which mobile operators are not given. Similarly the cost for the last mile for fixed-line operators is compensated by line rent as well. The incumbent operator has been enjoying APC, installation charges, line rent and waiver to pay USF since long and any such request at this stage is not justified.

NTC's Comment: Equal termination rates on symmetrical basis should be allowed due to the economics of the market factor. For example local termination rates are Rs. 0.52/min. for the fixed operator and Rs. 1.25/min. for the mobile operator, which is quite on the higher side in the metro area, and comprises major part of the settlement claim between the fixed and mobile operators. The profitability margins are not fair enough between fixed and mobile network architectures due to their large consumer base by offering incentives/ packages because of practicable and simple in nature, and distinct foreign investments.

Another aspect is the traffic Inward/ Outward ratio comparison which is 14% for Incoming minutes and 86% for outgoing minutes terminated on and by NTC respectively (FY 06-07) and the disparity of rate has also made the Incoming/ Outgoing traffic also imbalance for corporate revenues and high carrying costs of NTC operational infrastructures due to our limited subscriber base.

Telecard's Comment: While commenting on various aspects of MTR, in its July 2005 determination, the Authority observed that the previous determinations in this regard were aimed to provide relief to mobile operators and due to this the financial performance of the mobile operators has considerably improved. The Authority, as per its calculation, had proposed an MTR of Rs. 0.92 per minute but giving relief to the new mobile operators and due to change in the charging mechanism, suggested a rate of Rs. 1.10 per minute. However, in its order, agreed to mobile operator's demand of a higher CPP rate.

It is worth noting that since the determination of 2005, the mobile subscribers have crossed the 70 million mark and are growing at an exponential rate. On the other hand, the retail mobile rates have also come down considerably.

The rate of inflation in the last two years has been hovering around 8-10% p.a. The downward trend in retail rates of mobile operators, in spite of inflationary trends, suggests that the mobile operators may have attained a higher technical efficiency coupled with a corresponding productive efficiency. This might have enabled them to bring down their cost per minute for a call transported between their own networks therefore a reduction in retail rates. Pertinent to mention is that the retail on-net tariffs of mobile operators are similar to the retail rates of PTCL for an on-net call and in some instances lower than PTCL.

The concept of higher fixed to mobile termination rates envisages a situation whereby the mobile operators subsidize its subscription service (subscription subsidies). However in case of Pakistan, the mobile operators are using the high MTR to earn more revenues. Whereas PTA did not agree with the "Externality Charges" proposed by Mobilink in its July 2005 determination, the current MTR inadvertently incorporates the charge. The high MTR as compared to a lower termination charge on fixed line operator can be characterized as a tax on fixed-line customers to enhance mobile operator's revenue.

The fixed line operators are the net payers because of the asymmetric charge in spite of the fact that mobile operators have grown tremendously. The fixed line operators, including PTCL, are unable to exercise countervailing power needed to constrain charges to competitive levels.

We believe that the PTA should conduct a scientific survey to ascertain how much a fixed line caller is willing to pay for a mobile destined call. We believe that with the high MTR, the fixed-line customers are heavily burdened and will either reduce the number of mobile calls or will churn out.

Therefore, in our opinion, the call termination rates for fixed and mobile networks be made symmetrical by bringing down MTR to the level of fixed-line termination. This will introduce a level playing field and increase the teledensity of fixed-line operators.

SCO's Comment: Per line cost of PSTN is much more then GSM, therefore the termination rates on PSTN network should be more than the call termination rate on mobile network. If this is not agreed then at least call termination charges should be made symmetrical for fixed and mobile networks.

Issue # 2

If there is an access deficit to PTCL, is there any need to fund this deficit by the Authority? If yes, how such deficit should be funded?

PTCL's Comment: Yes. International benchmarks suggest an access cost of more than 600 rupees per month. PTCL's top-down LRIC cost model shows a similar figure. Monthly access revenue is only 174 rupees. Given the "social" obligations imposed on post-privatization PTCL such as promoting IT industry, providing the basic telephony at

affordable rates, this access deficit should be compensated. There are two options to recover the access deficit:

a. Through increase the line rent: In present market scenario zero line rent prepaid mobile with very cheap calling packages, offers an attractive option to customers, receiving calls for certain period even in case of no balance. This has led to the migration from fixed to mobile and any increase in the line rent will accentuate the trend. Increase in line rent will increase the number of customers to disconnect the service affecting company's business viability adversely and will make the fixed line telephone un- affordable to large section of society thus defeating the policy objectives of ensuring access for poorer segments of the society.

b. Through access deficit surcharge: The access deficit could be funded with an Access Deficit Surcharge, applied on all interconnection minutes originating/terminating to fixed network. It could be funded with a higher Access Promotion Contribution, applied on all international incoming minutes terminating to fixed network. It could be funded with a mandatory contribution from the gross revenues of all licensed telecom operators (fixed percentage). A combination of the three aforementioned options could also be used. However, if the Authority has any other option in mind to fund the access deficit PTCL is ready to discuss the same.

Warid's Comment: We believe such funding may not be encouraged/ allowed. The anti competitive pressures like continuous tariff reduction and below cost selling/ predatory pricing can be controlled by introducing floor pricing. Mechanism for such floor pricing can be cost based. Such cost based floor prices are likely to provide sustainability to the sector.

Mobilink's Comment: Access deficit is a fading concept because of its complexities and decreasing role of fixed line sector in providing access to basic voice telephony to all the citizens and areas. The market dynamics have changed very significantly with the phenomenal growth of cellular mobile phone being cheaper and having quick and large outreach. The social obligations (of fixed line operator) of providing access, if any, are being fulfilled by the cellular mobile sector very well.

We need to also determine whether there really exits any access deficit and if so, what are the reasons for the same? One can argue that in PTCL case, reason for the access deficit (if it really exists) could be because of its operating inefficiencies. PTCL for example is one of the operators having lowest number of lines per employee in the world until recently.

Furthermore in the deregulated environment, the incumbent operator must try to rationalize its tariffs for all its services including access and optimize on costs than asking other operators to pay for its high operating cost. The access deficit if allowed will add up to the cost of other operators terminating traffic onto PTCL hampering the competition badly particularly the smaller operators.

There are numerous other problems associated with the concept of the access deficit as a means of achieving universal access and with the implementation of the ADC itself.

Firstly, the access deficit is an ineffective means of increasing telephone penetration and achieving universal access. Evidence shows that consumers are extremely demand insensitive to the price of telephone access. As with all cross-subsidies, ADCs also distort the prices faced by consumers not only for access services but also for those services priced higher than their true costs in order to fund the access deficit.

Further problems arise in relation to the information and agency problems associated with the design and implementation of the ADC scheme. The information requirements needed to operate an ADC scheme are very high. Detailed estimates of the access deficit are required as well as estimates of the incumbent's and new entrants' interconnection usage to arrive at a per minute or per trunk mark-up. These are difficult tasks to perform and are likely to be subject to significant disputation both by the incumbent and by new entrants.

Because of these problems many countries around the world are abandoning ADC schemes as a means of achieving universal access or universal service. These include the UK, Australia and various countries in the EU.

We therefore strongly oppose the proposal for allowing PTCL to implement access deficit charge.

Telenor's Comment: APC was an interim arrangement intended to support the incumbent operator – i.e. PTCL. Considering that the telecom sector in Pakistan is now relatively mature with very effective competition, inclusion of such markups in termination rates would be against the spirit of fair competition and will distort the level playing field. We recommend that PTA should let market forces determine a mechanism to account for such a deficit – e.g. by removing price ceiling on line rentals.

Ufone's Comment: Although, access deficit is not very popular concept around the globe because of its complexities and long term impacts but it do exists in some of countries. Because of its complexities, it is really hard to determine whether access deficit really exists in actual or not.

For this issue, Ufone would like to suggest to the Authority that a detailed study may be conducted for Access Deficit and as, costing of termination rates is under process, the existence, size and method of charging of Access Deficit may be determined through costing of Fixed Networks.

Paktel's Comment: The main essence of access deficit is to provide access to un-served areas where it is not viable for a fixed line operator to provide access and to compensate the cost of last mile. If we look at the past, APC had been extremely high in the range of 3.5 cents per minute which due to market dynamics have declined to 2.5 cents per minute. The decline started with the introduction of deregulation and competition in the

market. All the operators are contributing to the universal service fund which is mainly used to provide services in un served areas. Moreover, even fixed line operators are now operating WLL to provide access to its customers. Moreover, six mobile operators are in the market which is providing access to voice as well as data services in urban as well as rural areas. Payment of access deficit to any fixed line operator is therefore not justified.

NTC's Comment: Origination/ Termination charges should be standardized on one rate between the fixed and mobile operators to overcome the access deficit of the fixed-line operators.

Primarily NTC is equally affected by such Tariff regime (in present price race) due to our scattered network for our subscribers. NTC has made huge investments on developing infrastructure of Copper/ Fiber, Right-off-ways (ROW), and NTC's per Line cost is Rs. 30,000/- approx. NTC recommends the proportionate increase in APC share to compensate its access deficit by the Authority.

Telecard's Comment: Paramount to the discussion is whether currently there is any competition in the area of access infrastructure. PTCL is still a monopoly in the copper based access infrastructure with 100% market share and has the largest wireless local loop infrastructure with nearly 60% of the WLL market. PTCL also has plans to launch its IPTv and its WiMax services. PTCL just celebrated its six months of successful launching of broadband services and is the major internet and data service provider in the country. In absence of Local Loop Unbundling (LLU), PTCL will remain a dominant force in the access network.

We certainly don't agree to the argument that APC for LL was purportedly contributing towards the access deficit. As per the deregulation policy clause 4.3.3 (d) and AP Regulations 2005 clause 14 (1), the main purpose of APC was to encourage the LL operators to foster new infrastructure development and increase tele-density. Its aim was not to create a revenue stream that will contribute towards any losses or deficit of the LL licensee. We also haven't seen any GOP policy or regulation that sets the price of residential phone service of PTCL below the costs. PTCL has been exempted from paying Universal Service Obligation Contribution (USO), until end 2008 if it meets its obligation to install exchanges and lines (no fewer than 83,000 lines per annum) in rural/ under served areas. This exemption alone will save PTCL an amount in excess of Rs. 5.5 billion up to 2008.

The fixed line tariff regulation has defined the local loop basket services. It includes the Installation charges, Line rental service, Local call services and other mandatory services. The provisioning of lower than the cost PTCL line rent charges, connection fee, local call charges along with subsidized WLL handset charges and no line rent on its WLL service is a calculated step taken by PTCL management to acquire new customers and to reduce customer churn. Therefore any deficit, if any, due to this is an opportunity cost of acquisition and retention.

In order for the PTA to conclude whether PTCL has access deficit, PTCL needs to prepare accounts for its network, retail and access businesses. This will help in transparency and eliminate any doubts. The Authority has also to decide whether PTCL has to rationalize its tariffs for the local loop basket service before subsidization by the Authority.

In our opinion the Access deficit should be funded from the Universal Service Contribution by amendment in relative laws of USO Fund. However there are going to be a lot of difference in opinion among the telecom operators about the quantum of deficit and the possibility of manipulation and misreporting by the operator applying for Access Deficit subsidy.

SCO's Comment: PTCL is providing basic telephony services. If PTCL goes in deficit or becomes insolvent then communication system of the country will suffer heavily. PTA may help it by taking following measures:

- Solving billing disputes of PTCL with other operators.
- Helping PTCL from USF.
- Giving concession to PTCL in PTA fees.

Issue # 3

Should the existing regime of symmetrical MTR be continued or should it be shifted to asymmetrical rates?

Warid's Comment: Since the charges are determined on cost basis, the principle of asymmetric based on SMP and non-SMP does not exist.

Mobilink's Comment: The cellular mobile sector has seen tremendous growth in a very short span of time in recent past requiring the operators (both new and existing) to deploy and expand the networks using most modern technology. All the six operators hold nationwide licenses of which five use GSM technology using similar equipment and operating environment.

We understand that the natural outcome of cost based charge system could be implementation of asymmetric charge system within cellular mobile sector, in our opinion however, its implementation may not practically be possible for the reasons given below:

i) Each of the operators will have to negotiate its interconnect charge with the other operators, which may prove to be a very hectic exercise taking months to conclude. The same exercise may have to be repeated on year to year basis on demand of the other operators because of change in cost structure of the terminating operator giving rise to interconnection disputes

ii) The operators as well as the regulator will have to unduly engage in a lengthy and time consuming exercise on year to year basis
iii) Each of the operators will need to share its accounting information with the other operators, which may not be possible for those, which are not listed on stock exchange

Considering the above problems, most of the countries have opted for symmetric interconnect rate regime within mobile sector. Even this is true in case of UK, where Ofcom has taken a symmetric,, forward-looking, multiyear approach to setting price controls in general as the allowed charges differ only to the extent that operators have different access to radio spectrum.

We submit that symmetric rate model is the most practiced charging mechanism within mobile sector worldwide. We therefore propose to continue the existing symmetric regime within mobile sector to avoid the complexities of implementation of asymmetric regime.

Telenor's Comment: Implementation of asymmetric termination rate may not be practically possible for the reasons given below:-

a) Under asymmetric system each of the operators will need to share its accounting information with the other operators, which may not be possible for the non-listed companies;
b) Each of the operators will have to negotiate their interconnect charge with the other five operators, which may prove to be a difficult practice.
c) The same exercise may have to be repeated annually on demand of other operators because of change in cost structure of the terminating operator.

We therefore propose to continue the existing symmetric regime within mobile sector to avoid the complexities of implementation of asymmetric regime.

Ufone's Comment: As the interconnect charges are being determined on cost basis, the principle of asymmetric charges can be applied by segregating SMP and non-SMP interconnect rates. Ufone would also like to suggest that the Authority should decide the SMP and non-SMP interconnect rates.

Paktel's Comment: This mainly depends on the termination rates worked out by PTA for different mobile operators. In order to make a sensible suggestion, we need to have the cost base data of all the operators and rates suggested by PTA for the category of small, medium and large operators. We also need to know PTA's definition of small, medium and large operators.

Being the small operator we need to have high MTR on our network while should have lower MTR on other network to make a level playing field for small operators.

NTC's Comment: It is suggested and recommended that existing regime of symmetrical mobile termination rates be continued by lessening termination rates on mobile. Because, the consumer base for the mobile is increasing day by day with more coverage resulting in more termination of traffic on their networks.

Telecard's Comment: Telecard believes that the current symmetrical mobile termination rates should be continued. Asymmetric regulation can induce allocative and productive inefficiencies. Efficient price controls for mobile termination rates involve the setting of a single symmetric charge for all mobile operators competing on the same market. It is generally accepted that all regulated firms should be set a common target which disregards, for example, the impact of scale or market share. Higher efficiency may allow some firms to capture profits at the regulated price. Conversely, inefficiency may mean that some firms incur losses at the same price. In both cases, a symmetric price gives the right incentives to improve productive efficiency as a result. This is a general principle that applies to price controls and there is no reason to believe that termination rates should be an exception to it.

It is also generally recognized that price controls need to be related to the costs achievable by efficient companies, not to the costs actually incurred by a company, regardless of efficiency. If the price controls on the termination charges are instead set to reflect the actual costs of each company, this will not provide the right incentives. A policy of setting asymmetric price controls in this way is likely to be to the detriment of customers in the longer term. Less efficient firms will have no incentive to become efficient. This is because they will see no need to catch up with the better ones. To make it worse, the better firms will see no need to innovate and become even more efficient. Since there will be less innovation in cost reducing activities, prices to customers which are expected to reflect costs in the industry will not move down quickly. The ultimate losers will be customers as a whole.

Furthermore, this approach is likely to impact adversely on competition and to reduce the incentive to efficiency. Operators with higher costs get higher price caps, regardless of the reasons for these higher costs. Such an asymmetric approach is not conducive to the competitive process nor to improved efficiency in the mobile sector as a whole. It also invites operators to argue for yet further justifications for price differentials.

The UK example quotes, Ofcom allows different charges only to the extent that operators have different access to radio spectrum which is largely outside their control. It rejects arguments for differences due to supposedly different costs of capital and market shares.

Finally, there will be significant disputes in the costing as the Authority cannot share operator specific data on costs.

SCO's Comment: Existing regime of symmetrical termination rates of mobile should be continued due to non-availability of fair usage policy between all operators.

Issue # 4

What level of pre-tax WACC do you consider appropriate for fixed and mobile networks?

PTCL's Comment: PTCL agrees that main parameters to be used in Capital Asset Pricing Model to calculate cost of equity are the values of risk free rates, risk premium and beta. Whereas information regarding risk free rate is available in shape of sale procedures of Pakistan Investment Bond base data for calculation of risk premium and beta has to be gathered carefully.

While calculating equity risk premiums both country risk and Risk in Telecom Market has to be considered. Pakistan's Capital Market is open for foreign investment; similarly Pakistani investor can freely invest in foreign markets. Many Pakistani's are investing in Dubai, Kenya and Bangladesh. In this era of free flow of Capital it is not fair to divide strategic investor in local and foreign investor. Thus both type of risk i.e. country risk and industry risk are equally applicable to all kind of investors.

For calculation of beta, data regarding fluctuation in stock exchange and fluctuation in share price of the firm is required. But none of mobile operators are listed in stock exchange. In the absence of this data how beta of mobile operator will be calculated?

PTA calculated WACC for mobile operators around 40% whereas PTCL submitted its WACC as 32.71% based on study conducted by M/S Analysys (UK) which is well documented. PTCL will request for consideration of same WACC. Pre-tax WACC for mobile should be a bit higher (beta is higher, but equity-debt ratio favors lower-cost debt).

Warid's Comment: We propose pre-tax level as 20%.

Mobilink's Comment: According to provisions of the Act and Rules, an operator is entitled to reasonable return on investment. This return on investment is worked out using Weighted Average Cost of Capital (WACC) based on an appropriate cost of debt and equity.

The major factors to determine the right cost of debt and capital includes the following:

(i) Capital Structure

The phenomenal growth of the cellular market required the companies to employ any kind of capital structure to meet their funding requirements. However, taking the forward- looking approach gearing ratio of 60:40 is considered appropriate as done by Ovum.

(ii) Cost of Debt

Keeping in mind the lending practices in Pakistan, we understand that linking cost of debt to the PIB cut off yields, in not reflective of the cost of funding of cellular companies, all the loans are referenced to the KIBOR and not the PIB yield. So linking the cost of debt with PIB yield would not capture the true cost of debt of the cellular companies.

We therefore propose to use Interest Rate Swap (IRS) for a period of 5 years instead of PIB rate. The companies in Pakistan use IRS rate instead of conventional government paper rate as proxy of Risk Fee Rate because generally the debt portfolio of the companies is made up of floating rate long-term loans indexed with KIBOR. The corresponding risk free fixed rate for the similar maturity would be the IRS rate. This is the rate offered by the market if we were to swap variable portion of our loans i.e. KIBOR with a fixed rate for the average duration of the loan portfolio. The term of 5 years for the IRS has been selected to match the average duration of the borrowings.

We also feel that this is the reasonable duration of cash flows to be earned from the capital employed in the assets. We have used forward-looking rate instead of historical average because this is the best forecast about the behavior of rates in future. The IRS is then to be topped up by a premium of 2.0%, consequently we therefore recommend the cost of debt at 13.50% i.e. using prevailing 5 years IRS rate.

(iii) Risk Free and Country Risk Rates

In our opinion the Risk Free Rate of 11.50% and country risk rate of 5.5% is appropriate. The later may go higher if the country faces political instability.

(iv) Beta

The estimation of Equity beta is done using simple regression techniques based on a reasonable time-series of stock price data. Since none of the cellular company is listed on stock exchange, this data is not available. We therefore have to use Beta of following telecom companies as benchmark.

Companies	Beta
Pak Telecom	1.25
Telecard	0.99
WorldCall	0.82
Callmate Telips	0.83

We then workout weighted average of Beta to be 1.22 based on existing capital structure of the above companies instead of simple average as taken by Ovum. The simple average gives misleading results because of marked difference of the capital employed that of PTCL and other operators. This beta is first de-leveraged based on the capital structure of the above companies and then re-leveraged based on 60:40 gearing ratio. The resultant Beta comes out to be 2.37. We would like to mention here that the Beta for cellular industry would be even higher, as the cellular industry is always considered riskier than the fixed line.

Using the above factors, our pretax WACC rate is worked out to be about 26.5%

Telenor's Comment: For Telenor Pakistan, the required pre-tax rate of return is 25%. This is in line with the following general assumptions for calculating the industry's WACC:-

- Risk free rate of 11.50%, which is the average yield on a 10-year Pakistan Investment Bond;
- Average industry debt-to-equity ratio of 60:40;
- Market risk premium of 7% to 9%, given political uncertainties, security concerns, high inflation rate and high risk of currency devaluation;
- Beta of 1.9 to 2.3, based on Analysts estimates of telecom companies listed in the Karachi Stock Exchange; and
- Corporate tax rate of 35%.

Ufone's Comment: According to provisions of the Act and Rules, an operator is entitled to reasonable return on investment. This return on investment is worked out using an appropriate Weighted Average Cost of Capital (WACC). This WACC incorporates various kinds of risks including country risk, credit and market risk for the sector for the two sources of capital generally employed by the businesses namely cost of debt and cost of equity

The major factors to determine the right cost of debt and capital includes the following:

(a) Capital structure of the company i.e. Debt/Equity ratio – The phenomenal growth of the cellular market, required the companies to employ any kind of capital structure to meet their funding requirements. However the 60:40 is appropriate ratio in this regard.

(b) As per the PTA document, the average yield on ten year PIB's (Pakistan Investment Bonds) has been used as the Risk Free Rate and with the 2% premium over that rate has been taken as the cost of debt. As per Ufone's opinion the latest available average yield on Ten Year PIB's auction (based on the SBP document of Pakistan Investment Bonds) are 10.196% as of 31st October 2007 and if we take 2% premium over that as already mentioned by the authority then the actual Cost of Debt would be 12.196%.

(c) Market Risk Premium for a local investor – Given the inflationary situation and political instability in Pakistan the appropriate market risk could be between 7%-9%

(d) Country Risk Premium taken by the Authority is 5.5% as per the Standard and Poor's most recent B2 were before the Imposition of Emergency in Pakistan. Also given the continued turmoil in the country, bomb blasts and following the assassination of Late Ms. Benazir Bhutto, Standard & Poor has downgraded the credit rating of Pakistan from positive to negative. We

therefore understand that a country risk of at least 7% would be more appropriate.

(e) Equity beta – The appropriate Equity Beta is 2.33 based on the beta detail available for Callmate, PTCL, Worldcall and Telecard. The weighted average Un-leveraged Equity beta for all these operators comes to be 1.18 but when we re-leveraged that beta according to 60:40 capital structure then it comes to be 2.33, as mentioned above.

(f) Corporate Tax Rate – A tax rate of 35% is applicable

Using the above factors, our pretax WACC rate is worked out to be 26.489%

Paktel's Comment: We have reviewed the WACC calculation done by the consultant and we agree to the WACC rate of 19.94%.

Issue # 5

Do you agree with the proposal of increasing the SCO of increasing the charges of their interconnection facilities/ services? If yes, please suggest on which basis such charges should be determined by the Authority.

PTCL's Comment: Under the Telecom Rules 2000, interconnection charges should be based on cost. PTCL faces high operating and building costs in many parts of Pakistan (NWFP, FATA, Baluchistan, etc.). From the experience of PTCL it can be assumed that high cost of operation of SCO may be due to high cost of maintaining the access network. Thus a fair solution may be applicability of Access Deficit Charge in addition to the newly-calculated PTCL interconnect rates to SCO as well.

Warid's Comment: In the absence of sufficient disaggregated accounting information SCO's claim of high cost of operation are not maintainable. Also SCO has not published its RIO as per their obligation as an SMP operator in AJK & NA. Moreover the principle for interconnect charging has to be cost based and not on operator's own assumptions of cost. Therefore we strongly suggest that SCO should provide accounting information to PTA to determine cost based interconnection charges on the basis of LRIC. These charges may then be made part of the RIO.

Mobilink's Comment: Demand of higher interconnect rate merely on the basis of difficult terrain is not justified. In our opinion, SCO's interconnect rate should be far less than PTCL because of lower cost of operation as well as equipment. We however, suggest carrying out a costing exercise for SCO also to workout actual cost of termination.

Telenor's Comment: We oppose this given that SCO has not participated in the costing exercise and hence, their cost structure is not entirely transparent. SCO should be

encouraged to improve their management information and carrying out a costing exercise to work out actual cost of terminating traffic.

Ufone's Comment: Demand of higher interconnect rate merely on the basis of difficult terrain is not justified. Ufone would like to suggest that SCO's actual cost of termination should be worked out through the costing exercise but in the absence of sufficient disaggregated accounting information SCO's claim of higher cost of termination are not acceptable. Also SCO has not published its RIO as per their obligation as an SMP operator in AJK & NA. Moreover the principle for interconnect charging has to be cost based as per the deregulation and mobile policy not on operator's own assumptions of cost.

Paktel's Comment: It is agreed that SCO termination charges are above high than the actual cost and need to be rationalized as for other operators. Since SCO is both fixed line and cellular operator with the status of incumbent same principle of symmetric and asymmetric rates may be applied.

We suggest that since CMPak, Mobilink and Telenor are also providing the services in the northern areas, it would be impracticable to have different MTR only for this area and it is suggested that it should be kept same as fixed operator.

NTC's Comment: SCO has geographical monopoly in the AJK & NAs. Currently SCO has three POIs at Jehelum, Satellite-town, Abbottabad, and PTCL hands over the traffic to SCO at Local level (near end). It is suggested that there is no need to increase the charges for Interconnection facilities/ services on local interconnections, and rates should be RIO based.

Telecard's Comment: We do not believe in asymmetric termination rates for any operator. In addition to this, SCO has enjoyed a monopolistic position for a significant time during which period we believe they would have recovered their fixed costs.

SCO's Comment: SCO is operating and providing communication in most difficult mountainous terrain, severe weather condition and extended distances. The cost of installation, operation and maintenance of various systems (OFC, Microwave, Satellite and PSTN exchanges etc) is much higher than rest of Pakistan. Therefore charges of interconnection facilities/ services in SCO's area of responsibilities be 50% more than PTCL rates.

Issue # 6

Do you agree that SMS termination rate should be determined for mobile-to-mobile traffic? Should the same SMS termination rate be applicable for both fixed and mobile networks?

Warid's Comment: We believe that the present principle of "sender keeps all" may continue as SMS charges increase will only benefit the SMP. Moreover levy of SMS termination charge is likely to increase the SMS tariffs and will adversely affect the consumer.

Mobilink's Comment: The mobile sector is currently facing spamming problem, whereby people are doing telemarketing using SMS service. Since there is no charge for off-net traffic, it is causing serious congestion both at signaling links and SMSCs. We understand that having some charge for off-net traffic will prove to be a deterrent to check the unwanted traffic as the spammer will no that it is not a free ride.

Telenor's Comment: We oppose this given that the issue is more of spamming nature instead of commercial one and is equally applicable for on-net SMS. The mobile operators may discuss alternative arrangements to overcome this issue with the help of PTA instead of placing interconnect charges on SMS termination. As such Telenor Pakistan favours continuing with SKA regime for mobile-to-mobile SMS.

Ufone's Comment: Ufone believe that the present principle of "sender keeps all" may continue as SMS charges increase will only benefit the SMP. Moreover levy of SMS termination charge is likely to increase the SMS tariffs and will adversely affect the consumer. And also currently most of the operators are not ready for the SMS interconnect billing and it will be an additional investment over and above the current enormous investments by the cellular operators on their networks, so Ufone would like to suggest that the current regime senders keep all for SMS termination may be continued.

Paktel's Comment: We don't support SMS termination charges. SMS service may be considered as basic data service and way to encourage data services penetration in Pakistan. SMS can be stepping stone for users who can not use other data services.

Telecard's Comment: TeleCard is of the opinion that SMS termination rates should be determined for mobile to mobile traffic and the same rates should be applicable for both fixed and mobile networks. TeleCard feels that the current competitive climate has reduced margins to an unsustainable level which needs to be reversed. The different regimes also allow anti competitive advantages to some.

SCO's Comment: SMS termination rates should be same for both fixed and mobile network.

Issue # 7

Operators are encouraged to highlight any other factor/aspect relating to charges of interconnection services of fixed-line and mobile networks, which in their opinion should be considered by the Authority in determining the charges.

PTCL's Comment: "Social obligation" that is expected of a company and the invisible costs that obligation represents should be considered. PTCL, for example, bears many

burdens due to the "social obligations" placed on it by the PTA, MoIT and GoP more generally, over the past 60 years. These burdens have decreased the efficiency with which PTCL operates and hurt its ability to compete. At the same time, despite privatization, PTCL is not yet able to shake off many of those burdens, and continues to bear invisible costs due to its past and present "social obligations". Cost-based interconnect rates, access deficit charges, etc., should be higher than calculated in order to incorporate some of the invisible costs imposed on PTCL.

Warid's Comment: We believe following external factors needs to be considered while determining MTR:

- Shareholders expectation for future investments.
- Second lowest APRU levels in the world which is not a healthy sign for the sector.
- Low EBITDA.
- Rising cost of doing business.

Paktel's Comment: We stress that all the operators entering into interconnect agreements shall also agree on service level agreements.

NTC's Comment: It is suggested the Authority ensure the interests of fixed-line operators in the subject scenarios due to significant imbalance in the volume of traffic and advantage of mobile distinct network architecture, the termination rates should be revised. And specifically cost-orientation principles for interconnect settlement rates may be determined by the Authority.

12. INTERNATIONAL BENCHMARKING FOR INTERCONNECTION CHARGES

The benchmarking approach comprised a sample of benchmarked countries which have adopted cost-based interconnection charging regimes. The benchmark data for fixed termination was gathered from a composite of:

- Six (6) European cost-based jurisdictions which were most closely correlated to the national characteristics of Pakistan on the basis of seven main criteria. The criteria used to rank comparators were GDP/capita (in Euros), urbanisation, population density, population (absolute), surface area (sq km), fixed teledensity and mobile penetration/teledensity. On the basis of these criteria, the most closely ranked EU nations were from Portugal, France, Spain, Italy, Germany and Austria.
- Three (3) Non-European jurisdictions which still regulate fixed termination on the basis of cost and which also bear similarities to the Pakistan market, albeit on the basis of slightly different selection criteria. The criteria used were GDP/capita (US$), population density, fixed teledensity, mobile penetration, ICT expenditure as % of GDP and urbanisation. On the basis of these criteria, the countries ranked as being closest to Pakistan (and which also have a cost basis for fixed termination charges) were Nigeria, Sri Lanka and the Philippines.

(i) Fixed Call Termination Rate

The charges used for benchmarking were component-based charges (i.e. local, single tandem (ST) and double tandem (DT) termination[3]), all of which were converted into a common unit of measurement (US$ cents) for comparison purposes. Furthermore, when converting the tariff rates to US$ cents, PPP (purchasing power parity) adjustments was applied to 60% of each country's effective termination rates to allow for the differences in the relative cost of living between benchmark countries. This proportion was based on a standard assumption used when benchmarking, that broadly 60% of the annualised costs of telecommunications operators are represented by labour costs (and are thereby reflective of local rates of pay and the cost of living).

Following figure shows the termination charge results of all benchmarked cost-based countries, and compares the average benchmark to the current comparable adjusted tariffs in Pakistan. The current rates in Pakistan are around 20% below benchmark levels.

Figure: Summary benchmark for fixed termination rates

Country	Fixed termination (Local US$ cents, PPP adjusted)		
	Local	ST	DT
Portugal	0.80	1.13	1.72
France	0.72	1.39	1.42
Spain	0.81	1.13	1.57
Italy	0.60	0.94	1.42
Germany	0.51	0.86	1.31
Austria	0.81	1.23	1.95
Nigeria	5.80	9.14	12.86
Sri Lanka	1.14	2.19	3.08
Philippines	12.52	19.73	27.75
Average benchmark FTR	2.63	4.19	5.90
Current rates in Pakistan converted to US $ cents ppp	2.01	3.17	4.86
Difference to benchmark average	**-24%**	**-24%**	**-18%**

(ii) Fixed Call Transit Rate

Domestic PSTN voice transit is less commonly a regulated cost-based service than voice termination. However, approximations to cost-based transit rates can be determined from the equivalent terminations rates, and the results are shown in following figure for the benchmark set of countries.

[3] While all EU country tariff data is available on the basis of local, ST and DT charges for fixed termination, the non-EU countries typically did not include such variants. Consequently, the consultants derived such component-based comparator data by applying the typical ratio of local, ST and DT charges to the average cost of termination.

Figure: Indicative benchmark rates for cost-based PSTN voice transit interconnection

Country	Transit (Local US$ cents, PPP		
	Local	ST	DT
Portugal	0.50	0.92	1.39
France	1.01	0.70	1.05
Spain	0.48	0.76	1.14
Italy	0.51	0.82	1.24
Germany	0.52	0.80	1.20
Austria	0.64	1.15	1.72
Nigeria	5.01	7.06	10.58
Sri Lanka	1.57	1.94	2.91
Philippines	10.81	15.22	22.84
Average Benchmark	2.34	3.26	4.90

(iii) Mobile Call Termination Rate

The benchmarking country sample was comprised of six (6) EU countries which were most closely correlated in terms of national characteristics to those of Pakistan as well as three (3) non-EU countries that were also closely correlated with Pakistan.

In this instance, the consultant was able to obtain cost-based termination rates for several Eastern European EU member states for which fixed termination rates were not readily available. As a result, the EU benchmark sample countries include Poland, Hungary, the Slovak Republic, Portugal, France and Spain. While arguably few EU countries are particularly representative of market conditions in Pakistan, it is interesting to note that the first three of these countries were ranked highest in terms of comparability with Pakistan largely as a result of their relatively low GDP/capita.

The reminder of the benchmark sample was comprised of non-EU countries that were closely ranked to Pakistan and which have indicated that they have adopted a cost basis for interconnection pricing. As with the fixed termination benchmark, these three (3) countries were Nigeria, Sri Lanka and the Philippines.

As with fixed termination, all benchmark tariffs were converted into US$ cents per minute using PPP adjustments to compensate for the relative cost of living in each respective country. Where more than one termination charge existed in a particular country (most EU benchmark countries having three (3) operators and some with asymmetric termination charges), a weighted average termination charge was computed by reference to relative market share of each operator.

Figure below indicates the unit cost-based charges for mobile voice termination in each benchmark country and how average benchmark compares with the comparably adjusted current, symmetric mobile termination charge in Pakistan.

Figure: Benchmark termination rates compared to current Pakistan MTRs

Mobile termination benchmark summary and comparison to the current comparable Pakistan termination rate.

	Mobile termination US $ cents PPP
Poland	18.94
Hungary	16.06
Slovak Republic	18.35
Portugal	15.97
France	9.36
Spain	13.88
Nigeria	11.62
Sri Lanka	2.63
Phillipines	22.36
Average MTR	**14.35**
Current Pakistan MTR expressed in PKR/min	1.25
Current adjusted Ix rates converted to US $ cents ppp	**5.02**
Current PTA MTR vs. revised benchmark	-65%

Even after allowing for PPP adjustment, the current mobile voice termination rate appears particularly low when compared with cost-based mobile termination charges from predominantly European states. The non-EU member states within the benchmark sample showed particularly wide variation in PPP-adjusted tariffs but interestingly only Sri Lanka has lower comparative rates than those currently applied in Pakistan.

(iv) Mobile SMS Termination Rate

Little benchmark information in relation to SMS termination was available. Most potential benchmark countries with similar national attributes to Pakistan did not operate a cost-based termination regime for SMS traffic, preferring 'Bill & Keep' or 'Sender Keeps all' charge arrangements as are present in Pakistan currently.

The French regulator, ARCEP, has recently imposed SMS termination charges. These were set at a maximum of 3 Euro cents (Rs.2.47) per message for the larger operators and 3.5 Euro cents (Rs.2.88) per message for the smaller operators. ARCEP however has admitted that there is uncertainty on the underlying cost-structures, and these rates are not cost-based.

The Ofcom cost model in the UK estimates that SMS costs are 0.15 PKR per message.

13. INTERCONNECTION CHARGES BASED ON FINAL COST MODELS

Following are the results of the final cost models after necessary modification in the light of operators' comment and the Authority's own findings:

Results of Mobile Cost Models

(i) FAC Model

Termination charges determined by FAC models for the year 2006 for voice call and SMS are mentioned below for Mobilink and Telenor:

(a) Call Termination Charges

PKR/min.

Description	Mobilink	Telenor
Incoming call from PSTN	0.46	1.58
Incoming call from other mobile networks	1.29	1.56

(b) SMS Termination Charges

PKR/message

Description	Mobilink	Telenor
SMS termination charge	1.07	0.17

(ii) LRIC Model

Termination charges determined by LRIC models for period 2006-2010 for voice call and SMS are mentioned below for Mobilink, Ufone, Warid and Telenor:

(a) Call Termination Charges

PKR/min.

Year	Mobilink	Ufone	Telenor	Warid
2006	0.85	0.89	1.13	1.93
2007	0.70	0.80	0.94	0.97
2008	0.68	0.74	0.80	0.79
2009	0.68	0.72	0.74	0.77
2010	0.69	0.71	0.71	0.73

(b) SMS Termination Charges

PKR/message

Year	Mobilink	Ufone	Telenor	Warid
2006	0.137	0.147	0.283	0.436
2007	0.107	0.110	0.182	0.290
2008	0.095	0.116	0.172	0.219
2009	0.095	0.106	0.146	0.186
2010	0.091	0.098	0.128	0.163

Results of Fixed-line Cost Models

(i) FAC Model

(a) Call Termination Charges

Call termination charges calculated through TD FAC model for year 2006 were as under:

Network Elements Based Charges:

PKR/min.

	Local	Single Tandem	Double Tandem
Average Rate	0.64	0.83	1.23
Peak Rate	0.67	0.86	1.27
Off-Peak Rate	0.44	0.58	0.85

Distance Based Charges:

PKR/min.

	Metro	National 25-80km	National 80-160km	National > 160km
Average	0.68	0.83	1.18	1.30
Peak Rate	0.71	0.86	1.22	1.34
Off-Peak Rate	0.47	0.58	0.81	0.90

(ii) LRIC Model

(a) Call Termination Service

Element based average, peak and off-peak call termination service charges calculated for PTCL through BU LRIC model were as under:

Network Elements Based Charges:

PKR/min.

Average Rate	Local	Single Tandem	Double Tandem
2006	0.60	0.72	0.93
2007	0.62	0.74	0.96
2008	0.63	0.75	0.97
2009	0.64	0.76	0.99

PKR/min.

Peak Rate	Local	Single Tandem	Double Tandem
2006	0.63	0.75	0.97
2007	0.64	0.76	0.99
2008	0.66	0.78	1.01
2009	0.67	0.79	1.03

PKR/min.

Off-Peak Rate	Local	Single Tandem	Double Tandem
2006	0.42	0.50	0.65
2007	0.43	0.51	0.66
2008	0.44	0.52	0.67
2009	0.45	0.53	0.69

Distance Based Charges:

PKR/min.

Average Rate	Metro	National 25-80km	National 80-160km	National > 160km
2006	0.63	0.72	0.90	0.99
2007	0.64	0.74	0.92	1.01
2008	0.66	0.75	0.94	1.03
2009	0.67	0.76	0.95	1.05

PKR/min.

Peak Rate	Metro	National 25-80km	National 80-160km	National > 160km
2006	0.65	0.75	0.93	1.02
2007	0.67	0.76	0.95	1.05
2008	0.68	0.78	0.97	1.07
2009	0.69	0.79	0.99	1.09

PKR/min.

Off-Peak Rate	Metro	National 25-80km	National 80-160km	National > 160km
2006	0.43	0.50	0.62	0.68
2007	0.45	0.51	0.63	0.70
2008	0.45	0.52	0.65	0.71
2009	0.46	0.53	0.66	0.73

(b) Call Transit Service

PTCL element based call transit service charges determined by BU LRIC model for peak and off-peak hours were as under:

Network Elements Based Charges:

PKR/min.

Average Rate	Local	Single Tandem	Double Tandem
2006	0.12	0.29	0.50
2007	0.12	0.29	0.51
2008	0.12	0.30	0.52
2009	0.12	0.30	0.53

Distance Based Charges:

PKR/min.

Average Rate	Metro	National 25-80km	National 80-160km	National > 160km
2006	0.12	0.29	0.48	0.54
2007	0.12	0.29	0.48	0.55
2008	0.12	0.30	0.49	0.56
2009	0.12	0.30	0.50	0.57

PKR/min.

Peak Rate	Metro	National 25-80km	National 80-160km	National > 160km
2006	0.12	0.30	0.49	0.56
2007	0.12	0.30	0.50	0.57
2008	0.12	0.31	0.51	0.58
2009	0.13	0.31	0.52	0.59

PKR/min.

Off-Peak Rate	Metro	National 25-80km	National 80-160km	National > 160km
2006	0.08	0.20	0.33	0.37
2007	0.08	0.20	0.33	0.38
2008	0.08	0.21	0.34	0.39
2009	0.08	0.21	0.35	0.40

14. MAJOR ISSUES IN COST MODELLING

Although there were number of modifications made in the FAC and LRIC models based on operators' feedback as well as the Authority's own findings, however, major issues are highlighted below:

(i) Unit Capex Values for Mobile Network Elements

In the preliminary mobile LRIC cost models, the unit capex values were taken as the lowest of the operators' cost. In case the operators' unit capex data was not available, international benchmark figures were used.

The operators objected on using the lowest cost figures due to different specifications and types of network elements deployed by each operator. They argued that principally, the lowest of operators' cost should be used provided all operators are using same type of equipments. Moreover, benchmarks should only be used where cost data is not available or is not in line with the local equipment prices.

Considering the request of the operators and keeping in view the differences in the types of network elements used by different operators, the final models have been amended by taking the average of the operators' capex figures for respective head and in case of non-availability of cost figures, international benchmarks have been used. Following table shows the comparative capex figures used in the issued and final cost models:

Head	Issued Models (PKR)	Final Models (PKR)
BTS - Average	5,124,569	6,510,725
Base Station Controller	17,918,528	69,354,599
Packet Control Unit	15,458,845	14,053,496
Serving GPRS Support Node	57,223,478	18,039,927
Gateway GPRS Serving/Support Node	35,943,478	27,615,436
MSC (with VLR)	211,129,628	304,993,815
Gateway MSC	128,253,457	98,181,818
HLR	17,521,385	228,032,727
Intelligent Network	229,352,478	592,241,797
Short Message Service Center	57,627,959	315,818,182
Multimedia Message Center	12,661,067	11,165,939
Voicemail Platform	19,296,379	52,727,273

The above capex figures are exclusive of installation costs, which have been assumed to be 10% of capex in the cost models.

(ii) Working Capital

Working Capital was assumed to be 'Nil' in the mobile LRIC models. However, the industry demanded that the working capital is an integral part on any business and should be uplifted by at least 10% while determining the mobile termination rates.

In principle, the demand of the industry was justified, however, on analyzing the audited accounts, it was revealed that the actual working capital of all cellular mobile operators was negative (-ve) for the last several years. The Authority, instead of using negative working capital which is the case in all mobile operators, uplifted the level to zero.

The same point was also highlighted by PTCL. They argued that working capital should be uplifted from existing 2% to at least 10% of capex. The Authority noted that current assets of PTCL comprises of 50-60% cash and bank balances (33 billion for the year-ended June 30, 2007), on which PTCL is already getting returns. Moreover, the trade debts of PTCL are also on the higher side. Accordingly, in order to encourage PTCL for efficient utilization of its working capital, the value of working capital has been retained at 2% in the final model.

(iii) Operating Costs for Mobile Operators

Due to non-availability of break down of operating costs from mobile operators for the year 2006, the opex figures were assumed and additional direct opex of 10% was allowed in the Bottom- Up LRIC models. The operators demanded that the direct opex should be increased at least 15%.

The Authority noted that in the final cost models, the opex figures were derived from the audited accounts of respective mobile operator, which were earlier not available. Since all relevant opex items were taken into account, therefore there was no justification of allowing additional percentage of direct opex in the model, which has been set to zero in the final model.

(iv) Percentage of Traffic in Busiest Hour for Mobile

The busy hour Erlang (BHE) was set to 10% in the issued model. However, few mobile operators requested that the BHE should be increased keeping in view the peculiar conditions of the Pakistani mobile market. Operators also pointed that due to missed calls behavior in Pakistan, most of the calls are non-revenue and accordingly BHE should be increased to 25-30% to cater these non-revenue calls.

The Authority noted that one of the mobile operators actually submitted BHE of 7.1% to the Authority during data submission process. It was also noted that the international practice is also to keep BHE at 10% for the purpose of cost modelling. Also when BHE of the operators, who demanded BHE at 25-30%, was calculated by the Authority, it came out to be less then 10%. Due to these factors, the BHE was kept at the same level of 10% in the final cost models.

(v) Mobile Market Size and Subscribers

The projections of mobile market size were made depending on the data available at the time of start of the consultancy, i.e. two years ago. The projected market size resulted in 100 Million mobile subscribers in 2010 whereas Pakistan mobile market has shown a tremendous growth in last two years and has reached to 78 Million by start of year 2008. Therefore, total mobile market size was re-estimated to 120 Million by 2010 on the basis of growth trend. Similarly, the customer base of all the operators was also revised on the basis of their actual number of subscribers.

(vi) Mobile Site Rental

Site rentals were increased at the rate of 7.9% per annum (equivalent to inflation rate) in the cost models issued to the mobile operators. The mobile operators demanded increase in site rentals on the ground that their actual increase in site rental is 10% as per their tenant agreements. The operators' point was acknowledged by increasing site rental at the rate of 10% and overall site rental was also increased keeping in view the growth in number of cell sites.

(vii) Mobile Cell Radii and No. of TRXs

The issued cost models were using network coverage area and traffic along with their forecasts for calculation of number of cell sites. The coverage area and traffic per cell site were being used to workout the number of cell sites. The mobile operators objected that the cell radii assumed in the issued models are much higher than that of the actual and number of assumed TRXs for rural cell sites is lesser than that of actual number. Having accepted both the points of the mobile operators, it was found that the number of cell sites comes out to be unrealistic (approximately four times the actual number) as the coverage area per cell site was far less than the previously assumed area.

The Authority decided to disregard the network coverage area for calculation of number of cell sites and took actual number of cell sites from operators' network rollout data/forecasts. Similarly, actual number of TRXs per cell site was used to populate the network. Hence, the revised cost models use operators' data for cell sites and TRXs for growth of network. It is worth mentioning that the consideration of actual network elements is inline with 'scorched node' methodology.

(viii) Traffic Volumes for Mobile Operators

In the issued mobile cost models, PSTN to mobile traffic was based on the PTCL provided figures (2.3 Billion minutes in 2006). Later, PTCL highlighted that all types of calls (i.e. local as well as long distance) terminating from PSTN to mobile should be grouped as 'PSTN to mobile traffic' which is 7.7 Billion in 2006. This figure was used by the Authority in the final cost models.

Similarly, traffic per mobile subscriber was assumed in the issued cost models. However, to make the models more realistic, actual traffic volumes provided by the operators have

been used in the cost models and traffic per subscriber has been calculated on the basis of actual traffic volume. The traffic volumes provided by the operators have been found to be higher than the assumed traffic used in the issued models. The new traffic per subscriber figures were also compared with that of the traffic disclosed by the operators to their investors for sanity check and was found lesser than the numbers disclosed to the investors.

(ix) Initial License Fee

In both the issued and final mobile cost models, initial license fee was kept at zero and a provision was made in the model so that operators can see the impact of the same on the mobile termination rate. This is in line with the Authority's earlier determination on the subject issue in year 2005, the Authority's approved guidelines on costing methodologies for accounting separation as well as the international best practices. The Authority, however, clarified that the annual license fee and annual spectrum charges are part of mobile termination rates and are included in the model.

(x) Element-based vs. Distance-based Charges

The Authority during initial models of PTCL calculated the termination charges on network elements basis. However, the Authority observed that all the operators are interconnected with PTCL on tandem/transit exchanges and not on local exchanges. Hence, the element-based charging could not be introduced at this stage owing to the practical interconnectivity arrangements. One way to handle the situation was to move PoI of interconnecting operators from tandem exchanges to local exchanges. Alternatively, the element-based interconnection charges could be converted to distance-based interconnection charges as is currently followed by the operators. The Authority has decided that instead of switching PoI from tandem exchanges to local exchanges, which will disturb the traffic and interconnection arrangements of many operators, element-based interconnection charges should be converted to that of distance-based charges.

(xi) Simplicity in Long-Distance Slabs

The Authority also observed that PTCL is no more offering long-distance tariffs to its consumers on three slabs. In fact, all long-distance calls are charged by PTCL at one standard rate of Rs. 2.00 per minute. The Authority, therefore, considers it appropriate to simplify the charging structure for interconnecting operators as well by reducing the three long-distance slabs into two. Resultantly, the long distance slabs of 80-160Km and above 160Km was merged.

(xii) Revalued Land and Buildings of PTCL

PTCL pointed that the land and building should be taken at the fair marker values in both the FAC and LRIC cost models since the consideration paid by Etisalat was after considering the revalued amounts of Land and Building of PTCL.

The Authority noted that as the TD FAC model was based on historical costs, which included assets as they were valued in the 2005-06 accounts using historic cost conventions. It was, therefore, not appropriate to make such changes to an HCA-FAC model. Moreover, PTCL itself has not yet taken the effect of proposed revaluation of its Land & Buildings in its financial statements for the year 2006-07.

As far as LRIC model is concerned, it was explained to PTCL that the Authority has taken into consideration increase in prices of real estate and has allowed almost three-times increase in these values. However, it is noted that PTCL acquired these land and building at relatively low rates. Also few of the regulators do not allow such increase in real estate for the purpose of determining interconnection charges. Nevertheless, the Authority will study this issue in more detail in next review of cost-based interconnection charges.

(xiii) Traffic Volumes of PTCL

The termination rates of PTCL were calculated based on the traffic volumes (actual as well as estimates) provided by PTCL during the data submission phase. PTCL later objected that the realistic traffic volumes should be used in the models by taking the most recent available information i.e. for the year 2007. PTCL also pointed that the traffic volume from 2005-2006 varies considerably from 2006-2007 and 2007-2008.

The Authority acknowledged that fixed to fixed minutes may be reduced but the overall traffic per subscriber, including all incoming and outgoing calls, is more or less constant. Moreover, due to recent launch of different retail tariff packages by PTCL, the overall traffic is likely to be improved as compared to the existing ones. Nevertheless, the per subscriber traffic has been assumed at constant level in the final cost model.

(xiv) Mean Call Unit (MCU) for PTCL Local Call

The MCU factor of 3.13 was used in the issued model to convert the local call pulses into minutes. This figure was derived from the sample data submitted by PTCL during the data collection phase. However, PTCL suggested that MCU of 2.505 should be used and pointed out that the earlier data submitted by PTCL was not correct, which includes internet dial up calls in the local call traffic.

The Authority has recalculated MCU by using revised PTCL data which came out at 2.81. The Authority, however, highlighted that PTCL has pointed out such error in its data at a very late stage. Moreover, the sample data provided by PTCL lacks transparency with regards to the selection of exchanges as well as the time period, in the absence of which the Authority could not verify that the sample is adequately reflective of the population. Based on these findings, the MCU factor was not changed by the Authority.

15. OTHER CONSIDERATIONS IN DETERMINING THE INTERCONNECTION CHARGES

Apart from the costing of interconnection services, the Authority also considered following factors, which have direct bearing on the interconnection charges:

(i) Infrastructure Sharing

The Authority observed that the cellular mobile operators have deployed their own infrastructure instead of sharing the already available BTS(s) etc of other cellular mobile operators. It is pertinent to mention that Mobile Cellular Policy also encourages infrastructure sharing by the cellular mobile operators. In this regard, the deployment of a completely new infrastructure is resulting in higher cost for network rollout and operations. The Authority is of the view that the mobile operators can efficiently reduce their cost by sharing their infrastructure with other operators and thus reduce related capex and opex.

(ii) Next Generation Networks

The emerging technologies such as NGN are enabling mobile operators to use in their core and NSS part and also facilitates in implementing better routing schemes. The deployment of NGN in mobile networks not only reduces capex but better routing schemes also results in lower opex for the operators. Keeping in view the benefits of lower cost of NGN, some of the operators have already started deploying NGN. The Authority is of the view that the shift towards NGN will further reduce the costs of mobile operators which should be shared with the other network operators as well as the consumers.

(iii) Position of Small Operators like CMPak

Paktel has been recently acquired by China Mobile Pakistan (CMPak), which has a very small subscriber-base. CMPak has invested more than US$ 700 million in Paktel and an additional US$ 800 million is planned till the end of year 2008. The Authority encourages private sector investment in the mobile sector. Hence, to help smaller operator like China Mobile, the Authority is not bringing mobile termination closer to cost of large-scale mobile operators. It is also pertinent to mention that due to smaller subscriber-base of small operators like CMPak, most of the calls originated by them are likely to be terminated on other mobile operators having larger subscriber-base. This in turn would increase their interconnection out-payments to other mobile operators.

(iv) On-net Tariffs Vs. Off-net Tariffs

During the meetings held with cellular mobile operators, some of the operators argued not to lower mobile termination rate which in their opinion is acting as a price floor in the industry. However, the Authority while reviewing cellular mobile tariffs noticed that the situation is quite opposite. The cellular mobile operators are apparently subsidizing their

on-net tariffs especially friend & family numbers. The cellular mobile operators are offering free on-net calls, happy hours, late night option and friends & family tariffs at very low rates, whereas off-net tariffs are in the range of Rs. 1.50 to Rs. 3.00 per minute. For postpaid packages, the mobile operators are offering free minutes to their consumers. The cost of free minutes (when divided by line rent) is around Re.1.00 per minute. Thus, the reduction in mobile termination rate would also increase the margin available to mobile operators for reducing tariffs for outgoing calls (especially off-net), which would help to attract more customer base.

(v) 3G Licensing

PTA is in the process of awarding 3G license to the existing mobile operators. Keeping in view the expected investments requirements in upgrading infrastructure, the Authority is of the view that the cellular mobile operators may be allowed a premium above the actual mobile termination cost of existing 2G/2.5G to absorb the cost of 3G.

(vi) Onward Routing Charges for Mobile Ported Numbers

The Authority vide its determination on *'Mobile Number Portability – Onward Routing Charges'* dated 7th May 2007 set onward routing charges for fixed-to-mobile calls at Rs. 0.30 per minute. This arrangement was to be reviewed by the Authority on the basis of cost of such provisioning. The Authority has noted that currently the volume of onward routing calls is considerably low and the overall billing for oneward routing calls is neglibly lower when compared to the interconnection billing for MTR. With such low volumes the Authority considers it appropriate to merge these charges in MTR instead of carrying out a separate cost based charging mechanism.

16. THE ORDER

Based on the cost model results of mobile operators and PTCL, the above-mentioned considerations and submissions from operators, the Authority hereby determines the following interconnection charges for fixed-line and mobile networks:

Mobile Termination Rate

For calls terminating on mobile networks from other mobile networks and fixed networks, the mobile termination rates shall be as follows for the periods mentioned hereunder:

PKR/min.

Period	Mobile Termination Rate
From 1st June 2008 to 31st December 2008	1.10
From 1st January 2009 to 31st December 2009	1.00
From 1st January 2010	0.90

The onward routing charges for Mobile Number Portability (MNP) shall not be charged separately by mobile operators w.e.f. 1st June, 2008 and shall be considered part of the mobile termination rates mentioned above.

Mobile SMS Termination Charges

The mobile-to-mobile SMS shall continue to be settled on "Sender Keeps All" principle.

Fixed-line Call Termination Charges

The following average rates shall be charged for call termination service by PTCL w.e.f. 1st June 2008:

PKR/min.

Call Type	Fixed Termination Rates
Metropolitan	0.60
National 25-80 km	0.82
National >80 km	1.20

From 1st June 2009, the average call termination charges of PTCL shall be as follows:

PKR/min.

Call Type	Fixed Termination Rates
Metropolitan	0.65
National 25-80 km	0.82
National >80 km	1.20

Fixed-line Call Transit Charges

The following average transit rates shall be charged by PTCL w.e.f. 1st June 2008:

PKR/min.

Call Type	Fixed Transit Rates
Metropolitan	0.12
National 25-80 km	0.30
National >80 km	0.55

The onward routing charges for ported mobile numbers shall not be charged separately by PTCL as these are part of the transit rates mentioned above.

The charges mentioned above shall continue to prevail unless otherwise revised by the Authority.

This Determination shall be effective from 1st June 2008.

Dr. Muhammad Yaseen
Member (Technical)
Pakistan Telecommunication Authority

S. Nasrul Karim Ghaznavi
Member (Finance)
Pakistan Telecommunication Authority

Maj Gen. (R) Shahzada Alam Malik
Chairman
Pakistan Telecommunication Authority

Signed on this ____day of _____ 2008.