TVR/VEL/004 10 January 2011

The Telecom Regulatory Authority of India Mahanagar Doorsanchar Bhawan Jawahar Lal Nehru Marg (Old Minto Road) Next to Zakir Hussain College New Delhi 110002

Dear Sirs,

#### Pre-Consultation on Review of Interconnection Usage Charges

Vodafone Essar Limited (VEL) welcomes the Authority initiating a consultation on Interconnection Usage Charges.

In this regard, VEL would first like to most respectfully submit that in order to conclude this consultation in a timely manner as desired by the Hon'ble TDSAT in its judgment dated 29 September 2010 in, inter alia, Vodafone Essar Gujarat Ltd & Ors vs. TRAI, it may be desirable for the Authority to first focus on and address the core issues highlighted by the Hon'ble TDSAT and, as a next step, take up any or all other issues. VEL assures full cooperation and support to the Authority in completing this exercise in a time bound manner.

VEL would like to most respectfully urge that the Consultation Paper be in consonance with the principles and the guidance provided by the Hon'ble TDSAT, which include inter alia:

- (i) Cost based and work done principle;
- (ii) Capital costs must be included;
- (iii) IUC must be conducive to future investment, especially rural and hilly areas;
- (iv) Charges must be sustainable in the long run;
- (v) There must be an above zero MTC; and
- (vi) New entrants should not be afforded any privileges.

We would also appreciate if the Consultation Paper could explain how the Authority's preferred methodology and approach will meet the objectives of IUC and the key principles identified in the TDSAT judgment vis-a-vis other options/methodologies. It may be appreciated that a clear reasoning and justification for the chosen methodology will ensure better consensus and more effective participation amongst all stakeholders.

Further, we would also like to request that the Authority may kindly clarify how the Authority intends to deal with the issue the Hon'ble TDSAT's Order envisages that the new IUC regime be implemented from 1 January 2011. It may be appreciated that retroactive implementation of IUC charges could lead to instability and it may therefore be desirable for the Authority to clarify to all stakeholders on how this concern is to be addressed.

To assist the Authority in this effort, we have attempted to summarize the key principles identified by TDSAT. It is again most respectfully submitted that the Authority frame its consultation paper and the ensuing IUC regime to be in consonance with the principles laid down by the Hon'ble TDSAT. These submissions are enclosed as <u>Annexure-1</u>. VEL's initial responses to the questions posed in the pre-consultation document are contained at <u>Annexure-1A</u>.

In addition to the above general principles, the Hon'ble TDSAT has also urged the Authority "to consider the matter once again upon taking into consideration all aspects of the matter **including the views of the Experts.** To this end, we re-submit the following expert evidence:

(i) Joint statement signed by:

- a. Dr Jerry Hausman, Professor of Economics at the Massachusetts Institute of Technology (MIT), Cambridge, USA;
- b. Dr Janusz Ordover, Professor of Economics, New York University, New York, USA;
- c. Dr Martin Cave OBE, London School of Economics, London, UK;
- d. Dr Steve Parsons, Adjunct Professor, Washington University, Missouri, USA & President, Parsons Applied Economics.
- (ii) Statement by Professor Jerry Hausman (MIT, Boston USA); and
- (iii) Statement by Dr Steve Parsons.

These are attached as Annexures-2A, 2B and 2C respectively.

It is most respectfully submitted that the Authority may be pleased to take this evidence into account. It is further most respectfully submitted that any deviation from the recommendations of the experts be supported with explicit and reasoned arguments.

We hope that our submissions will merit the kind consideration and support of the Authority.

VEL looks forward to an early issue of the Consultation Paper by the Authority and once again assures full cooperation and support to the Authority in completing this exercise in a time bound manner.

Kind regards,

Sincerely yours,

T. V. Ramachandran Resident Director Regulatory Affairs & Government Relations

#### Distribution : Dr. J. S. Sarma, Chairman, TRAI : Shri R. Ashok, Member, TRAI : Prof. H.S. Jamadagni, Member, TRAI : Shri R. K. Arnold, Secretary, TRAI : Shri N. Parameswaran, Pr. Advisor (RE&IR), TRAI : Shri Lav Gupta, Pr. Advisor (I & FN) : Shri Sudhir Gupta, Pr. Advisor (MN), TRAI : Shri. Raj Pal, Advisor (ER), TRAI : Shri. Shri S. K. Curte, Advisor (ER), TRAI

: Shri S. K. Gupta, Advisor (CN & IT), TRAI

# Annexure-1

# I. Preliminary Submissions

Vodafone Essar Limited (VEL) welcomes the Authority initiating a consultation on IUC.

In this regard, as the Authority is aware, the Hon'ble TDSAT in its judgment dated 29 September 2010 in, inter alia, Vodafone Essar Gujarat Ltd & Ors vs. TRAI, had expressed the desirability of the Authority starting the consultative process well in time and completing its consultations in a time bound manner so as to implement a new IUC regime, consistent with the principles and guidance laid down in the TDSAT judgment, by 1 January 2011.

It is most respectfully submitted that in order to conclude this consultation in a timely manner, it may be desirable for the Authority to first focus on and address the core issues highlighted by the Hon'ble TDSAT and, as a next step, take up any or all other issues. VE assures full cooperation and support to the Authority in completing this exercise in a time bound manner.

We would also like to most respectfully submit that as rightly noted by the Hon'ble TDSAT, a well documented policy decision of the nature of IUC is necessary for growth of the Telecom Sector. It is for this reason that the TDSAT had stated that the consultation ought to indicate the core issues and that the charges are likely to remain same for a sufficiently long period and at least for three years if not more, so that the investors would know about all the factors to be taken into consideration in advance before making any new or further investments.

It is further most respectfully submitted that the correct framing of the issues for consultation is absolutely crucial. The Hon'ble TDSAT has also noted that *"Framing a wrong question, it is trite, would lead to a wrong answer"* (101(4)).

VEL would also like to urge that the consultation paper be in consonance with the principles and the guidance provided by the Hon'ble TDSAT as enunciated in the next Section.

We would also like to request that the Authority may, in its Consultation Paper address the following issues:

- a. Clarify how the Authority intends to deal with the issue the TDSAT Order envisages that the new IUC regime be implemented from 1 January 2011. It may be appreciated that retroactive implementation of IUC charges could lead to instability and it may therefore be desirable for the Authority to clarify to all stakeholders on how this concern is to be addressed. The problems of retroactive implementation emphasize why the Consultation must be concluded in a timely fashion.
- b. Explain how the Authority's preferred methodology and approach will meet the objectives of IUC and the key principles identified in the TDSAT judgment vis-a-vis other options/methodologies. It may be

appreciated that a clear reasoning and justification for the chosen methodology will ensure better consensus and more effective participation amongst all stakeholders. Furthermore, the preferred methodology can only be chosen within the context of the policy objectives and vision for the telecommunications sector.

To assist the Authority in this effort, this document summarises the key principles identified by the Hon'ble TDSAT. It is again most respectfully submitted that the Authority frame its consultation paper and the ensuing IUC regime to be in consonance with the principles laid down by the Hon'ble TDSAT.

VEL's initial responses to the questions posed in the pre-consultation document are contained at <u>Annexure 1A</u>.

# II. General Principles

The Hon'ble TDSAT has in its judgment stated as below:

"It was therefore, bound to apply the correct principles. It is obligated to act within the four corners of the statute. It was required to keep in mind the provisions of the National Telecom Policy. It was required to apply the correct methodologies. The principles and the methodologies which were required to be applied by TRAI are, thus, jurisdictional questions so far as the same relate to determination of Interconnect Usage Charges. (See Anisminic Ltd. Vs. Foreign Compensation Commission 1969(1) All E R 208)" (101(3))

It is in this context, that the Hon'ble TDSAT has identified six key principles which must be satisfied whilst setting of IUC. These principles are:

- (i) Cost based and work done principle;
- (ii) Capital costs must be included;
- (iii) IUC must be conducive to future investment, especially rural and hilly areas;
- (iv) Charges must be sustainable in the long run;
- (v) There must be an above zero MTC; and
- (vi) New entrants should not be afforded any privileges.

We summarise the relevant principles and the relevant section of the Order below.

# (i) Cost based & Work Done Principle

The most fundamental principle enunciated by the Hon'ble TDSAT is that the components of IUC must be set according to the cost based and work done principle. The Tribunal has stated:

"... various components of IUC namely, Origination charge, carriage charge and termination charge must be held to be the established principle of cost based determination therefor" (114(12))

"...Its [TRAI] jurisdiction being limited to determine the charges on cost based and work done principle, could not have granted any subsidy far less artificial cross-subsidy." (101(5))

It is therefore submitted that IUC must reflect costs actually incurred and investments actually undertaken. This does not mean that every operator in every circle must receive an individual charge – the Hon'ble TDSAT has noted the difficulty of such an approach<sup>1</sup> – but rather it implies that the charges applied to the whole industry must be reflective of the costs incurred and investment undertaken by the industry.

It may also be appreciated that the requirement to set cost based charge does not allow for alteration /adjustment of charges due to revenue from other services. For example, any adjustment to the cost based IUC due to VAS revenue would be inconsistent and in conflict with cost based and work done principle enunciated in the Hon'ble TDSAT's Order.

Furthermore, the Hon'ble TDSAT has also recognized that whatever costbased approach is adopted, it must enable all operators to be able to compete with each other

"Furthermore, each of the operator, be it an established one or a new entrant; be it servicing metropolitan cities or the rural areas or semi urban areas, must be able to compete with the other" (114(12)).

It is therefore most respectfully submitted that any IUC rate that results in a subsidy for one set of operators, would lead to competitive distortions.

## (ii) <u>Capital Costs must be Included</u>

After establishing that the central pillar of establishing IUC is the cost based and work done principle, the Hon'ble TDSAT has also emphasized that capital costs must be included as a component of cost. The Tribunal has stated as below:

"It is not in controversy that cost would include CAPEX/OPEX and depreciation". 114(12)

"It must not be forgotten that every operator must keep its network maintained for use by its own subscribers as well as by subscribers of another operators on equal basis. If that be so, we fail to see any reason as to why the traffic sensitive cost contained in CAPEX should be kept out of consideration" 114(12)

<sup>&</sup>lt;sup>1</sup> "Although we agree that it might not have been possible for TRAI to lay down different charges for different operators, it could not have given a complete go by to the cost based principle or work done principle." (114(12)).

"TRAI failed to take a very significant aspect of the matter into consideration, namely, those who are making investments for infrastructure and those who are hiring them out." 114(12)

"If annualized capital cost is also taken into consideration along with OPEX for calculating the network usage charges payable by the subscribers of all the operators irrespective of the fact as to whom they belong to, could lead to the determination of fair amount of compensation irrespective of any [business] model taken by any operator." 114(12)

It is therefore submitted that cost of capital is a key component in the determination of IUC and for a charge under IUC to be non-discriminatory, it must include annualised capital costs:

## (iii) <u>Future Investment Principle</u>

The Hon'ble Tribunal has also recognized and noted that the charges set should not only be e consistent with the policy objective of the Indian Government to encourage further investment in rural and hill areas but should also be conducive to investment in rural areas. The Tribunal has stated as below

"It was its [TRAI's] duty to adopt such principle which would be conducive for investment in future and in particular in rural and hilly areas". (101(5))

"It was also required to bear in mind that the operators are required to make more investments. A charge should not be based on some premise which would not be investment friendly. Even otherwise, the experience of the TRAI itself is that the established operators are not very much willing to spread their network in rural and far flung areas. If that be so, it was necessary to have a more detailed and elaborate discussions. The TRAI as an expert body should have a vision, what can happen in future keeping in view the experience of other countries may be borne in mind." 114(12) (emphasis added)

## (iv) <u>Charges must be sustainable in the future</u>

The Hon'ble TDSAT has emphasized the importance of ensuring that all operators offer charges that are sustainable in the long run. In the context of the intensely competitive retail market and the low retail tariffs in the Indian market, the Tribunal has rightly observed that it cannot be assumed that the current price level (or ARPU level) is sustainable and efficient. The Tribunal has stated:

"TRAI was therefore required to consider that all the operators must offer the call charges to its customers which would be sustainable in the long run. ARPU, moreover, may not depend on tariffs alone but implementation of business model and deals from the operations also have a role to play." 114(12)

It is most respectfully submitted that the principle/issue of sustainability is also linked to the principle relating to future investment. The IUC charges must be set keeping in mind the vision of the Indian Government for the industry that it would like to see developing in the future – a viable, stable industry that invests in new technology and extends services into rural and hilly areas.

It is therefore imperative that IUC should not be set at unsustainable levels (either too low or too high). It is most respectfully submitted that adopting any methodology which does not take into account all costs, will only encourage a destructive retail price war and urban cream-skimming, which would be clearly inconsistent with the principle of sustainability.

# (v) <u>There must be an above zero termination charge</u>

A direct result flowing from the requirement for IUC to be cost based and investment friendly is that charges cannot be set to zero or to exclude elements of cost (such as capital costs). The Hon'ble TDSAT's judgment states as below:

"An established service provider, in common parlance, have two categories of customers. One retail customers and two wholesale customers. Retail customers are those who are direct customer of service provider meaning thereby with whom there exists a privity of contract.

Wholesale customers, however, would be those who take the services not only of the service provider with whom it has a contractual relationship but with another who is providing interconnect services to another service provider. When the customers of the wholesale market take the benefit of the services not only provided by the service provider with whom he has a privity of contract but also from another with whom he has none, it is difficult to concieve, that charges would be fixed only on the basis of retail markets.

It is not in controversy that the service providers are required to be compensated for the resources used by other service providers." (114(12)) [emphasis added]

"Its [TRAI] jurisdiction being limited to determine the charges on cost based and work done principle" 101(5)

It is clear from the above that a cost based IUC regime cannot allow for IUC to be set below cost or at zero (Bill & Keep).

# (vi) <u>New Entrants not to be afforded privileges</u>

The Hon'ble TDSAT also clearly stated the special interests of new entrants cannot be the principal ground for determining appropriate IUC levels. The Tribunal stated:

"We are also unable to agree with the submission of Mr. Vaidyanathan [TRAI], **that interest of new comers would be the principal ground** to adopt a methodology for determination of inter-operator charges. Policy decisions, in our opinion, in this behalf should be clear and explicit." 101(9)

# III. Inclusion of Expert Evidence

In addition to the above general principles, the Hon'ble TDSAT has also urged the Authority "to consider the matter once again upon taking into consideration all aspects of the matter **including the views of the Experts**:

"we are of the opinion that TRAI should consider the matter once again upon taking into consideration all aspects of the matter including the views of the Experts." 114(11)

To this end, we re-submit the following expert evidence:

- (i) Joint statement signed by:
  - a. Dr Jerry Hausman, Professor of Economics at the Massachusetts Institute of Technology (MIT), Cambridge, USA;
  - b. Dr Janusz Ordover , Professor of Economics, New York University, New York, USA;
  - c. Dr Martin Cave OBE, London School of Economics, London, UK;
  - d. Dr Steve Parsons, Adjunct Professor, Washington University, Missouri, USA & President, Parsons Applied Economics.
- (ii) Statement by ProfessorsJerry Hausman (MIT, Boston USA); and
- (iii) Statement by Dr Steve Parsons.

These are attached as <u>Annexures-2A, 2B and 2C</u> respectively.

It is most respectfully submitted that the Authority may be pleased to take this evidence into account. It is further most respectfully submitted that any deviation from the recommendations of the experts be supported with explicit and reasoned arguments. The Hon'ble TDSAT has stated: *"acceptance of one or the other methodologies should be supported by reasons"* (114(12)).

# IV. Summary Submissions

In conclusion it is submitted that the current consultation must be framed in the context of the Hon'ble TDSAT's Order dated 29 September 2010 which

directed the TRAI to consider the matter afresh and the same be consistent with the principles outlined by the Hon'ble Tribunal.

It is urged that the Authority make all efforts to expedite the matter and conduct a consultation in a time-bound manner. It is therefore again reiterated that the Authority may first focus on and address the core issues highlighted by the Hon'ble TDSAT and, as a next step, take up any or all other issues.

The Authority may kindly clarify on how it intends to deal with the retrospective element contained in the Hon'ble TDSAT's Order that requires the revised IUC regime to be effective /implemented from 1 January 2011. It may be appreciated that uncertainties and delays in the introduction of a stable IUC regime are destructive to effective competition in the telecommunications market.

It is imperative that the IUC rates are set on the basis and within the boundaries of the principles and guidance laid down by the Hon'ble TDSAT. The rates must be set on cost basis and work done principles; should include capital and operating costs, should be conducive to investment, sustainable and be consistent with national objectives of extending services into hilly and rural areas.

# Annexure-1A

# Issues for pre-consultation

Against the above context, we would like to respond to the pre-issues framed by the Authority.

(i) What should be the framework of Interconnection Usage Charges that meets the requirement of today as well as takes care of future developments like deployment of Wi-Max, High Speed Packet Access (HSP A), Fixed Mobile Convergence (FMC) and Next Generation Network (NGN)?

- a. The application of cost-based pricing for interconnection is a well developed practice that seeks to find an appropriate cost basis for well defined services.
- b. The well-established principles of cost allocation principles can accommodate these factors without difficulty.

(ii) What components of IUC for voice, SMS and any other value added services should be reviewed? What should be the level of charge for each component that requires review? Please give detailed justification/ reasons to support your viewpoint.

a. We believe that all the IUC costs set by the Authority need to be reviewed in the light of the principles enunciated by the Hon'ble TDSAT. The levels of charges will be an outcome of a rigorous cost based approach that is based on the work done and other key principles as enunciated by the Hon'ble TDSAT.

(iii) Which of the following approach/ methodology should be used for estimating Interconnection Usage Charges:

- (a) Existing Fully Allocated Cost methodology used by TRAI or any variation in it;
- (b) FLRIC or any other variant;
- (c) Bill and Keep;
- (d) Left to forbearance all components of Interconnection Usage Charges;
- (e) Any other methodology.
- a. The starting point for the Authority ought to be the economic principles that underpin the desired interconnection regime and as have been enunciated by the Hon'ble TDSAT. Any costing methodology that fails to satisfy these principles must be summarily rejected.

- b. It is most respectfully submitted that the Fully Allocated Cost methodology followed by the Authority based on Accounting Separation Reports (ASR) needs to be modified to include capital costs and to meet the cost basis and the work done principles enunciated by the Hon'ble TDSAT.
- c. We would like to emphasize and reiterate that the approach followed hitherto by the Authority is not in consonance with the principles enunciated by the Hon'ble TDSAT. Similarly Bill and Keep fails to meet the same principles

(iv) Explain the approach/ costing methodology adopted, provide the model, if any, developed for estimating the level of each component of IUC for voice, SMS & any other value added services with all calculation sheets. Give justification for adopting the proposed approach/ methodology. Also provide details of revenue, minutes of usage (MOU) (off-net/ on-net), CAPEX and OPEX corresponding to each network element, cables etc. separately for your network.

&

(v) Provide cost and revenue corresponding to each service like voice service, SMS, GPRS, EDGE, roaming services and any other value added services. Also provide cost and revenue for interconnecting services like terminating call, originating call, terminating SMS and originating SMS. All cost and revenue data may be cross referenced with the accounting separation report submitted to TRAI.

- a. Much of these data are already available with the Authority in the Accounting Separation reports submitted by all service providers to the Authority. These may be relied upon by the Authority.
- b. It is however submitted that it is, at this stage, more important for the Authority to conclude on the methodology that it will be adopting to estimate the IUC.

(vi) Justification as to why the model proposed by you should be used for determination of Interconnection Usage Charges for voice calls, SMSs and any other value added services.

a. Please see reply to (iii) above.

# Statement on the Proper Treatment of Capital Costs for a Cost-Based Mobile Termination Charge (MTC)

#### **Summary**

In this brief statement, we treat a question related to the determination of a cost-based mobile termination rate and the proper calculation of the relevant cost for mobile call termination. Should capital costs be included in the cost calculation? The answer is unambiguous – yes, capital costs should be included in the costs of mobile call termination.

### Capital Costs are a Valid Component of Telecommunications Costs

The fundamental cost concept in economics is that of opportunity cost: that is, that costs are determined by the value of resources in their next best alternative use.<sup>1</sup> To evaluate cost, one should first identify the resources that are used in providing a service,<sup>2</sup> and then value those resources; the value of those resources in their best alternative use is generally reflected via the market price of the resources.<sup>3</sup> The opportunity cost corresponding to the use of a piece of electronic equipment is no less real than expenditures for labor for maintenance of that equipment. The distinction between maintenance and operating expenses v. capital costs is not important per se.

There are reasons why the distinction between maintenance and operations expenses versus capital costs is sometimes employed when discussing telecommunications costs.<sup>4</sup> However, nothing in these reasons makes either category any less relevant as a fundamental

<sup>&</sup>lt;sup>1</sup> See virtually any text on the principle of economics, microeconomics, or managerial economics. See, e.g., PAUL HEYNE, THE ECONOMIC WAY OF THINKING 1987 (5<sup>th</sup> ed.), chapter 3, Opportunity Cost and the Supply of Goods. <sup>2</sup> Indeed, in explaining its call termination rate calculation, the Telecom Regulatory Authority of India (TRAI)

stated: "Economists and regulators agree that the approach adopted should be adapted to local conditions and should be based on costs so that the service providers are compensated for their resources use by the other service providers." TRAI "Explanatory Memorandum to "The Telecommunications Interconnection Usage Charges (Tenth Amendment) Regulations, 2009" section 5.3.2.

<sup>&</sup>lt;sup>3</sup> As a technical matter, it is possible that the highest valued alternate use of the resource is by the same firm, and therefore the market value would represent a lower bound of the opportunity cost of the resource.

<sup>&</sup>lt;sup>4</sup> First, this distinction may be consistent with the way expenditures are treated in the books of account; the availability of this accounting data means the data may be useful in performing a cost study. Second, with a network engineering cost calculation method, the forward-looking network is first "designed" and "constructed", then the costs of maintaining and operating the network are added to the network capital costs. And third, the appropriate calculation of capital costs requires a different focus (and different data) than for calculating operations and maintenance expense.

element of opportunity cost that is valid and germane to the proper calculation of call termination costs. Call termination requires resources from each category of cost – both capital costs and maintenance and operations costs.

If one employs this distinction (capital costs versus maintenance and operations costs), what is the economic nature of capital costs? First, as noted above, capital costs should reflect the opportunity costs of the resources required to create long lived capital assets. Capital related costs are comprised of: i) depreciation; and ii) the return on capital, including associated taxes.<sup>5</sup> Economic depreciation should reflect the change in the value of the asset over time. That is, the asset is put to one use (rather than using the resources elsewhere) for some period of time, and because of that use, there is a loss of value in the asset. The loss of value can be due to wear and tear in that use, or simple obsolescence. That is, part of the change of value of the asset is likely due to technical progress—the price of a replacement asset may decrease, which decreases the value of the existing asset. This change in price is part of economic depreciation. By either cause (wear and tear, or technical progress), the loss of the value of the asset – depreciation - is a real economic cost.

In addition to depreciation, there is the opportunity cost of having monies tied up in capital assets.<sup>6</sup> This reflects the lost opportunity to have earned a return from another investment. Like depreciation, this a valid, and very real, opportunity cost. This opportunity cost is also referred to as the weighted average costs of capital (WACC).<sup>7</sup>

No business, or potential business, will make an investment without an expectation that the revenues generated from the investment, will be sufficient to provide the return of the investment (i.e., the recovery of depreciation expenses over time), and a return on the monies invested (i.e., WACC). In telecommunications, capital costs are particularly important because the industry is relatively capital intensive. A cost calculation mistake, by excluding capital costs, will therefore, as a matter of substance, be a more critical mistake in the telecommunications industry, vis-a-vis the same mistake in a less capital intensive industry.

<sup>6</sup> It is determined by the time value of money, as determined in the markets for debt and equity capital.

<sup>&</sup>lt;sup>5</sup> Often, taxes are broken out as a third category of costs.

<sup>&</sup>lt;sup>7</sup> See virtually any textbook on finance. See also, Wikipedia, WACC, available at

<sup>&</sup>lt;u>http://en.wikipedia.org/wiki/Weighted\_average\_cost\_of\_capital</u>. It is noteworthy that the Wikipedia listing for WACC, has "opportunity cost" under the see-also category.

Telecommunications network providers must make capital investments, and these investments have a very real opportunity cost. This is likely one of the reasons why telecommunications regulators around the world have embraced long-run costs, in which all inputs (all resources) are assumed to vary.<sup>8</sup> This long-run construct is explicit in long-run incremental costs (LRIC) which are often employed in telecommunications regulation for the purpose of calculating appropriate charges. It is also embodied in Fully Allocated Costs (FAC, also called Fully Distributed Costs, FDC).<sup>9</sup> Indeed, the very terminology of "Fully" allocating or distributing costs means that all costs are fully accounted for; i.e., all costs, including all capital costs, are included in the cost calculation. Therefore, cost calculations performed for the purpose of establishing cost-based call termination rates in telecommunications always include capital costs, regardless of the cost approach employed. All major telecommunications regulatory and advisory bodies worldwide (of which we are aware) include capital costs (depreciation and return on capital)<sup>10</sup> in their regulated wholesale termination prices. These bodies include the U.S. Federal Communications Commission (FCC),<sup>11</sup> the UK regulator Ofcom,<sup>12</sup> the European Commission,<sup>13</sup> International Telecommunications Union,<sup>14</sup> and the World Bank.<sup>15</sup> The World Bank has issued Principles for Efficient Interconnection Price Structures, of which the first bullet point states that interconnection charges should be cost based, including cost of capital "since

<sup>&</sup>lt;sup>8</sup> See virtually any text on the principles of economics, intermediate microeconomics, or managerial economics, *e.g.*, W. BRUCE ALLEN, et. Al, MANAGERIAL ECONOMICS: THEORY, APPLICATIONS AND CASES, 2005 (6<sup>th</sup> ed) pages 336-339.

<sup>&</sup>lt;sup>9</sup> FAC or FDC generally rely upon accounting data, and often there is no attempt in a FAC or FDC study to make the accounting measures of costs forward looking (i.e., to reflect the current value of assets).

<sup>&</sup>lt;sup>10</sup> And associated taxes.

<sup>&</sup>lt;sup>11</sup> See, eg., In re Implementation of the Local Competition Provisions in the Telecommunications Act of 1996 (FCC 96-325, CC Docket No. 96-98, 95-185). (FCC, released August 8, 1996), as codified in Title 47, Code of Federal Regulations, particularly § 51.505 Forward-Looking Economic Costs.

<sup>&</sup>lt;sup>12</sup> Ofcom, "Mobile call termination", 27 March 2007, A5.2, A5.7, *available at* <u>http://www.ofcom.org.uk/consult/condocs/mobile\_call\_term/statement/</u>, at A5.14.

<sup>&</sup>lt;sup>13</sup> European Commission, "Commission Recommendation of 7.5.2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU".

<sup>&</sup>lt;sup>14</sup> The ITUs Information and Communications Technology (ICT) Regulation Toolkit states: "Incremental cost is usually considered over the long run — long-run incremental cost (LRIC) is the cost of producing a given increment of output, including an allowance for an appropriate return on capital to reflect the costs of financing investment in facilities used for interconnection, as well as the capital costs of those facilities." *Available at* <u>http://www.ictregulationtoolkit.org/en/Section.2164.html</u>

<sup>&</sup>lt;sup>15</sup> World Bank, 2000, *Telecommunications Regulation Handbook*, Washington. Available at http://www.infodev.org/en/Publication.22.html

these costs are necessarily incurred by the operator providing the facilities".<sup>16</sup> The World Bank specifically states:

"Because the telecommunications industry is capital intensive, the cost of capital is a critical issue in determining telecommunications costs, regardless of the costing methodology used. The main point to recall is that **the regulator has to incorporate the correct measure of the cost of capital in its costing methodology in order for the regulated operator to recover all of its efficient capital costs, including its equity and debt costs**."<sup>17</sup> [emphasis added]

In telecommunications, like in many other industries, firms incur some costs that can't be unambiguously attributed to a particular product or service (such as some portion of corporate office and corporate management). Efficiently incurred common (to pick one term) costs must still be recovered, for the firm to be viable. The World Bank states that "by including capital, joint and common costs, a LRIC approach can approximate costs in a competitive market".<sup>18</sup> As indicated in the quote and references above, regulated rates based on a measure of costs (including call termination rates) generally include an additive factor to pay for part of the shared, joint, indirect, or common costs of the telecommunications provider.

# The Economic Implications of Improperly Excluding Capital Costs from Call Termination Rates

In any environment, economic agents respond to the incentives created by prices; whenever a price is established below cost, economic agents respond to the price in ways that will produce inefficient results.<sup>19</sup> Producers are disinclined to provide the service and disinclined to make investments required to provide the service. Consumers will demand more than the efficient quantity and capital assets (used to provide that service) may be utilized beyond their optimal levels (leading to costs to society from congestion, such as blocked calls).

<sup>&</sup>lt;sup>16</sup> *Id.*, p.3-26

<sup>&</sup>lt;sup>17</sup> *Id.*, p. B-11.

<sup>&</sup>lt;sup>18</sup> *Id.*, p.3-26.

<sup>&</sup>lt;sup>19</sup> In the absence of positive external effects.

Under a CPP charging regime, setting below-cost MTC through the exclusion of capital costs would lead to an incentive for mobile operators to avoid those customers that terminate a large proportion of calls and attract those customers that originate a large proportion of calls.

One response to below-cost MTC would be to increase origination charges so that the sum of origination and termination charges covers the relevant costs. However, such a response is only possible when every operator in the market is affected in the same manner. Competition precludes all networks from raising prices if one network does not need to. The effect of this can be shown in the following example: Let's assume there are two broad customers segments: high usage subscribers who make more calls than they receive; and low usage subscribers who typically receive more calls than they make. The ARPU of high volume subscribers may increase under a below-cost arrangement because MTC is seen as a cost and there is no additional investment needed to service them. However, the ARPU of low volume subscribers would decrease with below-cost MTC and operators would need to increase their mobile subscription and calling prices to recover the lost ARPU for the low usage customer segment.<sup>20</sup> However, the ability of a mobile company to rebalance retail prices to offset termination loss would be constrained by mobile companies that have a large proportion of high usage customer.

If the industry is segmented between operators which low usage subscribers and operators which serve only high usage subscribers, adoption of below-cost MTC will create an incentive for all operators to adopt the high user, urban-only business model. Below-cost MTC provides disincentives to invest in network infrastructure or to serve customers who terminate a high proportion of calls (such as may exist in rural areas, and for lower income customers). In a country like India, with relatively low teledensity levels vis-à-vis the rest of the world, creating an artificial disincentive to invest in new network infrastructure and expand mobile penetration to rural and low income subscribers is bad economics, and bad public policy.

Further, providers that have invested in rural infrastructure and low usage subscribers face a competitive disadvantage (created by below-cost wholesale pricing) that is completely unrelated to the efficiency of their operations, and unrelated to achieving any reasonable public

<sup>&</sup>lt;sup>20</sup> Under competition economic profits are zero. Thus, if revenues decrease due to say an industry wide tax, a competitive firm will be required to increase its prices to keep its profit at zero (or positive). See J. Hausman and J. Wright, "Two Sided Markets with Substitution: Mobile Termination Revisited," 2006. More generally for evidence of this effect see Genakos and T. Valletti, "Testing the 'Waterbed' Effect in Mobile Telephony, 2008.

policy goal. Indeed, if public policy suggests (either directly or indirectly) that new investment in telecommunications infrastructure is laudable – then this artificial competitive disadvantage in the retail market pushes providers away from the laudable result.

In telecommunications, in a market with limited penetration, such perverse incentives can be particularly troublesome since they will retard infrastructure investments that may have had large economic multiplier effects; i.e., the extent to which investment in telecommunications infrastructure drives other economic activity in India, creating disincentives to invest in telecommunications infrastructure has a multiplied detrimental effect on the economy in total.

In sum, we expect producers and consumers will be worse off from adopting mobile call termination prices based on "costs" which fail to make any contribution towards recovery of network capital costs.

#### **Excluding Capital Costs from Call Termination Rates is Unprecedented**

We are unaware of any other jurisdiction that excludes capital costs from a calculation of call termination rates. Therefore, the calculation of regulated call termination rates by a process that excludes capital costs, does not produce a cost-based call termination rate, and is a process which is (to the best of our knowledge), unprecedented

# Testament

I find the above statement true to the best of my knowledge and a reasonable statement on the calculation of costs for Mobile Termination for a Cost-Based Rate.

Signed

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Dr. Janusz A Ordover Professor of Economics, New York University, New York, USA

# Signed

Mark Cave

Dr. Martin Cave OBE

Director, Centre for Management under Regulation, Warwick Business School, UK

Signed

Jerry Allen Hausman

Dr. Jerry Allen Hausman

MacDonald Professor of Economics at the Massachusetts Institute of Technology,

Cambridge, Massachusetts, USA

(Continued ...)

Signed

--Ston A Pa

Dr. Steve G Parsons President, Parsons Applied Economics Adjunct Professor, Washington University, St Louis, Missouri, USA

- 1. My name is Jerry A. Hausman. I am MacDonald Professor of Economics at the Massachusetts Institute of Technology ("MIT") in Cambridge, Massachusetts. I received an A.B. degree from Brown University and a B.Phil. and D.Phil. (Ph.D.) in Economics from Oxford University where I was a Marshall Scholar. My academic and research specialties are econometrics, the use of statistical models and techniques on economic data, and microeconomics, the study of consumer behavior and the behavior of firms. I teach a course in "Competition in Telecommunications" to graduate students in economics and business at MIT. Issues in mobile telecommunications, including competitive and technological developments in the industry, are among the primary topics covered in the course.
- In December 1985, I received the John Bates Clark Award of the American Economic Association for the most "significant contributions to economics" by an economist under forty years of age. I have also received the Frisch Medal of the Econometric Society for the best paper in <u>Econometrica</u> over the previous 5 year period. I have received numerous other academic and economic society awards. My curriculum vitae is attached as Exhibit A.
- 3. I have conducted significant academic research regarding the economics of the telecommunications industry. I have published a number of research papers in the area of mobile telecommunications. These papers include "Valuation and the Effect of Regulation on New Services in Telecommunications," <u>Brookings Papers on Economic Activity:</u> <u>Microeconomics</u>, 1997; "Mobile Telephone, New Products and the CPI," <u>Journal of Business and Economics Statistics</u>, 1999; "Economic Welfare and Telecommunications Welfare: The E-Rate Policy for Universal Service Subsidies," <u>Yale Journal on Regulation</u>,

1999 "Efficiency Effects on the U.S. Economy from Wireless Taxation," *National Tax Journal*, 2000; "Competition in U.S. Telecommunications Services Four Years After the 1996 Act," (with R. Crandall), in S. Peltzman and C. Winston, eds., <u>Deregulation of</u> <u>Network Industries</u> (2000); and "From 2G to 3G: Wireless Competition for Internet-Related Services, R. Crandall and J. Alleman ed., <u>Broadband</u>, Brookings, 2002, . I also wrote the chapter on "Mobile Telecommunications" for the <u>Handbook of</u> <u>Telecommunications Economics</u>, 2002, edited by M. Cave et. al. In 2003, I gave the Shann Memorial Lecture at the University of Western Australia, "Mobile, 3G, Broadband and WiFi," published in R. Cooper and G. Madden (eds.), <u>Frontiers of Broadband</u>, Electronic <u>and Mobile Commerce</u> (2004). I have recently completed another paper on mobile telecommunications, "Two Sided Markets with Substitution: Mobile Termination Revisited," (2006).

- 4. I have studied the mobile telecommunications industry since 1984. I have provided declarations and testimony regarding mobile competition and regulation to state public utility commissions and to the U.S. Federal Communications Commission ("FCC") on a number of occasions. I have testified before the FCC in en banc hearings where issues in mobile competition were discussed. I have also provided testimony to the Australian ACCC on mobile termination policy, to the New Zealand Commerce Commission on mobile termination issues, to the Hong Kong Telecommunications Authority on regulation of mobile telecommunications, and to the UK, German, Spanish, and Canadian governments on issues of mobile telecommunications.
- 5. I have significant experience in regulation of both landline and mobile telecommunications.I wrote the chapter on regulation for the international handbook of telecommunications:

"Regulated Costs and Prices in Telecommunications," in G. Madden ed. International Handbook of Telecommunications, 2003. I have authored numerous papers on telecommunications regulation: "The Effects of the Breakup of AT&T on Telephone Penetration in the US," American Economic Review, 1993; "Efficient Local Exchange Competition," Antitrust Bulletin, 1995; "State Regulation of Cellular Prices," Wireless Communications Forum, 1995; Valuation and the Effect of Regulation on New Services in Telecommunications," "Taxation by Telecommunications Regulation," Tax Policy and the Economy, 1998; "Regulation by TSLRIC: Economic Effects on Investment and Innovation," Multimedia Und Recht, 1999; also in J.G. Sidak, et. al. eds., Competition and Regulation in Telecommunications, 2000; "A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks," Yale Law Journal, 1999; "Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers", Yale Journal on Regulation, 2001; "Cable Modems and DSL: Broadband Internet Access for Residential Customers," American Economic Review, 2001; "Competition and Regulation for Internet-related Services", in Korea Institute for Industrial Economics and Trade, Industrial Competitiveness and Competition Policy in the Era of Telecommunication Convergence. 2001; "The Effect of Sunk Costs in Telecommunication Regulation," in J. Alleman and E. Noam, eds, The New Investment Theory of Real Options and its Implications for Telecommunications Economics, 2002; "Competition and Regulation for Internet-related Services: Results of Asymmetric Regulation", R. Crandall and J. Alleman ed., Broadband, Brookings, 2002; "Does Bell Company Entry into Long-Distance Telecommunications Benefit Consumers?," Antitrust Law Journal, 2002; "Why do the Poor and the Less-Educated Pay More for LongDistance Calls?," <u>Topics in Economics Analysis and Policy</u>, 2004; "Did Mandatory Unbundling Achieve Its Purpose? Empirical Evidence from Five Countries," <u>Journal of</u> <u>Competitive Law and Economics</u>, 2005; "Are Regulators Forward-Looking? Copper Prices and Telecommunications Networks," <u>FCC Communications Journal</u>, 2009. I have a forthcoming paper on the effects of regulation of telecommunications in the US: "Telecommunications Regulation: Current Approaches with the End in Sight," forthcoming in N. Rose. ed., 2009.

- 6. When the US FCC adopted TELRIC based pricing in 1996, I submitted testimony explaining how it should be done and the FCC asked me to make a presentation to their staff and to the FCC Commissioners on the correct method to set regulated prices. I have given similar advice on the proper method of regulation to the governments of the UK, Australia, New Zealand, Canada, and Sri Lanka.
- 7. From 2002-2006 I was an Advisor to the China Ministry of Information on Telecommunications Regulation. I advised the Chinese government on the correct framework for cost-based regulation of landline telecommunications. I also advised on mobile policy issues including adoption of 3G technology and the choice of calling-party pays or receiving-party pays for mobile termination.
- 8. I have been invited to give talks regarding the wireless industry on many occasions all over the world. I have also testified before the United States Congress and Administrative Agencies of the Federal Government on issues involving the mobile telecommunications industry. For example, in 1995, I testified on "Competition in Mobile Markets," Testimony before the U.S. House of Representatives, Committee on Commerce, October 12, 1995. In 2001 I testified on "Competition in Mobile Markets in Australia," before the Australian

Competition and Consumer Commission ("ACCC"). In 2006 I gave the keynote address to the ACCC Conference on regulation in Australia.

## A. Purpose of Declaration and Conclusions

- 9. Vodafone Essar Limited (VEL) has asked me to explain the economically correct method that a regulatory authority should use to set interconnection usage charges. In particular VEL has asked to review and comment on the Telecommunications Regulatory Authority of India's (TRAI's) proposed approach.
- 10. When setting regulated interconnection usage charges the correct cost-based approach is to use the framework of Forward-Looking Total Service Long Run Incremental Cost (LRIC). This approach covers the minimum cost of providing the service given a long run framework where capital is adjustable and the increment is the amount of service in question. The regulated price should often be adjusted and often increased above LRIC to take account of joint and common costs, sunk and irreversible investments, and externalities.
- 11. I am unaware of any regulatory agency in a calling party pays (CPP) framework among OECD countries that has not based interconnection charges on the LRIC framework.<sup>1</sup> Given the "long run" in LRIC the cost of capital must be included. I am unaware of any leading regulatory authority that has not included the cost of capital in its regulated prices. This consideration is especially important in mobile and landline telecommunications

<sup>&</sup>lt;sup>1</sup> In the US the FCC uses the closely associated TELRIC (total element long run incremental cost). The only exception in the US of which I am aware is that for free dial-up internet calls the US FCC adopted bill and keep because of problems of regulatory arbitrage. However, only the US, Canada, and New Zealand have free dialup internet calls.

because of the large proportion of capital costs in the total costs of providing service and because of the presence of networks in telecommunications provision.

- 12. The TRAI does not apply LRIC to calculate the mobile termination cost. Instead, it uses a fully allocated cost (FAC) approach which is flawed because it does not include capital costs. Correcting this mistake leads to an MTC of Rs. 0.41 instead of the incorrect Rs. 0.20, as calculated by the TRAI.
- 13. Once regulated prices have been set, telecommunications firms should be allowed to make voluntary private arrangements such as "bill and keep" for the exchange of traffic between networks.<sup>2</sup> However, it is a mistake for a regulatory agency to decree the use of bill and keep because traffic amounts and service costs may well differ across competing firms. Use of bill and keep will typically also lead to an economically inefficient outcome.

## **B.** Economic Principles of LRIC Regulated Prices

14. Long run incremental cost (LRIC) is the approach to set regulated access prices used by almost all regulatory agencies. The UK regulator Ofcom recently stated: "LRIC is widely used as a regulatory costing technique, for example by other National Regulatory Authorities in Europe and by the FCC in the USA ... Ofcom continues to hold the view that a LRIC methodology constitutes the most appropriate means of determining the efficient levels for charges on mobile voice call termination services."<sup>3</sup> LRIC is also used by other regulatory bodies in Australia and New Zealand and when I was a

<sup>&</sup>lt;sup>2</sup> Under a "bill and keep" arrangement, each network provider agrees to terminate the traffic originated by the other provider, without an explicit charge for such termination. Each provider bills their customers originating the calls, and keeps that revenue.

<sup>&</sup>lt;sup>3</sup> See Ofcom, "Mobile call termination", 27 March 2007, ¶ A5.2-5.3.

telecommunications advisor to the Chinese government I recommended the used of LRIC, a position which the government adopted.

- 15. I first explain the framework of LRIC regulation. I largely follow the approach I used in my handbook chapter, "Regulated Costs and Prices in Telecommunications" in the <u>International Handbook of Telecommunications</u>, 2003.
- 16. The typical approach to cost-based regulation in telecommunications is to use costs of production to set prices that would be the result of a "competitive" situation. I begin with the most simple model of costs-based regulation where only a single output service is produced. The given regulated telecommunications service is produced by one or more input factors which can be thought of as capital inputs, e.g. mobile towers and switching systems and non-capitalized labor inputs, e.g. for maintenance of equipment.<sup>4</sup> No multiperiod capital goods are present in the initial simple model. I assume that marginal cost remains constant as quantity increases but there is also a fixed cost of production. The cost function of the single service can be written as:

$$C(q,w) = F + wq \tag{1}$$

where F is the fixed cost, q is output quantity, and w is the constant marginal cost per unit of output. A regulator might conclude that in a competitive, free entry situation price would equal average cost, so that

<sup>&</sup>lt;sup>4</sup> In telecommunications, some portion of expenditures on labour are associated with the placement of long-lived capital assets, and are these labor expenditures are generally capitalized with the expenditure on the capital asset. Here, "labor" is a more simple variable input.

$$p = (C/q) = (F/q) + w.$$
 (2)

Setting price equal to average cost seems to be the correct outcome, for a firm producing a single service, if the regulated utility is to recover its costs so long as demand factors are not taken into account, which is the usual situation when a regulated price is set based on cost factor.

17. Note that in this simple single period model all fixed costs, F, (which is comprised of capital costs and other fixed costs) and variable (operating) costs, wq, that vary with quantity produced are captured in the price p. The correct way to think about the problem is that the regulated firm "rents" the capital at the beginning of the period and uses it for that period to produce the output q. The cost of this capital is the opportunity (interest) cost plus the depreciation (expected change in market value caused by wear and tear on the equipment and technological progress) of the capital used. In terms of its components, the capital cost a equals:

$$\mathbf{a} = (\mathbf{r} + \boldsymbol{\alpha} + \boldsymbol{\delta}) \mathbf{k} \tag{3}$$

where r is the rate of interest (i.e. the firm's cost of money),  $\alpha$  is the rate of technological progress,  $\delta$  is the rate of physical depreciation caused by wear and tear in the use of the equipment, and k is the price of the capital good in question.<sup>5</sup> Note that the firm must

<sup>&</sup>lt;sup>5</sup> For a further discussion of the effect of technological progress and depreciation on the cost of capital see e.g. J. Hausman, Valuation and the Effect of Regulation on New Services in Telecommunications," <u>Brookings Papers on Economic Activity: Microeconomics</u>, 1997, p. 32, equation (9) and J.J. Laffont and J. Tirole, <u>Competition in Telecommunications</u>, MIT Press,

recover its capital costs in the regulatory set price, just as it must recover its operating costs in the regulatory set price. Otherwise, the firm will lose money. Thus, capital is an input of production whose cost must be recovered in competition similar to other inputs such as labor.<sup>6</sup>

18. Of course, most firms own their own capital, but equation (3) still determines the capital cost in setting a regulated price. Suppose the firm continues to provide a single service and buys the capital good and uses it over many periods until it is replaced. The capital cost along with other fixed costs and variable cost determine the cost in each period where equation (3) determines the capital cost. Thus, in considering the "long run" in LRIC, the capital costs contribute to the overall cost, where the capital cost arises from buying the capital goods to produce the service and their yearly cost follows from equation (3). In the "long run" all capital is mobile so it must be paid for. If capital costs are not included in the cost base, the firm will not cover its cost of producing the service in the long run.<sup>7</sup> This consideration is especially important in mobile and landline telecommunications because of the large proportion of capital costs in the total costs of providing service because of the presence of networks in telecommunications provision.<sup>8</sup> . This consideration is of particularly relevance to India which is about to start investment in 3G which will require

Cambridge, MA, 2000, p. 152. The authors state that this capital cost plus operating costs determines the equilibrium access price.

<sup>&</sup>lt;sup>6</sup> Ofcom, op. cit., A5.20, in determining the MTR in the UK uses a "cost module" which estimates "network costs based on asset costs (both capital and operating) and a projected network deployment."

<sup>&</sup>lt;sup>7</sup> In the short run, as opposed to the long run, investment costs are already incurred and much of the investment is a sunk cost. However, in the long run investment is not sunk so the cost of capital must be taken into account.

<sup>&</sup>lt;sup>8</sup> The UK regulator Ofcom estimates that in mobile service in 2005 (latest year of data) that operating costs are only 8.7% of overall aggregate costs which emphasizes the importance of the recovery of capital costs along with other fixed costs. See Ofcom, "Mobile call termination", 27 March 2007, ¶ A12.30.

significant investment expenditure in capital equipment. Since the goal of regulation is to mimic the result of a competitive situation, the firm must recover its cost in a competitive situation or it will exit the industry.

19. I now consider the role of joint production of two or more services and common costs. I consider a regulated firm which produces two services; say outgoing calls and incoming calls. In terms of the cost function I will again assume constant marginal costs for each output:

$$C(q_1, q_2; w_1, w_2) = F_1 + w_1 q_1 + F_2 + w_2 q_2 + G$$
(4)

where  $F_1$  is the fixed cost of producing service 1, in the sense if service 1 were not produced this fixed cost would equal zero.  $F_2$  has the same role for the second service. The common cost G arises when two (or more) services arise from a joint production process, but some of the cost is incremental to neither product. The term "fixed and common costs" arises often in discussion of regulated costs and prices because of the common occurrence of this type of cost. Note that in equation (4) the fixed cost *G* cannot be uniquely assigned to either output. The LRIC of producing service 1 is computed as:

$$LRIC_1 = F_1 + w_1 q_1 \tag{5}$$

where the cost of capital enters as before and the size of the increment is the entire quantity of service 1 produced, hence the name "Total Service" LRIC (TSLRIC) or "Total Element" LRIC (TELRIC) is often used alongside LRIC.<sup>9</sup>

- 20. Note that in equation (4) the fixed cost *G* cannot be uniquely assigned to either output. An example would be a head office and general corporate management (e.g. finance, legal, HR, etc) which cannot be uniquely assign to either incoming calls or outgoing calls. That is, if either  $q_1 = 0$  so there were no outgoing calls, but only incoming calls, the cost of G would continue to exist since head office and general corporate management would still be required. Similarly, if there were no incoming calls so  $q_2 = 0$  G would still be needed for outgoing calls. Thus, the common cost G is required by both services. As such, LRIC, as defined in equation (5) above disregards the common costs G, which the firm must, in some way, recover.
- 21. Now setting the regulated price of each service equal to "average cost" requires some caution, and some explanation. Indeed, the measure of average costs shown in equation (2) cannot be applied; the resulting prices would preclude the firm from covering all its costs (i.e., precludes recovery of common costs G). Consider what occurs if the common costs G are ignored, the regulated price per unit for the first service, would then be set as:

$$p_1 = (LRIC_1)/q_1 = (F_1/q_1) + w_1$$
 (6)

<sup>&</sup>lt;sup>9</sup> See J.J. Laffont and J. Tirole, <u>Competition in Telecommunications</u>, MIT Press, Cambridge, MA, 2000, p. 105 who state: We thus conclude that what the wholesale price [access charge] should, like the incumbent's retail prices, participate in the coverage of the network's fixed costs."

And the price of the second service,  $p_2$ , is set in a similar manner by LRIC<sub>2</sub>. However, the sum of the revenues from the two services is below the total cost of the two services:

$$p_1q_1 + p_2q_2 < C(q_1, q_2; w_1, w_2) = F_1 + w_1q_1 + F_2 + w_2q_2 + G \quad (7)$$

because a pure LRIC determined price does not include the common costs G. The firm would not cover its costs under this application of LRIC because common costs are not included in the regulated unit price.

22. Here regulators typically choose to use an allocation of the fixed cost *G* to each service. The FCC stated: "We conclude that, under a TELRIC methodology, incumbent LECs' prices for interconnection and unbundled network elements shall recover the forward-looking costs directly attributable to the specified element, as well as a reasonable allocation of forward-looking common costs."<sup>10</sup> The FCC further stated: "We conclude that forward-looking common costs shall be allocated among elements and services in a reasonable manner, consistent with the pro-competitive goals of the 1996 Act."<sup>11</sup> Thus, the FCC stated that all direct cost, including capital costs should be included, as well as a share of joint and common costs. Similarly, the UK regulator Ofcom in setting the MTR in its most recent 2007 review includes an allocation of common costs in the MTR in addition to the LRIC cost.<sup>12</sup>

 <sup>&</sup>lt;sup>10</sup> FCC: "Local Competition First Report and Order", CC Docket 96-98, August 1996, ¶682.
 <sup>11</sup> Ibid., ¶696

<sup>&</sup>lt;sup>12</sup> See Ofcom, "Mobile call termination", 27 March 2007, ¶ A15.1-A15.4. Common costs include administrative costs in terms of general overheads, and customer acquisition, retention and service costs.

- 23. A recent study of the markup to LRIC costs to account for common costs found a median markup of 15%.<sup>13</sup> Thus, the amount of common costs is significant so a markup to LRIC should be used.
- 24. The conclusion of my economic analysis is that the mobile termination charge (MTC) should be based on LRIC such that all long run incremental costs, including the capital costs, should be included in the calculation of LRIC. An allowance in the MTC should also be made to cover part of the common costs of providing mobile service. The need for recovery of common costs occurs regardless of the method one might employ to estimate the costs of mobile call termination. Therefore, regardless of whether one employs estimates from a bottoms up, engineering economic model, or a top-down accounting model, whether a form of incremental cost or a type of fully allocated cost common costs must still be recovered.

<sup>&</sup>lt;sup>13</sup> B. Palmer and P. Hollinger, "Key Cost Concepts and Methodologies Used to Price Unbundled Network Elements in the United States", 27 August 2007, ¶19. Canada also uses a markup for common costs of 15%.

#### C. Welfare effect of setting MTC below cost

- 25. Regulated prices in turn have important effects on competition, economic efficiency, and consumer welfare.<sup>14</sup> In competitive markets demand elasticities are an important component of pricing decisions in a multi-product situation. Instead of using inherently arbitrary allocation procedures, regulators could improve the outcome of the regulatory process either by taking account of demand and competitive conditions. I will return to this point below.
- 26. Many regulators, e.g. Ofcom in the UK and in both Australia and New Zealand, have adopted the regulatory position that regulatory error in setting prices too low typically causes a greater loss to economic efficiency and consumer welfare which is significantly greater that regulatory error in setting prices too high. This outcome occurs because if regulated prices are set too low insufficient investment will typically occur. With insufficient investment consumers are unable to purchase services they would otherwise buy which leads to a large loss in consumer welfare and economic efficiency.<sup>15</sup> This outcome would occur if the regulated price does not permit recovery of efficiency costs that arise in a LRIC framework. Thus, regulators attempt to err on the high side (but not too high) to guard against the effects of regulatory error.
- 27. The loss to economic efficiency and to consumer welfare from regulated prices that cause under-recovery of efficient costs for regulated services seems potentially extremely high in India where the outcome would be delayed investment in mobile services in rural India.

<sup>&</sup>lt;sup>14</sup> Economic efficiency is the effect on consumers and producers; i.e., the sum of producer and consumer surplus.

<sup>&</sup>lt;sup>15</sup> For estimation of consumer welfare loss in telecommunications caused by incorrect regulation see J. Hausman, "Valuation and the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity: Microeconomics*, 1997.

Since fixed line penetration is very low in India, the spread of mobile to rural areas will increase communications to a significant degree.

28. Using the Average Revenue per User (ARPU) of approximately Rs. 3,000 per year (Rs. 250 per month) and the price elasticity estimated by Kathuria et. al. I estimate the lower bound to the gain in consumer welfare to be to be approximately Rs. 781 per year for each new mobile subscriber.<sup>16</sup> The calculation of this amount arises from using the estimated price elasticity to determine the "virtual price", i.e. the price which would set demand equal to zero. I then take the difference between the virtual price and actual price to calculate the gain in consumer welfare since the consumer realize the cost savings by not having to pay the virtual price. This amount equals approximately 1.25% of an average Indian's income so that it is a significant amount.<sup>17</sup> For example, for 10 million additional mobile subscribers the consumer welfare gain is Rs. 7,810 million per year. While lower income subscribers have lower ARPUs so that the absolute gain in consumer welfare would be less for them, their average incomes are also lower so the percentage increase in consumer welfare for lower income consumers will be higher than for high income consumers since lower income consumers spend a greater percentage of their income on mobile service.

<sup>&</sup>lt;sup>16</sup> At current exchange rates this amount is about \$17.00. See J. Hausman, "Sources of Bias and Solutions to Bias in the CPI", *Journal of Economic Perspectives*, 17, 2003 for a discussion of this approach and how the calculation is done. Note that this estimate of the gain in consumer welfare is a lower bound estimate. I use an estimate price elasticity for India from R. Kathuria, M. Uppal, and Mamta, "An econometric analysis of the impact of mobile," p. 17, in Vodafone, The Policy Paper Series, January 2009.

<sup>&</sup>lt;sup>17</sup> See R Kathuria, op. cit., p. 9, for an estimate of average income.

#### D. Analysis of Bill and Keep as a Possible Policy Outcome

- 29. Lastly, I turn to the question of whether "bill and keep" (B&K) should be the outcome in a CPP framework. I am unaware that the regulated MTC has been set to zero, which is the B&K outcome, in any advanced regulatory setting, e.g. the UK, Australia, New Zealand, and the other EU countries that apply a CPP regulated framework. Under certain economic conditions, e.g. balanced traffic, carriers may find it in their best interests to voluntarily adopt a reciprocal B&K outcome, but unless a massive regulatory failure occurs regulators should continue to use cost based pricing.<sup>18</sup> That is, regulation should not stop carriers from privately agreeing on a B&K reciprocal agreement, but regulation should not adopt B&K as a policy outcome.
- 30. One key implication of mandatory B&K is that it provides an incentive for providers to acquire subscribers that originate a high proportion of calls, and avoid customers that terminate a high proportion of calls. Without an MTC, costs and revenues are misaligned; a customer that only terminates calls causes the network provider to incur costs, but to receive no revenue from calls. This outcome incorrectly reduces the incentive for network providers to invest in rural areas, or other areas in which customers will be likely to terminate a high proportion of calls. Correct economic incentives require that costs, and revenues, are aligned.
- 31. In India where the mobile industry is highly competitive with among the lowest mobile calling prices in the world, the adoption of B&K would be a significant policy mistake. It is

<sup>&</sup>lt;sup>18</sup> A massive regulatory failure occurred for dialup internet access in the US where the price to the calling party was free. The FCC adopted B&K to stop the distortion of "call sinks" from occurring where terminating networks paid people to keep connected so they could charge the originating network increased terminating fees. The FCC stopped this distortion by adopting B&K for dialup internet calls. However, note this distortion was caused by setting the price of dialup internet calls to zero which created the massive regulatory distortion.

likely that the introduction of B&K will distort infrastructure investment and promote business models which limit investment to major urban areas and promote massive increases in usage. This outcome may be beneficial to urban residents, but will do little to encourage mobile operators to invest in expanding network coverage or to assist low volume users to adopt mobile phones. I explain why below.

- 32. Let's assume there are two broad customers segments: high usage subscribers who make more calls than they receive; and low usage subscribers who typically receive more calls than they make. The ARPU of high volume subscribers may increase under a B&K arrangement because MTC is seen as a cost and there is no additional investment needed to service them. As I understand it, the policy focus of the Indian Government is to promote rural coverage and penetration and reduce the digital divide between urban and rural subscriber.
- 33. Under competition if mobile companies did not receive an MTC, they would receive lower ARPU and would be forced to increase their mobile subscription and calling prices to cover their costs, or introduce charges to receive calls, for the low usage customer segment.<sup>19</sup>
- 34. Indeed, the network costs of mobile companies that have a large proportion of low usage subscribers would likely increase because the number of inbound calls would increase since the call costs for high usage subscribers are likely to fall (because MTC is a cost for this segment) we would also expect call quality of service to decline as the network becomes congested due to extra incoming traffic.

<sup>&</sup>lt;sup>19</sup> Under competition economic profits are zero. Thus, if revenues decrease due to say an industry wide tax, a competitive firm will be required to increase its prices to keep its profit at zero (or positive). I found evidence of this (waterbed) effect in the UK when Ofcom decreased MTR prices. See J. Hausman and J. Wright, "Two Sided Markets with Substitution: Mobile Termination Revisited," 2006. More generally for evidence of this effect see Genakos and T. Valletti, "Testing the 'Waterbed' Effect in Mobile Telephony, 2008.

- 35. However, the ability of a mobile company to rebalance retail prices to offset termination loss would be constrained by mobile companies that have a large proportion of high usage customer.
- 36. If the industry is segmented between operators which serve rural and low usage subscribers and operators which serve only urban areas and focus on high usage subscribers, adoption of B&K (or below cost MTC) will create an incentive for all operators to adopt the high user, urban-only business model. As a result, operators are likely to forgo mass rural investment and focus on providing services to urban subscribers.
- 37. Using the observed mobile diffusion trends from other markets, there is a high probability that the future growth in Indian penetration is likely to come from subscribers whose ARPU contains a significant component of incoming revenue. In addition, these additional subscribers are also likely to need significant investments in mobile coverage in order for the mobile operators to be able to offer services. It is likely, therefore, that sustaining ARPUs would be important in making further coverage investment a viable option for mobile operators.
- 38. Given the estimated high economic benefits to mobile in India and other less developed countries, this decrease in mobile penetration would lead to significantly decrease economic efficiency and consumer welfare.<sup>20</sup> Thus, adoption of a B&K policy in India would be a regulatory mistake of the highest order.

<sup>&</sup>lt;sup>20</sup> For an estimate of economic efficiency gains in China see J. Hausman, "Mobile, 3G, Broadband and WiFi," published in R. Cooper and G. Madden (eds.), Frontiers of Broadband, Electronic and Mobile Commerce (2004). For estimates for India, see R. Kathuria, op. cit. Numerous studies have found significant economic efficiency gains from the use of mobile telephone in India.

| Statement by | Steve | G. Parsons, | Ph.D. |
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I. Introduction and Summary

Professional Qualifications

My name is Steve G. Parsons and I am president of Parsons Applied Economics. I have a Ph.D. in Economics from the University of California at Santa Barbara where I was both a University of California Regents Fellow and an Earhart Foundation Fellow. I have taught at several universities and am currently an adjunct professor at Washington University in St. Louis. I teach "the Economics of Technology" to graduate students in the School of Engineering, and previously taught "the Economics of Telecommunications and Information Systems" and "Telecommunications Regulation and Public Policy" in

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the Telecommunications Management program at the same university. I have made many professional presentations and written many protessional papers analyzing economic issues in telecommunications. My research in the telecommunications industry has been published in books and industry/trade, economic, and law journals including the Journal of Regulatory Economics; the Southern Economics Journal; the Administrative Law Review; the Yale Journal on Regulation; the Federal Communications Law Journal; Information Economics and Policy; Hastings Communications and Entertainment Law Journal; and the International Journal of the Economics of Business. My academic, consulting, and testifying work has included issues such as economic costs, pricing, interconnection, reciprocal compensation, competitive standards and safeguards, and regulatory reform. I have taught cost studies and cost principles, pricing, and applied economics through various industry associations, universities, and other venues for more than 25 years. I have been involved in over 200 telecommunications cases and projects, and have served as the primary expert economic witness on over 40 occasions, filing reports, written testimony, and affidavits, as well as testifying in depositions and before state courts, U.S. federal courts, state public utility commissions, a regulatory authority for a U.S. protectorate, the Federal Communications Commission, and regulatory authorities outside the U.S. 1 have worked for incumbents, large end users, new entrants, and regulators in the telecommunications industry in North America, Latin America, the Pacific Rim, and Central Europe.

A more detailed description of my qualifications is contained in my attached curriculum vitae, attached at ANNEXURE B to the main Rejoinder.

#### Materials Reviewed

In preparing my opinion, I have reviewed the following materials:

Bharti Airtel Ltd. & Anr. v. Telecom Regulatory Authority of India & Ors. REPLY ON BEHALF OF THE RESPONDENT No 1 TELECOM REGULATORY AUTHORITY OF INDIA (TRAI) [hereinafter TRAI Reply];

"Explanatory Memorandum to 'The Telecommunications Interconnection Usage Charges (Tenth Amendment) Regulations, 2009" [hereinafter TRAI Explanatory Memorandum];

TRAI Consultation Paper on Determination of Port Transaction Charge, Dipping Charge and Porting Charge for Mobile Number Portability (MNP Consultation), 22 July 2009

Certain materials referenced by the TRAI Explanatory Memorandum (e.g., ASWATH DAMODARAN, CORPORATE FINANCE: THEORY AND PRACTICE, (2d ed. 2001) (cited in TRAI Reply, at page 18).

Price Waterhouse Coopers, "Indian GSM Cellular Benchmarking Study 2008" at 16 (April 2009), and other sources related to the financial statistics of operators.

The Reporting System of Accounting Separation Regulation, TRAI, 2004 (4 of 2004), available at http://www.dot.gov.in/Acts/legislation/23feb2004.pdf.

Various sources on financial statistics, telecommunications regulation, economics, and costs for call termination.

#### Purpose and Tone

I signed and fully agree with the document "Statement on the Proper Treatment of Capital Costs for a Cost-Based Mobile Termination Rate" [hereinafter referred to as Multiple Experts Statement]. My purpose here is to expand the discussion of the proper inclusion of capital costs in a calculation of a cost-based mobile termination rate, and discuss closely related cost topics based upon my own professional experience and academic research.

The majority of my professional experience, academic research, and published work is specific to economics as applied to the telecommunications industry. Much of that work has involved the proper conceptual treatment of telecommunications costs and their method of calculation. I have conducted, reviewed, or supervised many telecommunications cost studies and I have trained literally hundreds of telecommunications cost analysts and others who use cost information for regulatory purposes and business decisions. This training included both the proper economic principles underlying economic costs as well as the appropriate methods by which to calculate costs.

#### Summary of Topics Treated

My expert statement is divided into seven sections. Below is a summary of each section.

Section II notes that TRAI does not provide any expert opinion nor cites a single authority to support the exclusion of capital costs from the MTC. In contrast, Appendix A (attached to this statement) quotes at length the literature on regulatory policy, economics, and related disciplines. This is unanimous in noting that a call termination rate should contribute to the costs of the capital assets that provide call termination service. Moreover, capital costs are appropriately included regardless of the cost technique employed. That is, both Fully Allocated Cost (FAC, which TRAI choose to employ) and Long-Run Incremental Cost (LRIC) require the inclusion of capital costs in a MTC calculation. In addition, if the

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TRAI was uncertain as to whether to include or exclude capital costs, benchmarking against the costbased MTCs in other countries would have been a red flag that it had erred in excluding capital costs.

While TRAI cites no sources to support it's exclusion of capital costs from the MTC calculation, Section III describes how the sources it does cite for support are actually consistent with the inclusion—not the exclusion—of capital costs.

Section IV notes that TRAI initially describes, in its Explanatory Memorandum to the IUC Regulations, a valid standard for "fair compensation" that "should be based on cost so that the service providers are compensated for their resources used by other service providers." However, while the networks of mobile operators are required to provide call termination service, I highlight that the TRAI excludes the cost of using those assets to provide that very service.

Section V describes how TRAI has confused the acronym CAPEX with the ongoing capital costs associated with the use of capital assets. This confusion may have contributed to TRAI's mistake in excluding capital costs from the MTC calculation. However, the distinctions between OPEX and capital costs are based upon accounting convention, not fundamental economics. There is nothing in the distinction between capital costs and OPEX that justifies the exclusion of capital costs from the MTC.

Although TRAI's rationale for excluding capital costs is not clear, in Section VI, I evaluate what appears to be TRAI's six arguments for excluding capital costs. I respectfully conclude that these arguments are internally inconsistent, incorrect, generally unsubstantiated, and insufficient to justify TRAI's decision to exclude capital costs in its MTC calculation. The inconsistencies exist in part since TRAI does not adequately distinguish between capital costs and OPEX; its incorrect arguments for excluding capital costs would (if correct) apply to OPEX as well. The exclusion of capital costs is also inconsistent with its prior regulatory decisions.

In Section VII, I examine the specific elements of TRAIs MTC calculation. I make a simple partial adjustment to the calculation to include depreciation and post-tax WACC; this produces a MTC of Rs 0.37. This calculation employs TRAI's method for calculating OPEX and excludes the cost of income taxes. I also note that TRAI's method of estimating the OPEX for VAS likely overstates VAS costs and understates the MTC, but unlike the exclusion of capital costs, this is not a gross error in the application of fundamental principles. This section also warns that the cost of equity can't be obtained from the accounting records. Further, this section describes how and when costs are likely to decline, or rise. One should not expect average costs to decline when providers are expanding into less densely populated areas.

II. Capital Costs Are a Valid Component of Telecommunications Costs and International Best Practice Includes Capital Costs in Mobile Termination Rates

The Multiple Experts Statement describes why capital costs are a valid component of telecommunications costs. The inclusion of capital costs in a cost-based call mobile termination charge (MTC, or in some jurisdictions MTR, mobile termination rate) is so fundamental, it is difficult to imagine someone making the mistake of intentionally excluding capital costs. It is bit like building a car, but excluding the engine.<sup>1</sup>

The proper inclusion of capital costs in a MTC calculation is consistent with the basic principles of economics, areas of sub-speciality in economics (such as public utility regulation), and related disciplines (such as accounting, to the best of my knowledge). This treatment is consistent with my experience and teaching of cost concepts and is consistent with the international best practice for calculating costs for MTC, for other regulatory cost purposes, and for estimating costs for business purposes.

# TRAI Provides No Support for Its Claim that It Has Adopted International Best Practice

TRAI uses the term "best practice" three times in its Memorandum of Explanation, but in each case only in reference to comments by parties (e.g., with respect to hybrid FL-LRIC). In its reply, TRAI claims that "[t]he adopted methodology uses well understood principles of calculating costs and also the data that is submitted by the service providers themselves in their accounting separations report"<sup>2</sup> and "denie[s] that the outcomes depart from principles of economic theory, international best practice and the legal requirement imposed on the TRAL."<sup>3</sup>

Two points are particularly noteworthy. First, TRAI does not specifically claim that the exclusion of capital costs in a MTC calculation is in keeping with international best practice. One could carefully read the TRAIs reply to conclude that it is the use of "actual cost" or accounting costs that is "well established." It is certainly true that the use of accounting data for estimating MTC is well established as one of the accepted methods (and sources of data) by which to estimate MTC (in addition to the well established method of using forward-looking Long-Run Incremental Costs, LRIC). The validity of TRAI's statement with respect to the acceptance of historical costs does not, however, go to the heart of the Issue—whether TRAI's exclusion of capital costs is "well established" and, in particular, whether it satisfies the standard of international best practice.

<sup>2</sup> TRAI Reply at 1026.

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<sup>&</sup>lt;sup>1</sup> In telecommunications, capital investment is the engine for growth in penetration and teledensity.

<sup>3</sup> Id. at 1020.

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Second, in its Memorandum of Explanation and its Reply, TRAI provides not a single citation, quotation, nor expert opinion to suggest that its exclusion of capital costs is in keeping with principles of economic theory, well established, a "best practice," or in compliance with international best practice.

#### Material in Support of the International Best Practice of Inclusion of Capital Costs in a MTC

In this statement, I explain, based upon my experience in conducting and reviewing telecommunications cost studies and in training hundreds of telecommunications managers and analysts regarding telecommunications costs and their calculation, that it is international best practice to include capital costs in a call termination rate. Moreover, fundamental economic principles dictate that the capital assets that are required to provide call termination service have associated capital costs. However, one need not simply take my word for this, or the word of the other economists who signed the Multiple Experts Statement. In the attached Appendix A, "Materials Supporting the Inclusion of Capital Costs in an MTC," I quote and provide reference to some of the material indicating that the inclusion of capital costs in a MTC is valid, proper, and required by international best practice.

It is easy to choose, even at random, an economics reference that is consistent with the inclusion of capital cost in a MTC calculation. However, finding quotations in the academic literature stating that capital costs should not be excluded from an MTC calculation is far more difficult. By analogy, this would be like finding a mechanical engineering text that states that one should not attempt to build a car without an engine; the error is so fundamental and relatively obvious that it does not generally arise in discussion. Nonetheless, the attached Appendix A provides quotations and references from regulatory economics and associated disciplines that demonstrate that a properly calculated call termination rate must include the costs of using the capital assets that are required to provide the service.

#### Capital Costs Are Appropriately Included Regardless of the Cost Technique Employed

The telecommunications industry has a long and rich history in dealing with cost topics.<sup>4</sup> The terms that have been used in the telecommunications that reflect the type of cost study performed include: Incremental Cost (IC); Long-Run Incremental Cost (LRIC); Total Service Long-Run Incremental Cost; Forward-Looking Economic Cost (FLEC); Forward-Looking LRIC (FL-LRIC); Total Element Long-Run Incremental Cost (TELRIC); Average Incremental Cost (AIC); Long-Run AIC (LRAIC); Embedded Cost; Historical Cost; Fully Allocated Cost (FAC); Fully Distributed Cost (FDC); and hybrid cost (combining forward-looking cost information with embedded accounting cost information).5 I have conducted, supervised, or reviewed studies that could be included in each of these cost categories. The differences between these cost approaches include: whether the study will primarily rely upon accounting data or market values and engineering economics data; whether common costs are allocated formally within the cost calculation process, or if such recovery is formally performed in the pricing process; or whether the focus is on services or network elements. In many instances the distinctions between the terms are subtle and generally not important; the basic economic principles underlying cost estimation are straightforward and can be employed regardless of the specific data utilized or cost technique chosen. For example, on two different occasions I have performed pairs of cost estimations (one bottoms-up, engineering economics-FL-LRIC-and one FAC with forward-looking adjustments) for call termination in the same time frame. In each instance, the differential between the FL-LRIC and the FAC estimate with forward-looking adjustments was not greater than 15%.

Moreover, while the cost estimation process requires some effort, it is tractable and manageable and, with reasonable effort, can produce valid cost estimates.<sup>6</sup> But among all of the possible estimation techniques for a cost-based call termination charges, capital costs are always included in the cost calculation.

If TRAI Was Uncertain regarding the MTC Calculation, It Should Have Examined International Best Practices for Calculating MTC, and Benchmarks from Other Countries

In defending its calculations, TRAI characterized the difficulty of determining its MTC with reference to.? a large number of responses;<sup>8</sup> a "complex exercise" that was "very challenging";<sup>9</sup> "involved an elaborate process";10 and "the service providers have proposed a wide range of termination charges such as negative MTC."11 Given this discussion, TRAI should have 1) looked to international best

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- <sup>9</sup> Id. 99 12, 13. <sup>10</sup> Id. 9 17.
- 11 Id. 9 16.

<sup>&</sup>lt;sup>4</sup> The first formal treatment of incremental costs began with research in the telecommunications industry, and concluded that those purchasing a service would be receiving a cross-subsidy if they paid a price less than incremental cost. See, e.g., Steve G. Parsons, Cross-Subsidization in Telecommunications," 13 JOURNAL OF REGULATORY ECONOMICS, 1998. <sup>5</sup> There are also a variety of terms that suggest the nature of the cost component under consideration including: direct cost v

indirect cost; traffic sensitive or volume sensitive cost v non-traffic or non-volume sensitive cost; shared cost; joint cost; or common cost.

Some techniques, such as estimating costs by small geographic areas or zones, can require greater effort. But at high levels of geographic aggregation, there will generally be one or more techniques that can be employed to produce valid estimates with a reasonable amount of effort. <sup>7</sup> See generally TRAI Reply, ¶ 12-19, 21-25. <sup>8</sup> Id. ¶ 12, 14.

practices in calculating the costs for a cost-based MTC, 2) benchmarked its initial results against MTCs in other countries, 3) considered outside cost estimation expertise.

International best practices clearly require including capital costs in the determination of a cost-based MTC, as discussed above and in the Multiple Experts Statement.

Benchmarking one's results against other cost-based call termination rates is also an important exercise, particularly if one is uncertain regarding the method by which to perform the cost calculation. Consider, for example, a benchmark study of call termination rates in emerging markets by Ovum in January 2008.12

| e A6: Sumn | nary of regional mobile termination ra | MTR Median - PPP<br>(US\$c.) |
|------------|--|------------------------------|
|            | Africa                                 | 15.09                        |
|            | Middle East & North Africa             | 8.34                         |
|            | Eastern & Central Europe               | 16.73                        |
|            | Asia                                   | 3.46                         |
|            | South America                          | 18.33                        |

TRAI's rate is far below the average of any region. Moreover, TRAI's rate is significantly lower than for any other country employing a calling party pays regime.13 Had TRAI properly benchmarked, it would have been a red flag that TRAI had fundamentally erred in its MTC calculation.

#### Section Summary

TRAI does not claim, per se, that exclusion of capital costs from the MTC is international best practice. It does not provide an expert opinion, or specific citations to published literature to support the exclusion of capital costs from the MTC. In contrast, the Multiple Experts Statement and the authorities I cite in Appendix A demonstrate that the published literature on economics, utility regulation and public policy, and telecommunications law are unanimous in their support for the inclusion of capital costs in a costbased MTC. Moreover, the inclusion of capital costs in the MTC is consistent with international best practice. The proper inclusion of capital costs in a MTC calculation occurs irrespective of the type of calculation performed (FAC or LRIC). Benchmarking the MTC calculation against other cost-based rates In the world would have been a red flag that TRAI had erred in its exclusion of capital costs.

# III. Sources Cited by the TRAI Are Consistent with Inclusion of Capital Costs in a MTC

TRAI does not provide expert opinions or cite references to support its exclusion of capital costs from the calculation of the MTC; its two references in its response to the appeal by AUSPI are simply to define EBITDA and to assert that the concept of EBITDA (and ratios using EBITDA) are commonly used.14 These texts are not specific to telecommunications regulation or to the specifics of the calculation of mobile termination rates, especially the text related to mergers and acquisitions. It is noteworthy, however, that one of the texts cited by TRAI discusses taxes and valuation based on assets and net assets (i.e., investments less depreciation), yet TRAI ignores taxes and depreciation in its calculations.<sup>15</sup> The other book cited by TRAI (CORPORATE FINANCE) devotes entire chapters to: "The Time Value of Money" (which is generally measured by WACC); "The Basics of Risk" (which is a factor that determines WACC, and "hurdle" rates); "Estimating Hurdle Rates for Firms"; and "Estimating Hurdle Rates for Projects" (where hurdle rates generally deal with the rates of return on capital investments necessary to make the investment acceptable).<sup>16</sup> This book also has several chapters dedicated to the financing mix (dealing with the mix of debt and equity, and types of debt) necessary to make capital investments, including "An Overview of the Financing Process"; "The Financing Process"; "The Financing Mix: Tradeoffs on Theory" (dealing with the mix of debt and equity, and types of debt); "The Optimal Financing Mix"; and "The Financing Mix and Choices."17

In short, despite several chapters in its references that relate to capital costs, TRAI ignores capital costs termination of mobile the in its calculation

Consider an excerpt from the final chapter, "Back to First Principles," in the text TRAI that cites, describing the investment principle:

As laid out in chapters 7 and 8, the hurdle rate should be a weighted average of the cost of the different financing that a firm uses to fund investments. categorize the different financing into debt and equity, estimate costs for each, and calculate weights based on market value to arrive at a cost of capital. The

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<sup>12</sup> Ovum, "A benchmark of mobile and fixed call termination rates in emerging markets: A report to Vodafone" January 2008. ANNEXURE H to the Rejoinder.

Id.
 <sup>14</sup> Bharti Airtel Ltd. v. Telecom Regulatory Authority of India, REPLY ON BEHALF OF THE RESPONDENT No 1
 <sup>15</sup> TELECOM REGULATORY AUTHORITY OF INDIA at 18.
 <sup>15</sup> WILLIAM J. GOLE AND JOSEPH M. MORRIS, MERGERS AND ACQUISITIONS: BUSINESS STRATEGIES FOR ACCOUNTS (2d ed.

<sup>2006).</sup> <sup>16</sup> ASWATH DAMODARAN, CORPORATE FINANCE: THEORY AND PRACTICE, (2d ed. 2001), chs. 3, 6, 7, 8. 17 Id., chs. 16-20.

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cost of capital represents the minimum acceptable hurdle rate for a project, when returns are measured prior to debt payment.18

Moreover, the text suggests that the investment principle is the "dominating" principle for a firm or an Industry during its "start-up," "expansion," and "growth" phases of its life cycle.19

In the table of contents of the book on Corporate Finance, cited by TRAI with respect to its use of EBITDA, EBITDA is only listed on pages 177, 178. These pages deal with default risk, and EBITDA/Interest coverage (I.e., related to the interest payment on debt). Moreover, at the bottom of the table in which EBITDA is referenced are ratios involving total capital and return on capital. Therefore, even on the very pages in which EBITDA is employed, it is used in reference to capital costs, which TRAI has excluded from its calculations. 20

In justifying its use of EBITDA (or ratios based on EBITDA), TRAI also cites Professor Roy Smith and the University of California website.<sup>21</sup> Professors Smith and Lehavy (Professor of Accounting at the University of California, Berkeley's Haas School of Business) warn about the use of EBITDA:

"It's an analytical term. Accountants don't actually report EBITDA," said Roy Smith, a finance professor at New York University's Stern School of Business. "It's a much greater number than earnings, (so) if you were to apply multiples that you would normally apply to earnings, you would get a very misleading answer."Without actually deconstructing a cash-flow statement, EBITDA is an imperfect substitute as gauge of a company's cash flow, or what comes in and what goes out. ... EBITDA has almost become a surrogate for cash flow, which some experts say is an over-reliance. There's plenty of disagreement over how and under what circumstances EBITDA is used. . . . Lehavy noted that depreciation, for example, is a gauge of how much a company has to reinvest in its equipment to keep producing, an important measure by any standard. "By excluding it, it means that you only get the revenues generated, but you don't reflect the expenses used to do that," he said.

(emphasis added). <sup>22</sup> By ignoring Professor Lehavy's warning regarding the misuse of EBITDA, and neglecting "depreciation for example" I find that TRAI has, as Professor Smith states, gotten "a very misleading answer."

In conclusion, while TRAI has not provided any specific cites to support the exclusion of capital costs from a MTC, the sources it does cite with respect to EBITDA are consistent with the inclusion-not the exclusion-of capital costs.

IV. TRAI Initially Describes a Valid Standard for Considering the Costs of Call Termination, but Later Ignores this Standard

#### TRAI states that:

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"Broad principles are usually common across regulators and these include among others promoting economic efficiency, promoting competition, promoting growth, keeping services affordable, and fair compensation for services rendered. Economists and regulators agree that the approach adopted should be adapted to local conditions and should be based on cost so that the service providers are compensated for their resources used by the other service providers.

(emphasis added).<sup>23</sup> However, TRAI subsequently ignores its own advice by not compensating operators for the costs of using the capital assets necessary to provide call termination service to other providers.

V. TRAI's Mistake in Excluding Capital Costs May Be Based, at Least in Part, upon a Misunderstanding of the Distinction between CAPEX and Capital Costs

TRAI uses the acronym CAPEX (capital expenditure) 27 times in its Memorandum of Explanation. In contrast, TRAI does not use the phrases "cost of capital," "capital cost," or "cost of money" even once. TRAI uses the acronym WACC (weighted average cost of capital) only once, but in a way I suspect that WACC itself was misapplied or misunderstood, as discussed below.

# TRAI Confuses CAPEX and Capital Costs

At times, TRAI appears to use the term CAPEX to genuinely refer to capital expenditures. At other times, however, it uses the term CAPEX, when the relevant concept it was attempting to espouse was more likely capital cost,<sup>24</sup> and at others it is simply unclear what TRAI meant.

18 Id. at 924.

<sup>40</sup> Id. at 177-78, 975.
 <sup>21</sup> Bharti Airtel Ltd. v. Telecom Regulatory Authority of India REPLY ON BEHALF OF THE RESPONDENT No 1
 <sup>22</sup> TELECOM REGULATORY AUTHORITY OF INDLA at 18.
 <sup>22</sup> CDS Marketwatch, *Deconstructing 'EBITDA'*, available at
 <sup>24</sup> http://webuser.bus.umich.edu/rjehavy/cbsmktwatch20001226.pdf.
 <sup>25</sup> TRAI "Explanatory Memorandum to 'The Telecommunications Interconnection Usage Charges (Tenth Amendment)
 <sup>26</sup> Resultions 2009" 8 5.3.2.

Regulations, 2009" § 5.3.2.

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The lay person may confuse these two capital concepts that sound similar but are distinctly different. A capital expenditure (CAPEX) is a one-time outlay to purchase (or adapt, expand, or enhance) a long-lived asset. A capital expenditure occurs at a single point in time, and adds to the asset account (i.e., adds to the net book value of the assets of the company).

A capital cost, by contrast, is the ongoing cost of using capital assets, comprised of depreciation and cost of money (including associated taxes); it is a flow. The Multiple Experts Statement describes capital costs in some detail, but briefly, depreciation is the loss in the market value of an asset over time (either due to wear and tear, or obsolescence), while the cost of money or WACC is the opportunity cost of the money tied up in that asset (which could have been invested elsewhere). Depreciation is sometimes said to represent the return of the investment, and WACC to represent the return on the investment.

Consider a simple hypothetical example. A mobile provider purchases a Base Station Controller (BSC, which allocates radio channels, collects and processes some customer information, and concentrates traffic) for \$10 million.<sup>25</sup> At the date of the purchase, the \$10 million is added (debited) to an asset account; this is the CAPEX associated with the BSC purchase. The corresponding capital costs occur over time as the asset (the BSC) is used. If the asset's life is 10 years with straight line depreciation, the depreciation over the first year is \$1 million (one-tenth of the \$10 million CAPEX). TRAI references a WACC value of 15%; this is certainly a post-tax WACC. If the post-tax weighted average cost of capital (WACC) is 15%, then after the payment of associated operating expenses, depreciations expense, and taxes on accounting profits, an additional \$1.5 million is required during the first year's life<sup>26</sup> of the asset to pay the debt holders their interest, and the opportunity cost of money (after taxes) for those who made an equity investment in the company.27

CAPEX (the \$10 million in the example above) should not be included in the MTC. CAPEX is the initial expenditure for long lived assets which, in this case, are used to provide call termination to other carriers.

However, the associated capital costs (ongoing depreciation and WACC, including associated taxes) corresponding to the assets used to provide call termination to other carriers (\$2.5 million, in the example above, for the first year of the asset's life), must be included in the MTC cost calculation.

The Distinction between Capital Costs and the Costs of Operation and Maintenance Does Not Provide a Rationale for Excluding Capital Costs from a Calculation of Mobile Termination Rates

The distinction between capital expenditures (CAPEX) and operating expenditures (OPEX) is a matter of convention to provide a practical method to treat the costs of long-lived versus shortlived assets. OPEX are reflected as costs during the period in which they occur since they are associated with short lived assets. In contrast, capital expenditures are associated with long lived assets; these expenditures are "capitalized" in order to reflect the costs of the use of these assets over the life of the assets. For example, consider the following on-line definition of CAPEX by Wikipedia:28

Capital expenditures (CAPEX or capex) are expenditures creating future benefits. A capital expenditure is incurred when a business spends money either to buy, fixed assets or to add to the value of an existing fixed asset with a useful life that extends beyond the taxable year. Capex are used by a company to acquire or upgrade physical assets such as equipment, property, or industrial buildings. In accounting, a capital expenditure is added to an asset "capitalized"), thus increasing the asset's basis (the cost or value of an asset as adjusted for tax purposes). Capex is commonly found on the Cash Flow Statement as "Investment in Plant Property and Equipment" or something similar in the Investing subsection.

For tax purposes, capital expenditures are costs that cannot be deducted in the year in which they are paid or incurred, and must be capitalized. The general rule is that if the property acquired has a useful life longer than the taxable year, the cost must be capitalized. The capital expenditure costs are then amortized or depreciated over the life of the asset in question.

(emphasis added). A capital expenditure adds to the value of the stock of capital assets (i.e., the value of assets with a life over one year). Initial capital expenditures lead to a stream of

24 TRAI Explanatory Memorandum, 5.3.18, 19 ("IUC for Transit was based on the sum of CAPEX and OPEX of the segment It was based on costs of BSNL—elements up to SDCC.")
 <sup>25</sup> The values in this hypothetical numerical example are for purposes of illustration only.
 <sup>26</sup> Properly, a cost calculation should reflect the "levelized" depreciation and WACC over the life of the capital asset. Such a levelized to solve the solve of the solv

calculation has the effect of creating an annuity, which would produce a stream of revenue just sufficient (in present value) to cover the capital costs incurred. One might approximate this result by calculating the capital costs at the midpoint of the economic life of the assets; e.g., using the cost of money at year 5 of the 10-year life of the asset.<sup>27</sup> One often hears discussion of post-tax WACC (and a separate identification of the taxes to be paid) or pre-tax WACC.

The post-tax WACC will be lower than the pre-tax WACC; the divergence between the two increases with the tax rate. This

is seen in the formula in the Multiple Experts Report. <sup>28</sup> http://en.wikipedia.org/wiki/Capital\_expenditure (citing SAMUEL A. DONALDSON, FEDERAL INCOME TAXATION OF INDIVIDUALS: CASES, PROBLEMS AND MATERIALS 173 (2d ed. 2007)).

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ongoing capital costs associated with the assets in place and used. As discussed in the Multiple Experts Statement, capital costs are comprised of depreciation (the loss in the value of the capital asset over time) and the cost of money (WACC and associated taxes).

In some sense, for those expenditures that are considered to be OPEX, 100% of the "depreciation" of those expenditures occurs in that year, i.e., 100% of the value of the assets is used up during the year in question. In contrast, a capital asset with an expected life of two years will depreciate only 50% of its value in the current year.<sup>29</sup> The fact that one asset completely depreciates in a single year (or less) while another has its value up over a period of more than one year—does nothing to make one cost any less real than the other.

Indeed, if the accounting convention had developed differently, and assets with lives longer than a financial quarter (rather than a year) were capitalized, then TRAI would have used OPEX that would have been much smaller than that used (since some assets with lives between 3 months and one year would now be capitalized). Similarly, had the accounting convention developed differently, and assets were only capitalized with lives longer than say five years, then TRAI would have used OPEX values significantly larger than they did (since those assets with lives of between one year and five years would now be treated as OPEX). However, nothing in this accounting convention changes the resources that are required for a mobile operator to terminate a call for another operator. Here, one can see that TRAI's calculation would swing wildly based simply on an accounting convention, not on the resources used to provide call termination.

In contrast, if the TRAI had properly included capital costs (the costs of using assets) and OPEX, accounting conventions and classification of assets would have no significant impact of the calculation of the call termination rate—the costs of the resources used to provide call termination would be included, regardless of their accounting classification.

TRAI has excluded the cost of resources used to provide call termination (the costs of the capital assets required to provide call termination) on the basis of financial reporting and tax calculation convention (annual reporting, and annual tax filings). There is nothing in the convention for capitalizing some assets (with expected lives longer than 1 year) and expensing others (with expected lives less than 1 year) that causes one cost or the other to be any less real in an economic or business sense.

To illustrate this point, consider the following hypothetical example. Imagine a hypothetical component which is used at a radio base station (tower) called a Circuit-Oriented Static Transistor (COST); the greater the volume of traffic at the radio base station, the more components required. COST is required in order to originate or terminate a call. The manufacturer lists the devices as having a life of 1 year, and they are generally sold in crates of 10. Each of the companies in the industry, purchase a crate for each maintenance-and-repair center in their network. Companies A and B use 1 crate per year, and Companies Companies A and C treat the expenditure as OPEX (both making this choice of treatment since the component itself has a life no longer than 1 year). Companies B and D, by contrast, treat the expenditures as CAPEX (B since the one-year life is at the demarcation point between OPEX and CAPEX, and D since it considered the "life" of the components within the crate).

It is particularly noteworthy that TRAI's method of calculating the MTC would (at least implicitly) include COST for companies A and C but exclude COST for companies B and D. In contrast, the proper method of calculating the MTC (which includes CAPEX) includes COST regardless of whether individual companies assign COST to CAPEX or OPEX.<sup>30</sup>

Now imagine that the manufacturer of COST creates a new component with twice the life (lasting 2 years) that is marketed as COST2; the new component performs exactly the same function as COST, it simply lasts twice as long. All four companies find that it is more efficient to deploy COST2 instead of COST. Now, however, all four companies classify COST2 as a capital expenditure. Despite the fact that COST or COST2 is a resource required to originate or terminate calls, the TRAI MTC method now excludes the cost of this resource because each of the companies made the rationale choice in deploying the longer-lived COST2. In contrast, the proper method of calculating the MTC (which includes capital costs) includes COST or COST2 regardless of the life of the component or the choice of accounting convention employed by the company.

It should be clear from this hypothetical example that the resources used to provide a service should determine the cost of providing that service not an accounting convention.

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<sup>29</sup> In this calculation, a straight line depreciation schedule was assumed for simplicity and convenience.
 <sup>30</sup> If companies C and D have many maintenance and repair centers, they will, on average order half as many crates as they have maintenance and repair centers; the assignment of the purchases as CAPEX or OPEX treatments will yield virtually identical cost results (on average).

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TRAI has confused the terms CAPEX and capital costs. TRAI is correct that the original capital investment (CAPEX) should not be included in the MTC. However, TRAI's apparent confusion may have led it to make a major mistake—excluding capital costs from the calculation of the MTC.

The distinction between capital costs and operating expenses is based upon an accounting convention, not a fundamental economic principle. Both operating expenses and capital costs are valid costs of doing business; both should be included in a MTC calculation.

#### VI. TRAI's Arguments for Excluding Capital Costs Are Poorly Enunciated, Unsubstantiated, Inconsistent, Incorrect, and Insufficient to Justify Its Decision

TRAI's rationale for excluding capital costs is not clear. Indeed, as I note above, it is not clear whether TRAI's arguments are based upon the intent to properly exclude CAPEX from the MTC calculation or based upon a misguided intent to improperly exclude capital costs from the MTC; capital expenditures should not be included in a MTC calculation, but capital costs should be included. In either event, TRAI has improperly exclude capital costs from the MTC calculation.

Therefore, I examine what appear to be TRAI's arguments for excluding capital costs. It appears that TRAI's mistake may be based upon six fundamental misunderstandings: 1) it would "transfer the whole cost of an operator to an interconnecting operator"; 2) it would "unnecessarily transfer the burden of business decisions taken by the service provider to the interconnecting service providers"; 3) that investments may vary across providers; 4) that the existence of telecommunications "network effects" should lead to lower (rather than higher) call termination rates; 5) that operators have other sources of revenue or cash flow or profits are otherwise sufficient to cover the costs of call termination; and 6) that it would requires a forecast into the future, that is too long. Making sense of TRAI's rationale is further burdened by its confusion and misuse of the term CAPEX, as discussed above.

Taken together, then, what appear to be TRAI's rationales are internally inconsistent, incorrect, generally unsubstantiated, and insufficient to justify its decision to exclude capital costs in its MTC calculation.

## TRAI's MTC Calculation Includes Originating and Terminating Minutes

It will be useful, at this point, to describe one key aspect of TRAIs MTC calculation. Its Memorandum of Explanation includes a section 6.3.5 "Estimation of the Mobile Termination Charge," which includes a discussion of average minutes of usage per subscriber, per month. These values are the summation of both originating and terminating minutes of use.<sup>31</sup> Including both originating and terminating minutes is a valid beginning to the calculation of call termination, where all of the costs of using the network are divided by all of the minutes that use the network. The implication is that TRAI has properly spread the OPEX across all minutes that use the network, both originating and terminating, but has failed to assign any capital costs to terminating minutes. This is a fundamental inconsistency in TRAI's approach.

Including Capital Costs in Call Termination Rates Does Not Transfer the Whole Cost to an Interconnecting Operator

In its Explanatory Memorandum, TRAI states that calculations of hybrid forward-looking Long-Run Incremental Cost (FLLRIC) for call termination

involved inclusion of both CAPEX and OPEX which transfer the whole cost of an operator to an interconnecting operator, the smaller and new service providers would be at a disadvantage of high input cost and would not be able to offer innovative tariff plans.

(emphasis added).<sup>32</sup> A proper MTC does not "transfer the whole cost of an operator to an interconnecting operator." Rather, a proper cost calculation reflects the full economic cost of each minute that is provided over the network, whether originating or terminating, and assigns no more and no less cost to a terminating minute from another operator as an originating minute by a customer of

the operator owning the network; each minute is assigned the same cost.<sup>33</sup> Moreover, TRAI does not provide a reasonable explanation why its method of assigning OPEX (across all minutes using the network, both originating and terminating) is fair and correct while the same form of assignment of CAPEX is not fair and correct.<sup>34</sup>

<sup>&</sup>lt;sup>31</sup> Using total minutes of use is a valid approach, as long as one considers the full costs of the network that provides the minutes. This method does, implicitly, assume that originating minutes and terminating minutes utilize the network with

equal intensity. <sup>32</sup> TRAI "Explanatory Memorandum to 'The Telecommunications Interconnection Usage Charges (Tenth Amendment)

Regulations, 2009" § 5.3.7. <sup>33</sup> In some instances, a cost study will properly be performed by evaluating components of the network and identifying how <sup>35</sup> In some instances, a cost study will properly be performed by evaluating components of the network and identifying how <sup>36</sup> often each type of call "touches" that component of the network; then the weighted average costs are added together. With so-called hot potato call routing (in which an interconnecting call is handed off to the terminating network at the earliest point) a terminating minute from another operator will likely utilize the network more intensively than terminating a minute by the network owner's own customer; and hence the terminating minute from another operator may "touch" more network work at the source of the terminating minute from another operator may "touch" more network

components and have a somewhat higher cost. <sup>34</sup> It appears that TRAI's cost calculation assigns a pro-rated portion of the OPEX to all calls; it does not, in some way assign all OPEX to interconnecting terminating calls (as a *quid pro quo* for implicitly assigning all CAPEX to those calls which do not require interconnection).

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Therefore, TRAI's treatment of OPEX (assigning it across all minutes, both originating and terminating), while fundamentally correct, is also fundamentally inconsistent with its implied claim that including the prorated share of capital costs to terminating calls somehow assigns all of the capital costs to interconnecting carriers.

TRAI's process allows interconnecting carriers originating calls to receive the benefits of the capital investments necessary for the terminating calls, but to pay for none of the capital costs. TRAI's method is guilty of the very sin it claims exists for the internationally well established Forward-Looking Long-Run incremental Cost (FL-LRIC, or sometimes simply known as LRIC).

Including Capital Costs in Call Termination Rates Does Not Unnecessarily Transfer the Burden of Business Decisions to Interconnecting Carriers

In attempting to explain its position, TRAI claims that:

Considering the CAPEX or even proportion of it for calculating the termination charge would unnecessarily transfer the burden of business decisions taken by the service provider to the interconnecting service providers. Decisions like planning horizon, network dimensioning, technology induction of a service provider should not affect the interconnecting service provider who should be required to pay the bare minimum cost. Taking CAPEX in calculating the termination charge would mean that the interconnecting service provider would not have any choice of innovative tariff plan or rentals.

(emphasis added).<sup>35</sup> First, as noted above, a proper MTC does not include CAPEX (the one-time, upfront expenditure for capital assets). Second, its clause "or even proportion of it" implies that TRAI believes that capital costs should not be included in the MTC because of transferring the burden of business decisions.

Recognize that the provision of any service requires that the service provider make a series of business decisions: whether to invest, which geographic market to enter, which technology to choose, "network dimensioning," whether to lease or buy certain components, the pricing approach, etc. It is simply nonsensical to claim that including capital costs in the cost of service, unnecessarily transfers the burden of business decisions to customers (whether wholesale or retail customers); the service would not exist but for the business decisions of the provider. Without recovering the costs corresponding to their business decisions (both OPEX and capital costs), businesses would go bankrupt.

Moreover, one cannot temporarily dispense with logic, economics, and business facts simply because call termination is a wholesale service. Many businesses around the world provide solely, or a large proportion of, wholesale services. Such companies would, in such a world constrained by TRAI's claim, never make a business decision that would create an investment necessary to provide a service. Indeed, a reasonable reference point to consider is whether the calculated MTC would be sufficient to cover all of the costs of a wholesale-only network provider—TRAIs calculation of MTC is clearly not sufficient to cover all of the costs of a wholesale-only provider by an amount equal to the relevant capital costs.

The flaw in TRAI's logic can be seen in another way. Consider that all businesses make two related decisions: 1) choice of technology; and 2) rent or buy capital equipment. Some technologies will have higher or lower proportions of capital costs versus OPEX. TRAI's decision to allow OPEX, but completely ignore capital costs, would mean that companies' technology choices (even if the total costs, i.e., the total of capital costs plus OPEX for the two technology choices, are similar) would influence the size of the MTC because technology choices will influence the proportion of costs that are CPEX.

The second related business decision is whether to rent or buy equipment and facilities. Imagine a mobile operator that chooses to rent all of its facilities on a monthly basis from other companies. In such a case, the company would have all OPEX and no capital costs. If this were the case, all of the costs would be included in the TRAI's calculation simply because the company chooses to rent rather than buy its equipment.

TRAI's calculation of MTC, therefore, is contingent on network operators' choices regarding technology and whether to lease/rent or buy facilities; this contradicts TRAI's rationale for excluding capital costs (that they depend on business decisions). All services are influenced by business decisions.

Indeed, the MTC should reflect the payment of the relevant OPEX corresponding to a terminating minute and the "rental" of the capital facilities required to provide call termination. Even TRAI's method would allow for this rental payment if the company providing network termination was renting its network components from a third company, but not if the terminating company owns those facilities themselves. TRAI's calculation of costs therefore rests, illogically, on ownership (or length of ownership, to the extent that leasing or rental confers a measure of temporary ownership).

Finally, one must recognize from the discussion above, that OPEX for a business is determined via a cascade of business decisions that bring a service (wholesale or retail) to fruition. Therefore, if TRAI were correct, that including costs caused by business decisions would "unnecessarily transfer the burden of

<sup>35</sup> Id at 5.3.23. The bold language is also repeated in the TRAI Reply, ¶ 26.

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business decisions taken by the service provider to the interconnecting service providers" then OPEX would have to e excluded as well as capital costs; OPEX is determined by business decisions. TRAI's divergent treatment of OPEX and capital costs is internally inconsistent.

TRAI's Claim that Capital Investments May Vary across Providers Does Not Justify the Exclusion of Capital Costs

At § 5.3.24 of its Memorandum of Explanation TRAI claims:

If CAPEX is also allowed to be recovered through the termination charge then termination charge would widely vary among the service providers since some of the service providers might have invested more in the capital expenditure keeping in view their future forecast and their business plan.

Capital investment and capital costs can vary across providers for primary categories of reasons. First, there are choices that can affect the ratio of OPEX to capital costs. As noted above, two providers might choose amongst technologies with similar "total" costs (OPEX plus capital costs) but divergent ratios of OPEX/(capital costs). Companies may also vary in the degree to which they rent or buy capital equipment. In addition, to the extent that there is room for discretion in accounting treatment of some expenditures, one company may simply choose to expense, rather than capitalize, a higher proportion of expenditures. As noted above, this is actually a reason for TRAI to include, rather than exclude, capital costs (based upon TRAI's own argument), since the "total" costs are likely to be similar, even when OPEX and capital costs vary.

Second, capital costs can vary significantly depending on the characteristics of the area served. The capital investment to serve customers in Circle C is obviously much higher per customer than in urban centers. Economic efficiency dictates that such cost differentials be reflected in price differentials. If it was technically feasible, and there were no administrative costs of implementing price differentials across geographic zones, I would always recommend such geographic de-averaging of prices. Economic efficiency dictates that, in general, if costs vary, prices should vary.<sup>36</sup> This would lead to a higher MTC in high-cost, more rural areas, and a lower MTC in low-cost, more urban areas. With such pricing, prices would reflect the cost differences across geographic areas, and providers would be compensated according to their cost structures.

As a practical matter, however, I recognize that such geographic de-averaging would be difficult to implement. There are always administrative costs of such actions; thus it may be practical to use an average price reflecting an average cost. But adopting an average cost does not justify excluding capital costs; TRAI must include the average capital costs across the average of geographic areas served.

Finally, one must recognize from the discussion above, that OPEX is likely to vary more than the total of OPEX and capital costs (for similarly situated providers). Therefore, TRAI's argument here is internally contradictory.

The Existence of Network Effects Should Lead to a MTC Above (Not Below) the Full Cost (Including Capital Costs)

#### In TRAI's Reply, it states:

It is common knowledge that telecommunications networks are intrinsically different from other infrastructure like roads and power because of the network externalities involved. The value of the network to users increases as more customers join the network.

(emphasis added). 37 The second sentence of this quote is a reasonable but brief representation of network effects (sometimes called network externalities, bandwagon effects, or direct network effects).38 But the fact that TRAI chose "roads" as its attempted counter-example suggests that it does not understand network effects. A positive network externality can exist when additional points (nodes) or links (segments connecting nodes) are added to a road network, just as they would with a telecommunications or internet network.39

<sup>&</sup>lt;sup>36</sup> There can also be valid demand-side reasons for prices to vary.

<sup>37</sup> TRAI Reply, ¶ 2.

<sup>&</sup>lt;sup>38</sup> For a general treatment of network effects approachable by the layperson, see HAL VARIAN, JOSEPH FARRELL, AND CARL FOR a general treatment of network effects approachable by the tayperson, see TAL VARIAN, JOSEPH FARKELL, AND CARL SHAPIRO, THE ECONOMICS OF INFORMATION TECHNOLOGY: AN INTORDUCTION; JEFFREY ROHLES, BANDWAGON EFFECTS IN HIGH TECHNOLOGY INDUSTRIES (2001). For a treatment of the topic focusing more on the telecommunications industry, see generally, STANLY LIEBOWITZ, AND STEPHEN MARGOLIS, Network Effects, in HANDBOOK OF TELECOMMUNICATIONS FOR STRUCTURE, DESCRIPTION OF CONSTRUCTION TO CONSTRUCT AND A STEPHEN MARGOLIS.

ECONOMICS: STRUCTURE, REGULATION, AND COMPETITION 76 (Martin Cave et al. eds., 2002). "See, e.g., Logistics in Africa, Network effects: Connectivity and commitment pay dividends in African transport, The ECONOMIST, October 16, 2008, available at

http://www.economist.com/businessfinance/displaystory.cfm?story\_id=12432456); J Laird, J Nellthorp. P Mackie, "Network Effects and Total Economic Impact in An Enlarged Trans-european Transport Network," ETC (2004), available at http://www.etcproceedings.org/paper/network-effects-and-total-economic-impact-in-an-enlarged-trans-european-transp; James J. Laird', John Nellthorp and Peter J. Mackie, Network effects and total economic impact in transport appraisal, 12 TRANSPORT POLICY (November 2005), available at http://eprints.whiterose.ac.uk/2020/.

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Even if TRAI understands the basic concept of network effects, it apparently misunderstands the implications of network effects for determining a MTC. At § 5.3.20 of its Memorandum of Explanation, it claims that:

Some of the service providers have argued that allocation of relevant OPEX only for termination charge, and not taking CAPEX into account is not the right way of calculating the termination charge. They further argued that for the capital-intensive industry there is a need to take the CAPEX also into consideration for calculating the termination charge. Some even likened it to highways where toll takes CAPEX into account. This only goes to demonstrate that the point being missed is that the telecommunications infrastructure is a different from all other infrastructures because of network externalities. The value of the telecommunications network increases for its subscribers as more and more subscribers join the network. When networks grow, networks interconnect with each other the perceived value increases for all the subscribers...

A report by Frontier Economics sums up the implications of the existence of significant network effects: "[]f network externalities are sufficiently strong, economic efficiency would require consideration of setting MTRs [Mobile Termination Rates] above the cost-orientated level."<sup>40</sup>

Indeed, this was the economic rationale employed historically in cross-subsidizing access to land-line networks. These cross-subsidies tended to take the form of low monthly line rental rates (especially for residential customers) and high rates for usage (especially for high levels of usage by business customers, and long distance usage), including relatively high wholesale rates for call termination (in the U.S. sometimes called "settlements" rates, and later "switched access" rates).<sup>41</sup>

It is the investment in network capital assets that allows networks to exist; network effects cannot exist without networks. Therefore, if TRAI believes that telecommunication in India is characterized by strong network effects, it should create incentives to invest in network infrastructure and establish MTC above, not below, the cost-based level. Regardless of the direction and degree to which the existence of network effects should cause the optimal call termination rate to diverge from the cost-based rate, network effects provide absolutely no rationale for excluding capital costs from the calculation of costbased MTC.

Finally, even if TRAI were correct in its discussion of network effects, it does not adequately explain why capital costs should be excluded rather than some portion of OPEX. TRAI's arguments are insufficient to draw any distinction between OPEX and capital costs; these arguments are logically inconsistent.

Other Sources of Revenue or Measures of Profit Are Irrelevant to Calculating a Cost-Based MTC In its Memorandum of Explanation, TRAI uses the term "profit" 12 times, and the term "revenue" over 70 times, but never uses the phrases "cost of capital," "capital cost," or "cost of money" (WACC is used once, but perhaps inappropriately).<sup>42</sup>

TRAI appears to believe that it is valid to consider other sources of revenues when calculating the MTC. For example, it states:

Another fact that one has to remember is that termination charge is not the only stream of revenue from which all CAPEX and OPEX needs to be recovered. There are other streams like fixed charges, origination charge, revenue from value added services and so on.<sup>43</sup>

The service profit and loss analysis has been done for the major service providers on the basis of the data furnished by them in their account separation reports and it is found that in some cases surplus revenue, over and above the reasonable profits(15% WACC), for some of the service providers is as much as 16 paise per minute which clearly indicates that service providers are able to generate sufficient revenue and cash flow in their mobile service operations. The GSM mobile industry has surplus revenue of 10 paise and wireless industry on the whole has surplus of 5 paise. This surplus revenue of 10 paise and wireless not only are able to recover CAPEX, OPEX and reasonable profits from their operations but they are also having surplus over and above that. Thus rationalization of termination charge based on current factors should not cause them concern.<sup>44</sup>

I have three responses, presented in order of their relationship to fundamental principles of economics and regulation.

<sup>41</sup> For a review of the technical literature on cross-subsidies and their history in telecommunications, see Steve G. Parsons, Cross-Subsidization in Telecommunications, 13 JOURNAL OF REGULATORY ECONOMICS (1998). See also David Kasserman and John Mayo, Cross-subsidies in Telecommunications, 11 YALE JOURNAL ON REGULATION 119-47 (1994); Steven Globerman, and Daryl Kadonaga, International Differences in Telephone Rate Structures and the Organization of Business Subscribers, 80 PUBLIC CHOICE (1994) (describing cross-subsidies from usage to access around the world); Nicolas Curien, The Theory and Measure of Cross-Subsidies: An Application to the Telecommunications Industry, 9 INTERNATIONAL

JOURNAL OF INDUSTRIAL ORGANIZATION (1991). <sup>42</sup> These counts include the uses of the words in tables as well as text.

<sup>43</sup> Memorandum of Understanding, § 5.3.20.

44 Id. § 5.3.22.

<sup>&</sup>lt;sup>40</sup> Frontier Economics, "The setting of efficient mobile termination rates", February 2009 (emphasis added) Available at http://www.comcom.govt.nz//IndustryRegulation/Telecommunications/Investigations/MobiletoMobile Termination/ContentFiles/Documents/VF%20Frontier%20report.pdf, accessed October 2009.

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First, as noted in the Multiple Experts Statement, regulated cost-based rates are determined using a long-run cost framework (generally either fully allocated cost, FAC, or a form of long-run incremental costs); revenues from other services play no role in determining the long run costs of a service.45 Costs and revenues are fundamentally different concepts. There is no support in economic theory or telecommunications regulatory practice for discounting the cost of providing call termination by the revenues received from other services.

To the extent that TRAI believes that there are problems in the pricing of other services in India's telecommunications market, this is neither the venue nor the method to address them. The purpose of the relevant proceeding was to determine a cost-based MTC; TRAI cannot simply ignore or throw out certain costs in the calculation because of a perceived issue with other prices or levels of profits.46

Second, TRAI never adequately distinguishes capital costs from operating expenditures. Other sources of revenue could as easily be applied to OPEX as to capital costs. TRAI's discussion is therefore logically inconsistent.

Third, TRAI has not adequately supported its claim of a surplus. The Memorandum of Explanation is not sufficiently detailed to allow me to determine how TRAI came to the conclusion that there is a "surplus." Consider its implied claims regarding: 1) the comparison to 15% WACC, and 2) "sufficient revenue and cash flow." Neither claim is supported in TRAI's Memorandum of Explanation.

In the quoted clause above, TRAI apparently references a 15% WACC as a benchmark of what it may be believe is consistent with a reasonable profit. At this point, TRAI neither defines WACC nor indicates how it arrived at 15%, but such a value would necessarily represent a post-tax (rather than pre-tax) weighted average cost of capital (WACC).47 One formula to reflect such a WACC comparison would be (net profit + dept payments)/(total investment),48 where profit is net of corporate income taxes. But while TRAI does provide a measure of debt payments (287.74, Rs in Core),4° it is missing two critical pieces necessary to make such a comparison: 1) any reference to net profit (net of taxes), and 2) a measure of total investment. It appears that TRAI may have made two fundamental mistakes: EBITDA does not show profits net of taxes, and the opportunity cost of capital is determined by total investment, not revenues.

Such mistakes are particularly likely since TRAI uses the term "revenue" over 70 times in the Memorandum of Explanation and has focused on revenues by using EBITDA margin (EBITDA/total revenues), VAS revenue ratio (VAS revenues)/(total revenues), and revenues per user (ARPU). Because telecommunications is capital intensive, total investment is likely to be significantly greater than annual revenues. This means that TRAI placed a value that was too small in its denominator (revenues rather than assets), leading to a measure of "profit" that is overstated and fundamentally incorrect.

Regarding TRAI's claim regarding a surplus and "sufficient revenue and cash flow," an analysis by VEL indicates that for the mobile industry in India is still in a negative cash flow situation. That is, revenues from operations are insufficient to cover current expenses and additional investments. A recent study by Price Waterhouse Coopers finds that the "[1]ndustry has not generated sufficient cash to fund its incremental capital expenditure and requires external funding to the tune of ~14% of Net Service Revenue."50 This effect is even more pronounced when one considers TRAI's primary measure, EBITDA. Incremental gross CAPEX for the industry, in 2008 was 146% of EBITDA (i.e., 1.46 times the size of EBITDA); in Circle B, this ratio was 209% and in Circle C it was 684%.

This information clearly contradicts TRAI's claim; since the Memorandum of Explanation does not provide cash flow information, investment information, or measures of total assets, TRAI's claim must therefore be rejected.

Finally, even if TRAI's arguments were correct, it has not distinguished between OPEX and capital costs. Other sources of revenue could be applied to OPEX as well as capital costs, and certainly nothing in the discussion suggests that capital costs in their entirety should be excluded.

TRAI's Claims of the Implications for Forecasts, of Employing the Long Run Concept Does Not Justify Excluding Capital Costs

TRAI claims that:

The long range concept implies that the time frame is sufficiently large so that all costs can presumed to be variable, even the capital investments costs related to network capacity.

therefore need to be added back to the numerator.

<sup>&</sup>lt;sup>45</sup> One may properly compare the revenues from a service to its costs to determine a measure of profit or contribution, but not

statutory powers. Even if statutory powers were present to engage in directly altering other retail rates, the principles of transparency and due process, dictate that such actions not occur in the context of determining cost-based MTC rates. <sup>47</sup> In my experience, post-tax WACC (rather than pre-tax WACC) is generally the value discussed. Moreover, I have never, in my taken my taken and the process and the process of the process of the process.

in my telecommunications experience, seen a pre-tax WACC value as low as 15%). <sup>44</sup> I have expressed the value in this way since the measure of net profit will have already subtracted dept payments, which

<sup>&</sup>lt;sup>9</sup> 6.3.4, page 58. <sup>50</sup> Price Waterhouse Coopers, "Indian GSM Cellular Benchmarking Study 2008" at 16 (April 2009).

The long time frame would however make the forecasts less reliable. A network designed or incorrect forecasts would give incorrect results.

The long-run concept, and its implications, is not really a time-related concept; this is an unfortunate naming convention that dates back to at least the late 1800s. Consider an excerpt from one of my own publications under the heading, "4.4. Misuse of Long-Run Cost Concepts in the U.S.," that "most authors subsequent to Marshall [1890], have tended to deemphasize the temporal nature of the long-run and short-run, focusing instead on total factor variability as the defining characteristic of long-run costs. (emphasis added).<sup>51</sup>

Therefore, the long-run cost concept must recognize all of the resources caused by the provision of products and services, and must reflect the costs of those resources.

Using a long-run cost concept does not require a forecast into the distant future. Indeed, as a first approximation, I often calculate a "current" cost corresponding to the cost for the most recent year's data (particularly if one is relying upon the books of account, as TRAI has, to make the cost calculation). I am hardly alone in this recommendation; consider the 2001 report to European Commission:

... undertaking an exercise to calculate the costs of a hypothetical new [mobile] entrant into the industry may not be as important as it has been in the fixed network environment. In most cases, looking at the current costs of assets in use in an operator's network and calculating annualisation charges appropriately will suffice.

(emphasis added). 52 Once the "current" cost has been completed, forecasting is really only useful to fine tune the cost calculation to correspond to the time period for which the tariff rate is likely to be in place.53 Capital cost calculations do require reasonable assessment of the economic lives of the capital resources employed in order to determine depreciation expenses, but this is a manageable process routinely performed throughout the world.

Furthermore, consider my own published words about the general use of long-run costs:

Many regulatory rules, and even statutory language in some states, require the use of long-run costs. Indeed, virtually every cost calculation produced in the industry is labeled 'long-run.

(emphasis added).54 Moreover, if TRAI believes that they could rely upon a "short-run" concept to reduce the measure of average cost, it is mistaken. "The long-run average cost function shows the minimum cost per unit of producing each output level when any desired scale of plant can be built." (emphasis added).55 Short-run average costs will be no lower than long-run average costs, and for some levels of production will be higher. One advantage of employing long-run costs is that they are more stable than short run costs since they effectively smooth out the lumpiness of large investments.56 In contrast, short run costs would be low for periods of large capacity, but exceptionally high as a new unit of capacity is required (i.e., when a new capital investment is required). Such drastic swings in costs would actually require more detailed forecasts of the future than employing long-run costs as the standard.

Even if TRAI's claim were correct that a long term forecast is necessary and that such a forecast would be difficult), this does not provide an excuse to simply exclude capital costs. This would be like stating that while I know that I currently weight 74 kilograms, I believe that I need a long-term forecast of my weight, but such a forecast will be difficult; so I take an action which is tantamount to guessing my future weight at 0 kilograms. Such a gross error of exclusion is simply unacceptable.

TRAI's Arguments Are Inconsistent

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The discussion above indicates that TRAI's arguments regarding the exclusion of capital costs are Inconsistent in three types for ways. First, TRAI does not sufficiently distinguish between capital costs and OPEX. Its arguments, if true, would apply equally as well to OPEX as to capital costs. TRAI's proper inclusion of OPEX, applied to both originating and terminating minutes of use, is logically inconsistent with exclusion of capital costs; its arguments to exclude capital costs are therefore logically inconsistent with its treatment of OPEX.

the costs that firms in a competitive industry need to recover when setting prices." (page 55, section 6.1) <sup>39</sup> One can discuss the degree to which capital assets are utilized (their "fill" or "utilization"). I recommend that the fill or utilization factors reflect the best estimate of the time period for which the tariff is in place, or the value that existed during the most recent time period for the first approximation in a "current" cost calculation.

Steve G. Parsons, Laffont and Tirole's Competition in Telecommunications: A View From the US, 9 INTENATIONAL

JOURNAL OF THE ECONOMICS OF BUSINESS 425 (2002). W. BRUCE ALLEN, MANAGERIAL ECONOMICS: THEORY, APPLICATIONS, AND CASES 337 (6th ed. 2005). This is the introductory text I use when teaching my course on the Economics of Technology.

<sup>&</sup>lt;sup>51</sup> Steve G. Parsons, Laffont and Tirole's Competition in Telecommunications: A View From the US, 9 INTENATIONAL JOURNAL OF THE ECONOMICS OF BUSINESS 425 (citing ALFRED MARSHALL, PRINCIPLES OF ECONOMICS (9th ed. 1961) and ALFRED KAHN, THE

ECONOMICS OF DUSINESS 429 (citing ALFRED MARSHALL, FRINCIPLES OF ECONOMICS (9th cd. 1961) and ALFRED KAHN, I ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS, VOLUME 1 ECONOMIC PRINCIPLES (1970).
 <sup>32</sup> Europe Economics, "Cost Structures in Mobile Networks and their Relationship to Prices: Final Report for the European Commission," 28 Nov. 2001 (Contract No. 48544), Section 6.4, page 63. And also stating: "If some sectors of the mobile industry are competitive, then the current costs of an MNO are the costs that have arisen in a competitive market; these are the order that furne is a competitive and the protect when retting arises "(case 55 castion 6.1)").

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Second, TRAI's Memorandum of Understanding, and its Reply to VEL, are not consistent when taken in their entirety; at times proper principles are espoused, but later ignored. TRAI had it right when it stated that "... the approach adopted should be adapted to local conditions and should be based on cost so that the service providers are compensated for their resources used by the other service providers."57 Unfortunately, TRAI violated its own standard by establishing a MTC that does not compensate service providers for the capital resources used by other service providers for call termination. TRAI did not underestimate the capital costs in some way; rather, TRAI completely excluded all capital costs.

Moreover, these arguments are scattered and contradictory. If TRAI's initial arguments were correct, TRAI should not have to appeal to, for example, the claims of the difficulty of long-run forecasting, or claims that cash flows of operators are sufficient to cover capital costs.

Third, TRAI's arguments regarding the exclusion of capital costs are inconsistent with its other regulatory decisions. For example, in the Memorandum of Understanding itself, the TRAI notes:

In calculation of port charges only the incremental CAPEX for provision of ports was taken into account. Although for providing ports there is a need for not only augmenting the switch capacities but also other downstream parts of the network to handle the additional traffic entering into the network through these ports.58

TRAI's consultation paper of July 2009 states that "[i]n order to determine the port transaction charge and dipping charges, it is necessary to estimate the capital expenditure (CAPEX) requirement for setting up of the network, subsequent Operational Expenditure (OPEX) for maintenance/management of these services."59 Section 4.2 of this document details the categories of capital investments to be considered, and sections 4.5.5 and 4.5.6 discuss depreciation and rates of return. Moreover, the TRAI includes the cost of capital despite the fact that it noticed variations in business models and capital costs: "It was also observed from the discussions that one of the MNP service providers has proposed to employ Capital Expenditure (CAPEX) oriented business model whereas the other one has employed operational Expenditure (OPEX) oriented business model for providing the MNP services."60

The TRAI's exclusion of capital costs from the MTC is also inconsistent with the its 2004 requirements for reporting of information, and its discussion of net book value (investments net of depreciation), financial capital maintenance, capital investment, return on capital, cost of capital employed, profit and loss statements (including costs of depreciation and debt), and depreciation.<sup>61</sup> For example, at section 5 it states that: "[t]he next step is to apportion the network element cost to various products, which should also include the return on capital employed." Such reporting requirements provide a recognition that network investments have an associated capital cost, and those costs should be attributed to the products that use the network assets.

#### VII. Specifics of TRAI's MTC Calculation

in the sections above I dealt with issues of logic, consistency, economic principles and international best practice in calculating an MTC. At this point I turn to specifics of TRAI's MTC calculations and offer a partial correction.

## A Simple Partial Adjustment to TRAI's Cost Calculation

Below, I make a simple adjustment to TRAIs calculations in its Memorandum of Understanding (at tables 6.2 and 6.3). This adjustment was comprised of: 1) adding an assignment of depreciation expense, and 2) applying a 17% WACC to an estimate of the value of industry net book investments.<sup>62</sup> This produces a value of Rs 0.37146. The calculations are provided in an Excel file Appendix B, and are also displayed in the table below.

The white section of the table (rows 1-11) is a simple replication of the table 6.3 in the TRAI's Memorandum of Understanding. The grey sections of the table show my simple adjustments. Row 12 pulls in total depreciation from TRAI's table 6.2. TRAI does not provide the net book value of the sum of the mobile providers in India; therefore, at row 13, I use my experience to estimate that 90% of the depreclation in plant and equipment corresponds to that for domestic voice related services. At line 14, I estimate the net book value of the assets of firms by multiplying depreciation by 5.63 At line 15, in keeping with my estimate at row 13, I estimate that 90% of the net book value of assets are associated with domestic voice traffic. At line 16, I apply the 17% post-tax WACC to the relevant net book estimate. At line 17, I sum the relevant depreciation and WACC to determine relevant capital costs (w/o taxes). At line 18, I calculate the ratio of relevant capital costs (w/o taxes) to TRAI's

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<sup>9</sup> 3.2.3.
 <sup>9</sup> TRAI Consultation Paper on Determination of Port Transaction Charge, Dipping Charge and Porting Charge for Mobile Number Portability (MNP Consultation), ¶1.10, 22 July 2009 (emphasis added).

<sup>61</sup>The Reporting System of Accounting Separation Regulation, 2004 (4 of 2004), available at http://www.dot.gov.in/Acts/legislation/23feb2004.pdf <sup>62</sup> My understancing is that a 17% post-tax WACC was used by Spectrum Value Partners in its FL-LRIC calculation. <sup>63</sup> Based upon my experience, mobile operators assets have average lives of about 10 years. Therefore, over the life of the asset, the average net book value would be approximately 5 times the depreciation.

 <sup>&</sup>lt;sup>57</sup> TRAI "Explanatory Memorandum to 'The Telecommunications Interconnection Usage Charges (Tenth Amendment)
 Regulations, 2009" § 5.3.2 (emphasis added).
 <sup>58</sup> § 5.2.3.

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calculation of relevant OPEX – this yields a value of approximately 95%; that is, relevant capital costs (w/o taxes) are approximately 95% of the value of the TRAI's calculation of relevant OPEX. At line 19, I apply the 95% value to TRAI's line 9 (MTC of Rs .17) to calculate a MTC (OPEX and capital costs w/o taxes) without license and spectrum fee of .33166. At line 20, I apply TRAI's 12% spectrum and license fee (see line 10). The result, at line 21, is a MTC reflective of TRAI's calculation of OPEX, plus relevant depreciation and WACC (w/o taxes), of Rs .37146.

| row | Adjusted: TRAI, Memo of Understanding: Table 6.3<br>paragraph 6.3.6 |                  |         |
|-----|---|------------------|---------|
| 1   | Particular  | Unit             | amount  |
| 2   | Gross Average ARPU  | Rs               | 280     |
| 2   | EBITDA Margin   | %                | 32%     |
| 4   | Total Opex  | Rs               | 190     |
| 5   | Percentage of Relevant Opex to Total Opex                           | %                | 43%     |
| 6   | Relevant Opex   | Rs               | 82      |
| 7   | Less allocation of relevant Opex to VAS                             | Rs               | 8       |
| 8   | Relevant Opex adjusted for Vas                                      |                  | 74      |
| 9   | MTC w/o license & spectrum fee                                      | Rs/minute        | 0.17    |
| 10  | License & spectrum fee  | %                | 12%     |
| 11  | MTC with license & spectrum (w/o capital)                           | Rs per<br>minute | 0.2     |
| 12  | Adjustments   |                  |         |
| 12  | Depreciation (from tbl 6.2)   | RS in crore      | 11598.1 |
| 13  | 90% of depreciation (net of VAS, sales & marketing, international)  | RS in crore      | 10438.3 |
| 14  | Net Book assuming 5 X depreciation                                  | RS in crore      | 57990.6 |
| 15  | 90% of net book (net of VAS, sales & marketing, international)      | RS in crore      | 52191.5 |
| 16  | 17% WACC (w/o taxes) on relevant net book                           | RS in crore      | 8872.55 |
| 17  | Relevant Depreciation + WACC (w/o taxes)                            | RS in crore      | 19310.9 |
| 18  | (Relevant Deprec + WACC)/(Relevant Opex)                            | %                | 0.95094 |
| 19  | MTC with depreciation & WACC (w/o taxes, license)                   | Rs/minute        | 0.33166 |
| 20  | License & spectrum fee  | %                | 12%     |
| 21  | MTC with license & spectrum depreciation & WACC                     | Rs per<br>minute | 0.37146 |

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It is important to note what is not done in this calculation: a) taxes were not included, b) no adjustment was made to account for the overstatement of VAS operating expenses, and c) the fundamental assumptions and method employed by TRAI were not modified (e.g., the use of forecasted EBITDA margin).

Also, as I noted above, the net-book value of the industry providers was not available; however in the absence of that information, I believe that my method of approximating the relevant net book value is reasonable, and represents a reasonable approximation of the MTC, given TRAI's method of calculating OPEX.

TRAI Has Employed a Technique that Overstates VAS Costs, and therefore Further Understates the MTC

While TRAI's exclusion of capital costs represents a gross violation of international best practice, sound economics and sound public policy, it is not the only shortcoming in its calculation. One of the other shortcomings of the MTC calculation involves the estimate of OPEX related to value added services (VAS).

TRAI utilized accounting statements to calculate the "relevant" OPEX. In deducting the costs for VAS TRAI noted that "[i]f the OPEX for these services were known they could been used for calculations."<sup>64</sup> Instead, TRAI estimated that "[a]s the revenue from VAS is about 10% of total revenue, therefore, instead of deducting total revenue from the relevant OPEX, 10% Opex has been decided to be deducted."

<sup>64</sup> TRAI "Explanatory Memorandum to 'The Telecommunications Interconnection Usage Charges (Tenth Amendment) Regulations, 2009" §5.5.3. TRAI quotes this section in the TRAI Reply at 1005.

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First, to be clear, let me address the clause in the quoted sentence related to subtracting "total revenue" of VAS from a cost-based termination rate. To subtract the revenues of one service from any cost calculation in order to arrive at a cost-based rate is simply incorrect. Such an approach to estimating the costs of providing call termination has no basis in economic theory and I am not aware of any other regulator having adopted such an approach for any service, including mobile call termination. As noted in the Multiple Experts Statement, regulated cost-based rates are determined using a long-run cost framework (either fully distributed cost or a form of long-run incremental costs); revenues from other services play no role in determining the long run costs of a service.65 Costs and revenues are fundamentally different concepts. By subtracting revenues from a calculation of a costbased rate, the resulting rate is necessarily below the proper measure of cost. There is no support in economic theory or telecommunications regulatory practice for discounting the cost of providing call termination by the revenues received from supplying VAS.

Second, TRAI is correct in proposing to use the actual OPEX for VAS, if it had been available.

Now consider the use of revenues (or revenue ratios) to approximate the cost of VAS. When I train students and cost analysts, I note that one must use caution when attempting to use revenues to approximate costs; it will often yield provide a very poor approximation. Revenues can be useful for estimating costs that are closely tied to revenues, such as the costs of bad debt, revenue-based taxes, or commission assessments. VAS do not fall into this category, however. By their nature, VAS are high margin services ---services that cause relatively low additional costs, and yield relatively high additional revenues. Indeed, the very name "value added" rather than "cost added" services means that the services tend to have high margin. In the land-line telecommunications world, such services were originally described as "vertical services" with much higher margins than other basic services; they were vertically adding revenues on top of an existing cost base. Therefore, I believe that TRAI has overestimated the costs of VAS when it subtracts 10% of OPEX to account for the OPEX related to VAS (because 10% of revenues are VAS). Because VAS are high margin services, the relevant amount of OPEX is some amount less than 10%.

Indeed, TRAI appears to implicitly recognize the high margins for VAS when it states: "[t]he Authority also feels that the tariffs for the value added services is [sic] unreasonably high."66 Therefore, in addition to the complete exclusion of capital costs, TRAI has overstated the reduction in relevant OPEX due to VAS, and therefore further understated the MTC.

The overestimation of VAS costs (and underestimation of MTC) by using revenues as a proxy is, in my opinion, an error in judgment and cost approximation; this error is understandable, given what may be a lack of experience and expertise in cost estimation.<sup>67</sup> This stands in stark contrast to the complete exclusion of capital cost, which is a gross error in applying basic economic costing principles and international best practices.

# Warning: The Costs of Equity Are Not Shown in Accounting Records

As described in the Multiple Experts Statement, one of the components of capital costs is the costs of equity (the return required by stockholders who have invested equity capital into the company).68 At § 6.3.4 of its explanatory memorandum, TRAI shows accounting values for part of the capital costs of the network providers (e.g., debt, "finance cost" at line 4).69 But this is not the full cost of financing since, by their nature these accounting records do not show the cost of equity. If the TRAI were to attempt to correct its errors by reducing the estimated costs of VAS OPEX, and including capital costs, it would not have sufficient information on its table at § 6.3.4 because the table is missing the cost of equity (and the associated taxes) and an asset base against which to apply the full cost of capital. I advise my students and clients to use the full cost of capital (WACC), estimated by the finance department in a company, and that WACC is one required piece of cost information not available from the accounting department or the accounting records; this is true even when employing an accounting-based FAC method.

# Avoiding Misunderstandings of Notions of "Declining Costs" in Telecommunications

The TRAI's Memorandum of Explanation, references the principle regulation: "Over time, with the reduction in costs due to falling equipment prices, and its higher capacity, as well as due to rapid subscriber growth, the Authority may in future consider allocating only a portion of the value added revenues against the costs relevant for call termination."70

subtract revenues to arrive at a cost. 66 TRAI Memorandum of Explanation, § 5.5.3

<sup>67</sup> Indeed, some cost accounting systems used by mobile telecommunications companies do allocate some costs on the basis of revenues, when other metrics would better reflect cost causation. Therefore, one can't fault TRAI to strenuously fort his

 Corrotates, minimum and textbook on finance; see, e.g., the text referenced by TRAI, ASWATH DAMODARAN,
 <sup>64</sup> And as described by virtually any textbook on finance; see, e.g., the text referenced by TRAI, ASWATH DAMODARAN,
 <sup>69</sup> TRAI TEXPlanatory Memorandum to "The Telecommunications Interconnection Usage Charges (Tenth Amendment)
 <sup>60</sup> TRAI "Explanatory Memorandum to "The Telecommunications Interconnection Usage Charges (Tenth Amendment)
 <sup>61</sup> TRAI "Explanatory Memorandum to "The Telecommunications Interconnection Usage Charges (Tenth Amendment)
 <sup>62</sup> TRAI "Explanatory Memorandum to "The Telecommunications Interconnection Usage Charges (Tenth Amendment) Regulations, 2009" § 5.5.2.

<sup>&</sup>lt;sup>65</sup> One may properly compare the revenues from a service to its costs to determine a measure of profit or contribution, but not

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One may sometimes hear claims that telecommunications is a declining cost industry. One must be careful in interpreting such statements, however. In telecommunications, costs (or cost components) may decline, remain relatively constant, or rise depending on the circumstances. In large part, whether costs are declining depends on whether one is referring to changes in costs over volume, over time, or over geography.

#### Volume

When costs decline over volume of output, this is called "economies of scale". This is a long run concept that assumes that all assets are variable and adjustable, and can be said to exist if average costs (in total) decline with volume. Whether economies of scale exist or not is an empirical issue. It depends on how input prices change with volume,<sup>71</sup> whether there are increasingly or decreasing returns to scale in the physical production process,<sup>72</sup> and whether increasing costs of coordination of the production processes eventually create diseconomies of scale or size.<sup>73</sup> The traditional treatment of economies of scale has generally been described in the context of a manufacturing plant that produced a product, rather than a service that requires geographically-specific investments.

If one could hold time and geography constant (i.e., for a specific period of time, and serving customers over the same geographic area), based on my experience in reviewing, conducting, and supervising telecommunications cost studies, I expect that there may be economies of scale that exit in any telecommunications market. However, I do not expect this effect to be very large.

#### Time

Costs may increase or decrease over time. To isolate the effects of time, one must hold volume and geography constant. That is, if the same volume of service were to be provided to the same customers, how will costs change? A critical factor driving changes in costs over time is the change in the prices of the factor inputs used to make the product or service. In economics, inflation is a rise in the general level of nominal prices of goods and services in an economy over a period of time.74 In most economies for most periods of time, there is some level of inflation.75 But certainly not all prices rise over time. In telecommunications the prices of some input prices are likely to fall over time (notably the prices of electronic components), while most other input prices are likely to rise over time (like skilled labor, land, materials, spectrum, and non-electronic equipment). Whether total service prices rise or fall will be determined in part based on the proportion of inputs with rising vis-a-vis falling input prices. One phenomenon is that as the prices of electronic components fall, the proportion of total costs comprised by electronic components becomes smaller; therefore, to the extent that falling prices for electronics components has driven telecommunications prices lower in the past, the effect of this change will necessarily be lessened in the future.

On balance, then, holding volume and geography constant, I expect that there may be some continued decline in telecom costs over time; however, I expect this effect to be less than it has been in the past, and rising prices for some inputs (e.g., skilled labour), may reverse this trend.

#### Geography

For a network-based system like telecommunications, geography can have a huge influence on costs. Network costs are largely driven by distance and density. The longer the distance and the lower the density, the higher the cost. In any market, suppliers are initially attracted to areas in which costs are relatively low and demand is relatively high. When suppliers expand coverage geographically, costs will necessarily rise. Based on my experience in conducting cost studies, I have found that costs can vary across geography by a factor of 5 or 10, or more.

Therefore, holding volume and time constant, expanding service across geography will have a huge impact on average costs.

On balance, then, allowing time, volume, and geography to vary, I expect the effects of geography to dominate in an expanding market like India, which currently has much lower teledensity levels than most other countries. That is, I expect that the increase in cost due to expanding geographic coverage will, over time, more than offset any reductions in cost that may occur due to falling prices of electronics components and economies of scale.

Section Summary

<sup>&</sup>lt;sup>71</sup> Some input prices may fall with volume if the firm is able to garner volume discounts. However, other input prices may

<sup>&</sup>lt;sup>72</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>73</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run circumstance (where all inputs are assumed to be variable and <sup>19</sup> Increasing returns to scale can be defined as a long-run adjustable) in which a 1% increase in inputs (including so-called fixed inputs or capital assets) leads to more than a 1% increase in outputs. This can occur when certain geometric relationships are at work, such as when the amount of steel determined by the sectional area within that circumference of the pipe, but the volume of product transported are THEORY, APPLICATION AND CASES 270–71 (6th ed. 2005). required for a pipeline are largely determined by the circumference of the pipe, but the volume of product transported are

See, e.g., RICHARD LEFTWICH, THE PRICE SYSTEM AND RESOURCE ALLOCATION 184 (5th ed. 1973).

 <sup>&</sup>lt;sup>74</sup> See, e.g., http://en.wikipedia.org/wiki/Inflation, or virtually any economic textbook on macroeconomics
 <sup>75</sup> Persistent periods of significant deflation can create problems in capital markets.

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This section deals with the specifics of TRAI's MTC calculation. I begin with an expansion of TRAI's table 6.3 to include relevant depreciation and post-tax WACC. Using an approximation for industry net book value of assets, I calculate the voice related depreciation and post-tax WACC and compare it to the size of TRAI's estimate of relevant OPEX; these capital ccst are 95% of the relevant OPEX. This then becomes the adder to the MTC calculation. I also note that TRAI's method of using revenues will over-estimate VAS OPEX, and underestimate the MTC.

Finally, I discuss the circumstances under which average costs will fall, or rise. In particular, expanding service to more rural jurisdictions (which causes average costs to rise) is likely to dominate other cost effects. Irrespective of the specific conditions in the industry, there is nothing in any notion related to that concept of a "declining cost" industry that can justify excluding capital costs. Certainly, one should not allow any preconceived expectation that average costs will fall over time, to abandon fundamental principles when making a cost calculation.

#### **VIII.** Conclusion

Telecommunications is a capital intensive industry. In order for a provider to terminate a call, not only must it use its network assets, those assets are absolutely required; call termination can't exist without them. The capital costs caused by the use of a network are no less real than the operating expenses to run and maintain that network. Fundamental principles of economics, logic, sound business practice, and sound telecommunications policy all aictate that MTC includes capital costs. Moreover, I am not aware of any regulatory body (other than the TRAI) that has excluded capital costs from a cost-based call termination rate; international best practice requires the inclusion of capital costs.

TRAI does not provide expert opinion, nor citations to academic literature, to support its exclusion of capital costs. It's rationale as to why it excludes capital costs is not well articulated, and may be based in part on a misunderstanding of the distinction between CAPEX and capital costs. Moreover, its arguments are internally inconsistent, and insufficient to justify such a fundamental error in cost calculation.

Using an approximation for industry net book value, I calculate that adding relevant depreciation and post-tax WACC to TRAI's calculation method results in a MTC of approximately Rs .37.

#### Appendix B: Materials Supporting the Inclusion of Capital Costs in an MTC

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It is easy to choose, even at random, an economics reference that is consistent with the inclusion of capital cost in a MTC calculation. However, finding quotations in the academic literature stating that capital costs should not be excluded from an MTC calculation is far more difficult. By analogy, this would be like finding a mechanical engineering text that states that one should not attempt to build a car without an engine; the error is so fundamental, and relatively obvious, it does not generally arise in discussion. For example, the IRG working group on regulatory accounting noted that

"Executive Summary Whereas Current Cost Accounting (CCA) and Long Rung Increment Cost (LRIC) methodologies are by far the preferred methods for imposing cost orientation when regulating fixed networks. Historical Cost and Fully Allocated Costs (FAC) methodologies (also referred as Fully Distributed Cost, FDC) are prominently used for mobile networks. The above described situation is coherent with the current legislation and with the market reviews imposed by the new regulatory framework.

(emphasis added).<sup>1</sup> LRIC and FAC methods both require consideration of capital costs.

The Multiple Experts Statement explained that the capital costs that are properly included in an MTC calculation are comprised of depreciation (the return of the investment) and the weighted average cost of capital (WACC, the return on investment), including the taxes associated with the return on equity. Therefore, one can determine the consistency of recommendations regarding the inclusion of capital costs through the consistency of the discussions regarding choices of depreciation methods and methods of estimating WACC. The report quoted above discusses in detail the possible choices for calculating the weighted average cost of capital (WACC) and choice of depreciation. Consider as a related example, the IRG's 2000 report on forward-looking LRIC discussing depreciation costs (the recovery of the initial investment) and rate of return (the return necessary to compensate for the opportunity cost of that investment), which stated:

In a FL-LRIC modeling exercise, it is necessary to calculate an annualised cost for consumption of capital assets. . . . In calculating the reasonable rate of return, which operators notified as having Significant Market Power are allowed to charge in their interconnection tariffs, the use of the Weighted Average Cost of Capital (WACC) formula is widely accepted.<sup>2</sup>

The report is thus fully consistent with the inclusion of capital costs in determining a cost-based call termination rate. The report does not specifically state "don't forget to include capital costs" because such a mistake is so obvious (and until now, had not existed) that no such admonition was required.

The proper inclusion of capital costs is not constrained to the telecommunications industry; indeed, no firm in any industry will make an investment without expecting to recover that investment (covering the depreciation cost) and earn a return on that investment at least as great as the opportunity cost of capital.

<sup>4</sup> IRG (05) 24 Regulatory Accounting in Practice (prepared by the IRG Working Group Regulatory Accounting in April 2005 and adopted by the IRG Plenary on 25 May 2005) , available at http://www.irg.eu/streaming/392.pdf?contentId=543102&field=ATTACHED\_FILE

<sup>2</sup> Principles of implementation and best practice regarding FL-LRIC cost modeling, as decided by the Independent Regulators Group, 24 November 2000, sections 6 and 7.

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This is true for unregulated and regulated enterprises alike. For those regulated entities, the proper method by which determine the rate of depreciation, and the specific amount of WACC (as a percentage) is an important part of the deliberative process in establishing regulated rates. Consider the discussion in a well known textbook on regulatory economics, under the headings <sup>1</sup>/<sub>2</sub>Depreciation as a Cos<sup>1</sup>," and "The Rate of Return".<sup>3</sup>

"The Meaning of Depreciation ...... Depreciation results in a cost of service"

From the investor of company point of view it is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividend on the stock. By that standard the return to the equity owner should be commensurate with returns on investment in other enterprises having corresponding risk. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and altract capital.

(emphasis added).<sup>5</sup> Consider another text dealing with regulatory economics under the headings "Depreciation as a Cost" and "The Attraction of Capital":

Depreciation as a Cost

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... Whatever its cause, depreciation involves destruction of the value of facilities used in the process of providing service. Unless the plants of regulated companies are to deteriorate, these facilities must be replaced. And provision for their replacement is properly to be charged to consumers as a cost for the service they receive.

#### The Attraction of Capital

... The importance of assuring this ability [to attract new capital] is not to be denied. If regulated undertakings are to keep pace with growing demand, modernize their equipment, and improve their facilities, they must be able to obtain more money from investors by selling bonds and stocks.

(emphasis added).<sup>6</sup>Similarly, a telecommunications economist I have worked with describes the relevance of capital costs as follows:

Capital costs associated with network construction derive from the initial onetime investment made in network facilities. The economic, or opportunity, costs may be expressed as recurring annual costs, because the money that has been invested in these assets could have been invested elsewhere and earning a return. The components of annual capital costs include capital repayment (or depreciation), return on capital, and income taxes. The primary reason for incurring capital costs is the advancement or deferral of network facilities

<sup>3</sup> CHARLES F. PHILLIPS, JR., THE ECONOMICS OF REGULATION: THEORY AND PRACTICE IN THE TRANSPORTATION AND PUBLIC UTILITIES INDUSTRIES AT 191 (1965).

<sup>4</sup> Citing National Association of Railroad and Utilities Commissioners, Report of the Committee on Depreciation, 1943, Washington, D.C., page xiv (emphasis added), <u>National Association of</u> Railroad and Utilities Commissioners, Report of the Committee on Depreciation, 1943, Washington, D.C., page 261 (citing Federal Power, Comm. v. Hope Natural Gas Co., 320 U.S. 591, 603 (1944)).

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<sup>6</sup> CLAIR WILCOX, PUBLIC POLICIES TOWARD BUSINESS, 1977 (4<sup>th</sup> ed), pages 296 and 315 respectively.

construction caused by changes in demand. The effect on total costs caused by demand changes can be accurately measured through the use of capacity cost calculations.

(emphasis added.)7 A telecommunications law textbook describes the history of the calculation of switched access rates (long-distance call termination rates):

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Because of the importance . . . of reasonable, cost-based interconnection rates, the Commission has prescribed both the structure and the pricing methodology of interstate access charges. The FCC's rules recognize that a substantial part of the traffic carried by ILECs [Incumbent Local Exchange Carriers] is access traffic, and a substantial part of the ILECs' investment in plant and equipment is therefore incurred to support the provision of access service. . . . ILECs. are entitled to compensation for this investment and for the associated operating and maintenance expense.

#### (emphasis added.)<sup>8</sup> Another book on telecommunications law and regulation states:

The basic idea of rate-of-return regulation is that a regulated firm should be entitled to (1) recoup its expenses dollar for dollar and (2) earn a reasonable profit on its invested capital. . The regulator's task is to set the cost of service high enough for the regulated firm to remain an attractive investment, but not so high that investors are permitted to exploit ratepayers. ... Regulators must also allow the firm to recover its fixed up-front investment in capital (e.g., buildings, telephone poles, switches, wire, cable). ... If regulators were to stop here, the firm's investors would simply get their investment back dollar for dollar. Regulators thus cannot stop here if they want to continue to count on investors to furnish the capital needed to run utilities. They must allow the firm a fair return on the rate base, that is, the total amount of capital the firm has invested at the particular time. To entice investors to continue to invest, regulators must set the rate of return high enough to compensate for the risks involved.

(emphasis added.)9 The topic has been similarly treated in texts on EU antitrust law regarding interconnection pricing:

6.5 Pricing: The Directive and Commission Recommendations

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Operators with significant market power must set interconnection charges which are transparent and cost oriented and have the burden to demonstrate that their costs are based on actual costs including a reasonable return on investment.

(emphasis added.)<sup>10</sup> Indeed, the 2002 Articles 12 and 13 of the European Parliament regarding price control and cost accounting obligations state

National regulatory authorities shall take into account the investment made by the operator and allow him a reasonable rate of return on adequate capital employed, taking into account the risks involved.

(emphasis added.)<sup>11</sup>Accounting for the investment made, reflecting risks and allowing a reasonable rate of return must have been important to the European Parliament since the exact language quoted above appears in both Article 12 and Article 13.

<sup>7</sup> BRUCE EGAN, INFORMATION SUPERHIGHWAYS REVISITED: THE ECONOMICS OF MULTIMEDIA at 173 (1996). I teach the concept of capacity costs to telecommunications cost analysts, and I use it when I perform cost studies. This concept stresses the fact that many investments may, to the casual observer, perform cost studies. Fins concept stresses the fact that many investments may, to the casual observer, appear to be "fixed" assets, are in fact driven by volumes of service supplied. As demand grows, such assets will reach their realistic capacity and must be replicated or otherwise expanded. Therefore, the capital costs corresponding to these assets are in fact cause by volumes of service, and appropriately included in a volume sensitive cost study, such as a MTC study. \* CHARLES KENNEDY, AN INTRODUCTION TO U.S. TELECOMMUNICATIONS LAW at 49–50 (19xx).

<sup>9</sup> HENK BRANDS AND EVAN LEO, THE LAW AND REGULATION OF TELECOMMUNICATIONS CARRIERS at 154-55 (1999).

10 ANTONIO BAVASSO, COMMUNICATIONS IN EU ANTITRUST LAW at 83 (2003).

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I have echoed these views in my own work: typical telecommunications cost studies "also include the full opportunity cost of capital, including a cost of debt and equity."12

And in a book on world telecommunications economics, Jeff Wheatley states:

"Section 7.7 Cost of Capital

7.7.1 Cost of capital and return on capital

Telecommunications networks use large amounts of capital. The annual debt service. dividend and depreciation charges may exceed the paybill, making a proper appreciation of their cost of great importance for the sound financing of operations.

7.7.3 Methods of estimating the cost of equity capital ..."

... There is extensive US literature on the cost of capital for public utilities, arising from the frequent use of ROC regulation for price control." (Emphasis added.)13

Consider also the discussion in the 2001 report "Cost Structures in Mobile Networks and their Relationship to Prices: Final Report for the European Commission" (with corresponding section numbers):

5.4.2 Call termination increment .... to obtain a call termination cost, it seems better to consider some measure of the total cost of termination the network incurs per year and convert this to a per minute cost [emphasizes the total of cost]. ...

6.3.2 Asset lives

0.3.2 Asset lives ... Many of the costs for telephone networks are capital investments that need to be amortised over a number of years. In a competitive environment, the correct way to amortise costs is to use economic depreciation ... For all annualisation methodologies the assumed life of an asset will be important ...

6.3.3 Cost of capital

6.5.5 Cost of capital ... The weighted average cost of capital (WACC) of a firm is equal to the average of the cost of debt and equity finance to the firm; weighted according to the proportion of debt to equity in the firm's financial structure (the gearing ratio). ... When calculating the costs of services, the standard approach is to estimate a cost of capital and only the the firm's financial structure (the setimate a cost of capital and only the the firm's financial structure (the setimate a cost of capital and only the the firm's financial structure (the setimate a cost of capital and only the the firm's financial structure (the setimate a cost of capital and only the the firm's financial structure (the setimate a cost of capital and only the set of the set of the set of the setimate a cost of capital and apply it to .. the firm that produces the service. ....

#### 9.6 Building Cost Models

9.6 Building Lost Models ... Regulatory authorities have a great deal of experience with developing cost models to estimate interconnection charges for fixed networks... There may be a role for costing models in mobile as well. These could be used to estimate the costs of call termination and possibly to resolve disputes ....

APPENDIX 1: AVERAGE COST PER MINUTE CALCULATIONS..A1.2.1 The methodology

<sup>11</sup> Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive), Article 12, and Article 13, available at http://eur-

lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0007:0020:EN:PDE

... .

12 Steve G. Parsons, Laffont & Tirole's Competition in Telecommunications: A View From the U.S., 9:3 International Journal of the Economics of Business 419-36 (2002) (emphasis added).

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<sup>14</sup> Europe Economics, "Cost Structures in Mobile Networks and their Relationship to Prices: Final Report for the European Commission," 28 Nov. 2001 (Contract No. 48544)

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... Potentially important cost categories include the cells (these include tower, antennae, and the site), TRXs, backhaul, BSCs, transmission in the backbone network, MSCs, VLRs, HLR, and network management equipment. There are both capital and operational costs that need to be calculated...

(emphasis added).<sup>14</sup> Consider also the entirety of Appendix 1, which provides an example of a mobile cost calculation.<sup>15</sup> Table A.3 in this appendix (reproduced below) lists specific mobile assets, the capital investment value, the corresponding annualsed capital cost, and the associated operating costs. (Luke, can you look to see if there is any appearance of inconsistency with this and the SVP LRIC study filed)

#### Appendix 1: Average Cost Per Minute Calculations

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Table A3: Cost assumptions underlying the estimates of the network elements

| Equipment                              | Capital<br>Investment cost | Annualised cost<br>(€) | Associated<br>operating costs<br>(€) | Total annual<br>costs (€) |
|--|----------------------------|------------------------|--------------------------------------|---------------------------|
| Site                                   |                            |                        |                                      |                           |
| Situ acquisition and<br>proparation    | 40,000                     | 6,400 '                | •                                    | 5.400                     |
| Site lease                             |                            |                        | 4,500                                | 4,900                     |
| 3 sociors equip. •                     | 782,000                    | 73,000                 | 26,060                               | 98,000                    |
| 1 soctor equip.                        | 125,000                    | 50.000                 | 17.000                               | 67,000                    |
| TRX                                    | 19,200                     | 6.700                  | 2,700                                | 9,400                     |
| Backhaul (2 Mbible)                    | 31,200                     | 8,400                  | 4.400                                | 12,800                    |
| BSC                                    | 800,000                    | 264,000                | 112,000                              | 376,000                   |
| ESC - MSC (34<br>Mbil/s)               | 127,800                    | 34,500                 | 17,900                               | 52.400                    |
| MSC                                    |                            |                        |                                      |                           |
| Processor                              | 2,179,000                  | 545,000                | 305,000                              | 850,000                   |
| Safawe                                 | 000,003                    | 200,000                | 112,000                              | 312,000                   |
| Interconnection<br>interface           | 40,000                     | 10,000                 | 5.600                                | 15.630                    |
| Switching support                      | 160.000                    | 40,000                 | 22,000                               | 62.000                    |
| Euliding                               | 240,000                    | 36,000                 | 34,000                               | 70,000                    |
| Site lease                             |                            |                        | 24,000                               | 24.000                    |
| MSC ports                              | 4,600                      | 1,100                  | 600                                  | 1,800                     |
| MSC - MSC (155<br>Mbh/s) <sup>41</sup> | N/A                        | N/A                    | N/A                                  | 200.000                   |
| HLR                                    | 640,000                    | 160,000                | 90.000                               | 250,000                   |
| Network                                | 24.000,000                 | 6,000,000              | 3,350,000                            | 9,350,000                 |

Scurce: Analysys mudel for Ottal (1998)

The underlying cost of capital has been assumed to be 14.25 per cent.

Eucroscipe rule used: 10 storing \* 1.6 Euros (as of 25 September 2001)
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Consider also a report commissioned by the GSM Association and produced by Price Waterhouse Coopers. *The Setting of Mobile Termination Rates: Best Practice in Cost Modeling* describes both accounting based and engineering economic FL-LRIC approaches:

15 Id., at appx. 1.

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Option 1 - Top down FAC/HC' Figure 1 shows a schematic of the most straightforward type of cost model. Costs are taken directly from the operator's accounting records and are allocated to services using service demand and allocation rules. In this type of model, there is no distinction between incremental costs and fixed and common costs—the average cost approach.If an NRA or operator relies on this approach, it is effectively making three key implicit assumptions: 1 The level of historic investment remains relevant for the setting of prices, and 2 The distinction between, on the one hand, marginal (or incremental) cost and, on the other hand, fixed common and joint costs, is not relevant for the setting of prices 3 Accounting depreciation is a reasonable method for scheduling recovery of capital costs. for scheduling recovery of capital costs.

#### 3.4.3 Valuation/depreciation methods

3.4.3 Valuation/depreciation methods The cost of an operator's asset base can be divided into two elements—the opportunity cost of the investment ("the cost of capital") and the depreciation of the asset base. In order to determine the level of these costs, a valuation or depreciation methodology is used in a model. There are several valuation/depreciation methodologies which could be used and it is not uncommon for a single model to contain more than one valuation/depreciation methodology, with alternative results produced

produced. Historic Cost Accounting (HCA) depreciation methodologies only consider the capitalised purchase price of an asset which is then depreciated its useful life. The most common form of HCA depreciation is straight line, whereby the annual depreciation charge is the purchase price divided by the useful life. Alternative methods such as declining balance methods may also be used. A return on capital is then added to the accounting depreciation to give the total capital costs (return of and on capital). This is calculated as the opening written down value of assets multiplied by the cost of capital (WACC). This ensures that the present value of cost recovery at the time of investment is equal to the investment, thereby giving investors a fair return.

3.4.12 Cost of capital All LRIC cost models include a cost of capital figure. It is used to calculate the fair return on investment that an operator requires.

#### (emphasis added).16

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<sup>16</sup> Commissioned by GSMA, undertaken by Price Waterhouse Coopers, *The Setting of Mobile Termination Rates: Best Practice in Cost Modeling*, (pages 9, 13 and 20 respectively), available at http://www.gsmworld.com/our-work/public-policy/regulatory-affairs/mtrs\_and\_cost\_modelling.htm.

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|       | Table 6.2, para 6.3.4                |                  |
|-------|--------------------------------------|------------------|
| s1.no | Particulars                          | (Rs in<br>crore) |
| 1     | total Bevenue                        | 78738.89         |
| 2     | total Expenditure                    | 61902.05         |
|       | Less                                 |                  |
| 3     | Depreciation                         | 11598.11         |
| 4     | Finance Cost                         | 287.74           |
| 5     | Total Operating Expenditure (Opex)   | 50016.2          |
|       | Less                                 |                  |
| 6     | Sales and Marketing                  | 8717.17          |
| 7     | Pass through                         | 14839.2          |
| 8     | License Fee                          | 6152.08          |
| 9     | Belevant Opex                        | 20307.08         |
| 10    | Ebidata margin                       | 36.70%           |
| 11    | Percentage of relevant Opex to total | 40.6             |
| 11    | Gross ARPU                           | 308              |

| row | Adjusted: TRAI, Memo of Understanding: Table 6.3<br>paragraph 6.3.6              |                  |         |
|-----|--|------------------|---------|
| 1   | Particular   | Unit             | amount  |
| 2   | Gross Average ARPU   | Rs               | 280     |
| 2   | EBITDA Margin  | %                | 32%     |
| 4   | Total Opex   | Rs               | 190     |
| 5   | Percentage of Relevant Opex to Total Opex  | %                | 43%     |
| 6   | Belevant Opex  | Rs               | 82      |
| 7   | Less allocation of relevant Opex to VAS  | Rs               | 8       |
|     | Relevant Opex adjusted for Vas   |                  | 74      |
| 0   | MTC w/o license & spectrum fee   | Rs/minute        | 0.17    |
| 9   | Liconco & spectrum fee   | %                | 12%     |
| 10  | MTC with license & spectrum (w/o capital)  | Rs per<br>minute | 0.2     |
| 12  | Adjustments  |                  |         |
| 12  | Depreciation (from th) 6.2)  | RS in<br>crore   | 11598.1 |
|     | 90% of depreciation (net of VAS, sales & marketing,                              | RS in<br>crore   | 10438.3 |
| 14  | international)   | RS in<br>crore   | 57990.6 |
| 15  | 90% of netbook (net of VAS, sales & marketing,                                   | RS in crore      | 52191.5 |
| 16  | international)   | RS in crore      | 8872.55 |
| 17  | 17% WACC (W/o taxes) of reconstruction   | RS in crore      | 19310.9 |
| 1   | Relevant Depreciation + WACC (W) o takey   | %                | 0.95094 |
| 1   | 9 (Relevant Deprec + WACC)/(Relevant Open)                                       | Rs               | 0.33166 |
| 2   | MTC with depreciation & WALL (W/o taxes, incense)                                | %                | 12%     |
| 2   | License & spectrum fee     Automatic with license & spectrum depreciation & WACC | Rs per<br>minute | 0.37146 |